Facilities Planning & Construction
UNIVERSITY of ALASKA ANCHORAGE

INVITATION FOR BID

UAA KPC Career Tech Backfill Phase 2 - Ward Offices (Soldotna)

Volume 2 of 2

PROJECT NO.: 10-0013
BID NUMBER: 14-06

Building Name: Ward
Building Number: KP 105

ISSUED: March 24, 2014

FACILITIES PLANNING AND CONSTRUCTION
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SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 01 11 00 - Summary of Work

B. Section 01 50 00 - Temporary Facilities and Controls

C. Section 01 77 00 – Closeout Procedures: Record Documents

1.2 DEFINITION

A. Demolition - Demolish: Completely detach from existing construction, tear down, remove and legally dispose of off-site.

B. Salvage: Remove without damage for reuse.

1.3 APPLICABLE PUBLICATIONS

A. International Building Code (IBC) Section 3303 – Safeguards During Construction: Exits.

1.4 SUBMITTALS

A. Record of contractor demolition experience.

B. Description of demolition and removal procedures including dust and noise control.

C. Schedule: Submit schedule indicating proposed methods and sequence of operations for demolition work to the OWNER for review prior to commencement of work. Include coordination for shut-off, capping, and continuation of utility services as required, together with details for dust and noise control protection.
   1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of the OWNER'S on-site operations.
   2. Coordinate with the OWNER'S continuing occupation of portions of existing building.

D. Submit photos of existing surrounding conditions prior to demolition.

1.5 QUALITY ASSURANCE

A. Demolition firm qualifications: Company with at least 5 successful completed demolition work projects similar to this project.

B. Regulatory requirements: Comply with governing authorities before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PREDEMOLITION MEETING

A. Meet with OWNER representative to review proposed schedule and sequence of work prior to start of work.

1.7 EXISTING CONDITIONS

A. Conduct demolition to minimize interference with adjacent building and property areas. Maintain protected egress and access at all times.

B. Provide, erect, and maintain temporary barriers and security devices.

C. Notify OWNER and AUTHORITIES owning or controlling affected services before starting operations and disconnecting services.

D. Differing Conditions: Should materials, systems, or conditions be encountered that differ from those indicated, immediately notify OWNER and do not proceed without approval.

E. If Contractor encounters hazardous materials, or suspected hazardous materials notify OWNER immediately and do not disturb.

F. Hazardous Materials are anticipated. Refer to OWNERS separate report and follow approved removal and disposal procedures.

1.8 CONDITION OF STRUCTURES

A. The OWNER assumes no responsibility for actual condition of items or structures to be demolished.

B. A copy of existing construction drawings is available for review at the OWNER'S offices. Accuracy and completeness of these construction drawings is not guaranteed.

1.9 OWNER OCCUPANCY

A. The OWNER will be continuously occupying areas of the building immediately adjacent to areas of demolition. Conduct demolition work in manner that will minimize need for disruption of the OWNER'S normal operations.

B. Provide minimum of 72 hours advance notice to the OWNER of demolition activities, which will cause severe impact.

1.10 SALVAGE

A. Items indicated to be demolished or removed but of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

B. Storage or sale of removed items on site will not be permitted.

C. Items indicated to be salvaged for OWNER'S reuse remain the OWNER'S property.

1.11 DAMAGES

A. Promptly repair damages caused to adjacent facilities by demolition work at no cost to the OWNER.

1.12 TRAFFIC

A. Conduct demolition operations and debris removal in a manner to ensure minimum interference with streets, walks and other adjacent facilities.

PART 2 - PRODUCTS

2.1 BARRIER PARTITIONS

A. Provide barrier between demolition and occupied building areas.

B. Fabricate barriers from two layers of 6-mil thread reinforced plastic sheet, with lapped, stapled and taped seams, or other approved low permeability material.

C. Framing for barriers may be of wood or metal free from rough or sharp projections and edges, with sufficient strength to maintain integrity of dust controlling membrane.

2.2 PROTECTIVE RAILINGS

A. Fabricate handrails-guardrails from wood, steel or other approved materials and anchor solidly to structure.

B. Railings shall withstand a 200-pound load applied in any direction at any point on the rail.

C. Railings shall withstand a load of 50 pounds per lineal foot applied horizontally at right angles to the top rail.

2.3 PROTECTION

A. Provide protection from demolition and exterior weather as necessary to prevent damage to existing finishes and equipment to remain.

B. Provide temporary shoring or supports as necessary to prevent any damage to the adjacent building and paving to remain while demolishing, and maintain until permanent structure is in place.

C. Provide protection to allow safe passage of OWNER's personnel to occupied portions of existing building.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencement of demolition work, inspect areas in which work will be performed. Photograph existing conditions at adjacent structure surfaces, equipment or to surrounding properties, which could be damaged resulting from demolition work.
   1. Provide minimum 4 by 5 inch digital images showing complete record of existing building interior and exterior demolition areas and adjacent properties.
   2. Submit to OWNER prior to starting work.

3.2 PREPARATION

A. Erect and maintain temporary barrier partitions to prevent spread of dust, fumes, noise, and smoke. Provide temporary barricades and other forms of protection as required to protect the OWNER'S personnel and general public from injury due to demolition work.
   1. Provide protective measures as required to provide free and safe passage of the OWNER'S personnel and general public to and from occupied portions of building.
   2. Protect from damage existing finish work that is to remain in place and that becomes exposed during demolition operations.
   3. Provide temporary weather protection to insure that no water leakage or freeze damage occurs to structure or interior areas of existing building.
   4. Remove protections at completion of work.

B. Mark locations, disconnect, remove, and cap designated utility services within demolition areas. Maintain and protect existing utilities indicated to remain. Provide 72 hours advance notice to OWNER if shut-down is necessary.

C. Mark location of disconnected utilities. Identify and indicate capping locations on Project Record Documents.

3.3 DEMOLITION

A. Except where noted otherwise, immediately remove demolished materials from site as work progresses.

B. Erect and maintain temporary partitions and closures to separate areas where noisy or dusty demolition operations are performed to prevent spread of excessive noise, dust or fumes to occupied portions of the building and to protect interior of building from weather.
   1. Construct temporary barrier partitions of minimum 3-1/2 inch steel studs, 5/8-inch Gypsum board painted white on occupied side, 5/8-inch gypsum exterior sheathing on demolition or weather side, and fill stud cavities with fiberglass insulation.
   2. Use water misting to limit dust and dirt rising and scattering in air. Do not create hazardous or objectionable ice, flooding or pollution when using water.

C. Perform demolition work in a systematic orderly manner. Use such methods as required to complete work indicated on drawings in accordance with approved demolition schedule and governing regulations.

D. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to the OWNER in written, accurate detail. Pending receipt of directive from the OWNER rearrange selective demolition schedule as necessary to continue overall job progress without delay.

E. Do not use explosives.

F. Do not burn or bury materials on site.

3.4 SALVAGE ITEMS TO OWNER

A. Remove the following material and equipment, intact with mounting hardware and connections, for use by OWNER:
   1. Demountable partition system components not reused in the Work.
   2. Shelving not reused in the Work.
   3. Doors, frames, and hardware not reused in the Work.
   4. Electrical devices (lights, power poles, etc.) not reused in the Work.
   5. Mechanical equipment (diffusers, mixing boxes, etc.) not reused in the Work.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from demolition operations from building site. Transport and legally dispose of materials off site as work progresses.
   1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling and protection against exposure or environmental pollution. Remove asbestos containing building materials as specified in separate Specification Section.

3.6 CLEAN-UP AND REPAIR

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections.

B. Leave interior areas to remain broom clean and free of demolition dust.

C. Leave exterior site area free from demolished building remains.

D. Repair demolition performed in excess of that required. Return structures and surfaces to remain to condition existing prior to commencement of selective demolition work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION

SECTION 04 22 20
MASONRY VENEER

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 21 00 – Thermal Insulation

B. Section 07 92 00 - Joint Sealants: Rod and Sealant at control joints.

C. Section 09 91 00 - Painting

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent shall apply,

1. ANSI/ASTM A82 - Specification for Steel Wire, Plain for Concrete Reinforcement.
2. ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
4. ASTM A525 - Specification for General Requirements for Steel Sheet, Zinc-Coated, (Galvanized) by the Hot-Dip Process. (discont'd & repl w A653 & A924)
5. ASTM A580 - Specification for Stainless and Heat-Resisting Steel Wire.
6. ASTM A641 - Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
7. ASTM A653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM B370 - Specification for Copper Sheet and Strip for Building Construction.
10. ASTM C90 - Specification for LoadBearing Concrete Masonry Units.
11. International Masonry Industry All-Weather Council (IMIAC): Recommended Practices and Guide Specification for Cold Weather Masonry Construction February 19, 1975 printing.
12. ASTM D 1056 – Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
13. International Building Code (IBC).

1.3 SUBMITTALS

A. Submit product data samples and manufacturer's installation recommendations under provisions of Section 01 33 00 - Submittal Procedures.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F. twenty-four (24) hours prior to, during, and forty-eight (48) hours after completion of masonry work.

B. Follow International Masonry Industry All Weather Council - Recommended Practices for Cold Weather Masonry Construction.
   1. Cold weather procedures include temporary enclosures and auxiliary heat sources.
   2. Locate heat source and provide ventilation to prevent excess build up of fumes and heat on mortar.

C. All masonry materials, reinforcement, and surfaces contacting masonry shall be free of frost, snow or standing water during Work.

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Hollow Load Bearing Block Units: ASTM C90, Grade N, Type I - Moisture Controlled, normal weight, deorative split face.

B. Masonry Units: Nominal modular size of four inch through wall by 8-inches high by 16-inches long. Provide special units for 90-degree exposed corners.

2.2 MORTAR: USE MASONRY UNITS FROM WARD BUILDING DEMOLITION ACTIVITIES.

A. IBC type S.

2.3 REINFORCEMENT AND ANCHORAGES

A. General: Provide 2-piece assemblies allowing vertical or horizontal differential movement between veneer and wall framing parallel to plane of wall but resisting tension and compression forces perpendicular to it, for screw attachment through sheathing into metal studs, with the following characteristics:
   1. Extend anchorage to within one inch of exterior face of masonry:
      a. Hot dip galvanized steel per ASTM A123 at interior and 304 stainless steel per ASTM A580 or A167 on exterior.

2. Stud Wall Anchor: 3-inch wide by 12 gage bent metal plate with 2 screw holes and notch for 3/16-inch diameter horizontal reinforcing wire; Dur-o-Wall D/A 213S heavy duty or equivalent Hohmann and Barnard or Heckmann.
3. Anchor Screws – Anchors to Wall: through sheathing into studs.
   a. Minimum No. 12 (1/4 inch) diameter type 400 series stainless steel or corrosion resistant to 500 hours of salt spray per ASTM B117 with no more than 5 percent red rust appearing. Screws shall completely penetrate materials to be joined.
   b. Minimum pullout value 400 pounds when tested in predrilled pilot holes through 16 gage thick, ASTM A653 steel.
   c. Minimum two screws per each anchor.

B. Horizontal Reinforcement: 3/16- inch diameter deformed galvanized steel per ASTM A641.

2.4 MASONRY FLASHINGS

A. Flexible Flashings:
1. 40 mil rubber membrane: self-adhering, self-seal around fasteners: Sandell (800) 283-3888, www.sandellmfg.com.

2.5 SEALANT

A. Polyurethane type per Section 07 92 00 - Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions to receive masonry for defects that will adversely effect the Work and for deviations beyond allowable tolerances.

B. Verify items provided by other sections of work are properly sized and located.

C. Beginning of installation shall mean installer accepts existing conditions as capable of producing an acceptable job.

3.2 REPAIR EXISTING VENEER MASONRY

A. Use masonry veneer salvaged from demolition activities. Repair masonry veneer at window openings to match adjacent masonry surfaces..

B. Place flashing behind masonry sill base and continue 6-inch minimum up behind air barrier.

3.3 COURSING

A. Provide steel lintels at new window heads to match existing lintels.

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

C. Install masonry veneer to match existing..

3.4 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or furrowing of mortar joints are not permitted.

D. Remove excess mortar as Work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges.

3.5 WEEP AND VENT INSTALLATION

A. Install weep holes in veneer at sixteen inches on center horizontally above through- wall flashing at bottom of walls.

B. Install cavity vents in veneer at 32 inches on center horizontally at top of each cavity space below sill cap.

C. Slope weep holes to drain away from wall.

3.6 CAVITY BEHIND VENEER

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep or vent holes.

B. Install mortar weep colbetors at bottom of cavities with weep tubes at 16 inches.

3.7 HORIZONTAL REINFORCEMENT INSTALLATION

A. Install horizontal joint reinforcement 16 inches on center typical.

B. Place joint reinforcement continuous in first joint below top of wall.

C. Place horizontal joint reinforcement in first horizontal joint above and below openings. Extend sixteen inches minimum each side of opening except do not extend through control joints.

D. Butt joint reinforcement ends between wall anchors. Stagger joints from adjacent reinforcement 16 inches.

E. Place bent wire around corner 24 inches in single piece.

3.8 ANCHOR TIE INSTALLATION

A. Screw anchor tie into back up wall studs through sheathing to support not more than 2 square feet and at maximum 16 inches vertically and 24 inches horizontally. Place anchors in each course around perimeter of openings, within 12 inches of openings, corners and control joints.

B. Secure wall anchors to horizontal reinforcement and embed into masonry veneer. Minimum 5/8-inch mortar cover between tie and joint reinforcement and exposed face.

3.9 FLASHING INSTALLATION

A. Extend flashing through veneer, turn up minimum 6 inches, screw 6 inches on center into sealant bed onto wall sheathing. Bed into mortar joint of masonry with mortar above and below flashing.

B. Extend flashing to exterior edge of masonry and turn down ¼ inch to form drip.

C. Lap end joints minimum six inches and seal watertight.

D. Use flashing manufacturer's recommended adhesive and sealer or urethane seal per Section 07920 - Joint Sealants.

3.10 CUTTING AND FITTING

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

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

3.11 TOLERANCES

A. Maximum Variation from Unit to Adjacent Unit: 1/8 inch.

B. Maximum Variation from Plane of Wall: ¼ inch in 10 feet and ½ inch in

20 feet or more.

C. Maximum Variation from Plumb: ¼ inch per story non-cumulative.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and ¼ inch in 10 feet.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.12 CLEANING

A. Clean work under provisions of Section 01 77 00 - Closeout Procedures.

B. Remove excess mortar and mortar smears.

C. Replace defective mortar. Match adjacent work.

D. Clean soiled surfaces with non-acid cleaning solution. Use cleaners recommended by masonry manufacturers.

E. Use non-metallic tools in cleaning operations.

F. Remove only efflorescence that forms within 12 months using Brick Institute of America approved methods.

END OF SECTION

SECTION 05 52 00
HANDRAILS AND GUARDRAILS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 09 91 00 - Painting

1.2 WORK SUPPLIED BUT INSTALLED UNDER OTHER SECTIONS

A. Inserts and anchorage's necessary for embedment into building prior to railing work.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. In case of conflict only the most stringent shall apply.
   1. 06 International Building Code (IBC): Section 1607.7.7.
   2. American Welding Society (AWS) "Code for Welding in Building Construction".
   3. Americans with Disabilities Act "Accessibility Guidelines For Buildings and Facilities." (ADAAG)
   4. ASTM A36 – Specification for Carbon Structural Steel.
   5. ASTM A123 - Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel Products.
   6. ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   7. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength.
   8. ASTM A312 - Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
   9. ASTM A385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
   10. ASTM A501 – Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
   11. ASTM A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   12. ASTM A554 - Specification for Welded Stainless Steel Mechanical Tubing.
   13. ASTM A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   14. ASTM B241 - Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
   15. ASTM B429 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   16. ASTM E935 – Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

17. ASTM E985 – Standard Specifications for Permanent Metal Railing Systems and Rails for Buildings.
18. ASTM F436 – Specification for Hardened Steel Washers.
19. Society for Protective Coatings Standards and Specifications (SPC).
20. International Building Code (IBC) 2009.

1.4 SUBMITTALS

A. Shop Drawings and Manufacturer's Descriptive Literature: Indicating shop and erection details shall be submitted, including dimensions, profiles, materials, finishes, splices and attachments, typical details, and manufacturer's installation recommendations.

B. Certification: Provide test reports or calculations signed by an Alaska civil engineer indicating that the products proposed can meet or exceed the performance requirements.

C. Contractor shall be responsible for submitting calculations and shop drawings to the Soldotna Building Safety Department as a deferred submittal for the Building Permit.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. The DRAWINGS are in part diagrammatic to allow for maximum selection to meet design conditions. Completed railings shall meet the IBC1607 and following design criteria:
   1. Public area stairs and floor openings (unless rail runs along solid wall): intermediate vertical rails so that a sphere four inches in diameter cannot pass through.
   2. Areas not accessible to public and equipment access: intermediate vertical rails so that a sphere 21 inches in diameter cannot pass through.
   3. Installed railings shall resist a load of 50 pounds per lineal foot and a 250-pound concentrated load applied in any direction at any point on the handrail per ASTM E935 without damage. Lineal loads and concentrated loads need not be concurrent.
   4. Intermediate rails, panel fillers and their connections shall be capable of withstanding a force of 50 pounds per square foot horizontal applied over entire tributary area including openings and spaces between rails. Reactions due to this need not be superimposed with the rail force.
   5. Extend railing continuous with smooth curves returning ends to walls and around corners without projections that snag clothing or catch fingers and allow continuous sliding of hands.

6. Inside handrails on switchback stairs shall be continuous between flights. Provide a minimum clearance of 1-1/2 inches between handrail and adjacent construction.
7. Extend hand railing beyond top and bottom landings in accord with IBC.

2.2 RAILINGS

A. 1.25 to 2 inches outside diameter round tube Handrails. Vertical members, and other non-handrail members may be 2 to 3 inch outside diameter, unless indicated otherwise on DRAWINGS.

B. Materials:
1. Round Tube Carbon Steel: ASTM A500 and A501, 2.7 pounds per lineal foot minimum.
2. Glazing Infill Panels: ½-inch tempered glass panels secured on vertical edges and bottom.
3. Knife Plates: for mounting to existing C Channel: 1/2 inch minimum thick steel welded to existing C Channel.
4. Post Plates (2 plates per post location): Carbon steel: shop paint primer: SPC Paint 15 red oxide alkyd resin. Field finish per Section 09 91 00 - Painting.

2.3 FITTINGS AND CONNECTIONS

A. Painted Steel to match Railing/Posts at glazing capture channels.

B. Mechanical with minimum of exposed fasteners or shop welded.

C. Welding @ railings to be done to maximum extent in shop, grind smooth.

D. Exposed connection finish shall match pipe rails.

E. Provide smooth, rounded closures for exposed ends of pipe.

2.4 THREADED FASTENERS

A. Exposed fasteners shall be flush with handrail surface and as specified in Fabrication.

B. Steel Bolts and Nuts: ASTM A307 Grade A. Galvanized per ASTM A153.

C. Plain Washers: ASTM F436 galvanized per ASTM A153.

D. Anchor Bolts: 1/2 inch minimum diameter, sufficiently long for through bolting structure or 6-inch embedment into concrete or masonry. Provide hex head or similarly deform embedded end of anchor bolts.

1. Drilled into place threaded expansion type concrete or masonry inserts to receive bolts may be used in lieu of directly embedded anchor bolts if approved by the (ARCHITECT/Contracting Officer) as equivalent to embedded anchor bolts. Submit manufacturer's literature indicating lateral (shear) and pullout (tension) data for approval.

E. Base Plate Grout: Factory-packaged, non-metallic, non-staining, non-corrosive, recommended for interior or exterior by manufacturer for conditions of use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions to receive railings for defects that will adversely effect the work, and for deviation beyond allowable tolerances.

B. Beginning installation shall mean acceptance of existing conditions as capable of producing an acceptable job.

3.2 FABRICATION

A. Work shall be done the maximum extent possible in the shop to minimize field splicing. .

B. Fasteners: Concealed wherever possible.

C. Bends: Form to uniform radius free from buckles with finish surfaces free from scratches.

D. Welds: Minimum 3/16-inch continuous fillet or butt type per AWS.

E. Surface Finish: Grind any sharp edges smooth and remove weld slag, splatter and discoloration.

F. Shop Painting for Carbon Steel:
1. Prepare surfaces in accord with SPC by SP-1, solvent cleaning prior to SP-3 power tool cleaning minimum or SP-7 brush-off blast cleaning to clean and remove loose rust, mill scale, pitting, rolled trade-grade markings and weld spatter.
2. Apply prime paint in accord with paint manufactures and SPC.

G. Galvanizing per ASTM A123 after fabrication: No unvented closed pipe sections. Lightly sandpaper or steel wool-galvanizing smooth on handrail surfaces.

3.3 INSTALLATION

A. In accordance with these specifications, approved shop drawings and manufacturer's written recommendations.

B. Erect, plumb, level, or to alignment indicated. Grout may be used to 1/2 inch maximum thickness between base plates and concrete, finished smooth around base plate. If grout is used install permanent galvanized steel shims.

C. Joint copes, miters and butt joints exposed to view in completed work shall be in uniform contact (1/32 inch maximum space) or closed by welding, ground smooth.

D. Splices, connections and fasteners as necessary for a complete, rigid installation.
   1. Horizontal rails: no projections except countersunk or rounded button head fasteners.
   2. Vertical post anchors: shall not project more than 1/4 inch past nuts, cut off and remove burrs if necessary.

E. Do not cut or abrade members with finishes, which cannot be restored in the field. Touch up galvanized abrasion and damage with zinc rich paint.

F. Dissimilar Materials: Aluminum contacting steel, concrete, masonry, wood exposed to weather, and the like shall have the contact surfaces separated by a heavy coat of zinc chromate primer, bituminous paint, or non-absorptive tape. Separation materials shall not be visible in exposed completed work.

G. Cutting and Fitting: No torch cutting. Drill neatly to avoid weakening structure. Avoid placing fasteners in normal view where possible.

H. Sand smooth and without sharp edges field cut and abraded components.

3.4 TOUCH UP PAINT

A. Apply zinc rich touch up SPC Paint 20 per ASTM A780 to field welds and bare metal areas of galvanized finishes.

B. Paint field repairs to painted carbon steel and anchor bolts.

3.5 TOLERANCES

A. Maximum variation from plumb and level: 1/4 inch.

B. Maximum offset from true alignment: 1/4 inch.

END OF SECTION

SECTION 06 23 00
FINISH CARPENTRY AND ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 06 41 16 – Laminate Faced Cabinets

B. Section 07 92 00 - Joint Sealants

C. Section 08 11 00 - Steel Door and Window Frames

D. Section 08 14 00 - Wood Doors

E. Section 09 21 11 - Gypsum Board Assemblies

F. Section 09 91 00 – Painting

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Special hangers or anchorage necessary for mounting that must be built into the structure.

1.3 DEFINITION

A. “Finish carpentry and architectural woodwork” shall mean exposed wood trim, paneling, and custom woodwork not specified in Section 06 41 10 - Custom Casework.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referenced in the text by basic designation only. In case of conflict only the most stringent shall apply.
   1. ASTM E84 – Test Method for Surface Burning Characteristics of Building Materials.
   2. Architectural Woodwork Institute (AWI) “Architectural Woodwork Quality Standards.
   3. U.S. Department of Commerce “American Softwood Lumber Standard”, PS-20.
   4. U.S. Department of Commerce “Product Standard for Plywood”, PS-1.
   5. U. S. Department of Commerce - Commercial Standard (CS) - Hardboard CS251.
   6. National Electrical Manufacturer’s Association (NEMA) Publications for General Purpose Grade High Pressure Decorative Plastic Laminate.

7. International Building Code (IBC) Chapter 23.
8. American National Standards Institute/Builders Hardware Manufacturers Association ANSI/BHMA A156.9 “American National Standard for Cabinet Hardware.”
9. ANSI A208.1 Particleboard.
10. ANSI A208.2 Medium Density Fiberboard.

B. Lumber Grading: In accordance with the American Lumber Standards and the grading rules of the grading agency covering the species involved or AWI.

1.5 QUALITY ASSURANCE

A. Perform finish carpentry and woodwork in accordance with AWI Quality Standards for “Custom” grade.

B. Particle board and plywood shall be tested and certified for reduced formaldehyde emission under National Particle Board and The Hardwood Plywood Manufacturer’s Quality Control Program.

1.6 SUBMITTALS

A. Shop Drawings: Including dimensions, location, finishes, materials, fasteners, hardware literature, typical joint details, erection details and the like.

B. Samples:
1. Plastic laminate: full line of an approved manufacturer’s standard including premium solid and textured colors for selection.
2. Interior wood trim and paneling with proposed finish, 6 inches minimum size.

1.7 STORAGE AND PROTECTION

A. Protect lumber and plywood from prolonged exposure to the weather until permanently enclosed into construction.

B. Store lumber and plywood under protective cover from weather and off the ground.

C. Store interior woodwork inside building 14 days minimum and at same temperature and humidity conditions as will occur after occupancy.

PART 2 - PRODUCTS

2.1 ENVIRONMENTAL CONSIDERATIONS

A. To the maximum extent possible, provide materials with 20% minimum recycled content.

B. Provide mastics, adhesives and binders with low VOC emissions.

2.2 INTERIOR WOOD TRIM

A. Grade “A” Alaskan birch. Same species and cut shall be used throughout each area.

B. Each piece shall be similar for color and grain with smooth planed surface and eased edges.

2.3 CASEWORK: AS SPECIFIED IN SECTION 06 41 10 - LAMINATE FACED CABINETS.

2.4 PLYWOOD

A. AD grade, smooth sanded interior type with exterior glue per PS-1.

B. Douglas Fir face veneer.

C. Interior use plywood: certified for reduced formaldehyde emission.

D. Size and thickness as per DRAWINGS.

2.5 HIGH PRESSURE DECORATIVE PLASTIC LAMINATE

A. 0.048 inch (1.0 mm) minimum thick, meeting NEMA general-purpose grade VGS or VGL requirements. 0.028 inch (0.7 mm) may be used for vertical use. Backer sheets may be BKL 0.020 inch (0.5 mm) thick.
   1. Nevamar Corporation.
   2. Formica.
   3. Wilson Art.
   4. Abet Laminati

B. Finish: Manufacturer’s standard texture and matt solid colors.

C. A maximum of (4) different colors will be used.
   1. Plastic laminate backing same thickness as face, tan color, backing grade.

D. Class II flame spread rating when used in fire rated corridor.

E. Adhesive recommended by laminate manufacturer, low VOC.

2.6 SCREWS

A. Self-drilling, countersunk head.

B. Galvanized or stainless steel in toilet and exterior areas.

2.7 NAILS

A. Finish or casing head nails.

B. Galvanized in toilet and exterior areas.

C. Siding and Soffit Nails: Ringshank hot-dipped galvanized stainless steel, or hardened aluminum.

2.8 ACCESSORIES

A. Connectors, edge trim moldings, adhesives, hardware, attachment anchors, closures, and trim shall be provided as indicated on DRAWINGS and as necessary for a complete finished appearance.

B. Interlocking metal or wood cleats in accord with AWI for panel installation.

C. Adhesives: recommended by manufacturer for condition of use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions to receive the finish carpentry and architectural woodwork for defects that will adversely affect the work, and for deviations beyond allowable tolerances.

B. Do not expose or install interior finish woodwork until wet work such as gyp board taping, masonry, concrete curing and plastering are complete.

C. Start of work shall mean acceptance of interfacing surfaces as capable of producing an acceptable job.

3.2 GENERAL FABRICATION

A. Construction per AWI “Custom Grade” unless specifically detailed otherwise. Install Bullet Shielding anchorage, joints and spaces in accord with manufacturers instructions. Install where indicated on DRAWINGS.

B. Finish shall be as specified under Section 09 91 00 - Painting.

3.3 GENERAL INSTALLATION

A. Completed work shall be plumb, level and square or to alignment indicated. Follow AWI and product manufacturer's instructions.

B. Coordinate and allow for work of other trades as necessary.

C. Length of Exposed Wood Trim: Use longest lengths practical but not less than twelve feet.

D. Exposed edges: Ease to 1/8-inch radius unless larger radii are detailed.

E. Attachment:
   1. Secure all members with sufficient fasteners, anchors into adequate backing, or adhesives to insure rigidity and permanence.
   2. Use concealed fasteners whenever possible.
   3. Where necessary to fasten through exposed surfaces countersink fasteners, and fill holes flush with matching wood filler.
   4. Minimum Fastener Penetration: 1-¼ inches or full penetration into solid backing.
   5. Concealed attachment for rigid, permanent installation with screws into structural backing.
   6. Use interlocking metal or wood cleats in accord with AWI to allow humidity movement for panel installation.

F. Joints:
   1. Use largest pieces practical.
   2. Tightly fitted, uniform and formed to conceal shrinkage.
   3. Running Trim:
      a. Miter corners.
      b. Join running trim with 45-degree bevel and only over solid backing.
      c. Stagger joints in adjacent pieces.
      d. Install scribed filler strips and seal to fill space between wood work and adjacent construction.

G. Distribute allowable defects for best overall appearance.

H. Completed work free from hammer and other tool marks.

I. Verify dimensions of woodwork locations in building to insure proper fit.

J. Install hardware in accordance with manufacturer's instructions.

3.4 TOLERANCES NON-CUMULATIVE AND EVENLY DISTRIBUTED:

A. Woodwork:
   1. Width, height, and depth: plus or minus 1/8 inch.
   2. Square and plumb: 2 degrees.

3. Scribe to fit surrounding construction: 1/8-inch maximum gap.
4. Paneling: Flatness (twist cup or bow) of individual panel: 1/8 inch in four feet as measured with 4-foot straight edge.
5. No hammer marks, chips or surface blemishes.

3.5 CLEAN UP

A. Leave panels, panel trim, woodwork and adjacent building areas clean and free from debris, excess sealant, adhesive and other soil caused by the installation of this Section work.

END OF SECTION

SECTION 06 41 16
LAMINATE FACED CABINETS

PART 1 - GENERAL

1.1 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Anchorage and backing components built into walls.

1.2 RELATED SECTIONS

A. Section 06 23 00 – Finish Carpentry and Architectural Woodwork

B. Section 07 92 00 - Joint Sealants

C. Section 09 06 00 – Finish Colors and Textures

D. Section 09 21 11 - Gypsum Board Assemblies

E. Section 09 91 00 - Painting

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. The publications may be referred in the text by basic designation only. In case of conflict the most stringent shall govern:

1. ASTM C501 – Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
2. ASTM C1048 – Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
3. ASTM D543 - Test Method for Resistance of Plastics to Chemical Reagents.
4. ASTM D570 - Test Method for Water Absorption of Plastics.
5. ASTM D695 - Test Method for Compressive Properties of Rigid Plastics.
6. ASTM D785 - Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
7. ASTM D790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
8. ASTM D1037 - Method for Evaluating the Properties of Wood-Base Fiber and Particle Panel Materials.
9. ASTM D2583 – Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
10. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

11. Architectural Woodwork Institute (AWI) - Architectural Woodwork Quality Standards.
12. AWI - Architectural Casework Details.
13. U.S. Department of Commerce - American Lumber Standard PS 20.
14. U.S. Department of Commerce - Product Standard for Plywood PS 1.
15. U.S. Department of Commerce - Commercial Standard (CS) - Hardboard CS 251.
16. ANSI A156.9 – Standard for Cabinet Hardware
17. American National Standards Institute (ANSI) 208.1 - Particleboard.
18. ANSI A208.2 - Medium Density Fiberboard.
19. National Electrical Manufacturer's Association (NEMA) publications for general purpose, Vertical Surfacing, and Post Forming Grade High Pressure Decorative Plastic Laminates (HPDC).
20. Composite Panel Association (CPA)

1.4 CABINET DEFINITIONS

A. The term "cabinet" includes casework, shelves, and countertops with finished exposed edges and minimum 4-inch back and end splashes.

B. "Exposed" means surfaces visible when:
   1. Drawer fronts and doors are closed.
   2. Cabinets and shelving are open type or behind glass doors.
   3. Bottoms of cabinets are seen: 48 inches or more above finished floors.
   4. Tops of cabinets are seen: below 72 inches above finish floor, or are visible from an upper floor or stair.
   5. Portions of cabinets visible after fixed appliances are installed.
   6. Front edges of cabinet body members seen through a gap greater than 1/8 inch with doors and drawers closed.

C. "Semi-exposed" means those surfaces visible when:
   1. Doors or drawers are open.
   2. Bottoms of cabinets are between 30 and 48 inch above finish floor.
   3. Front edges of shelving behind doors.

D. "Concealed" means surfaces visible when:
   1. Not visible after installation.
   2. Bottoms of cabinets less than 30-inches above floor.
   3. Tops of cabinets 72 inches or more above finish floor and not visible from upper level.

E. Any item not detailed or specified shall be "Custom Grade" in accordance with AWI Standards, Section 400.

1.5 SUBMITTALS

A. Finished samples of items proposed including:
   1. Typical cabinet case, door and drawer section.
   2. Hinge, pull, drawer slide, shelf bracket.
   3. Section of each type countertop and backsplash.
   4. Plastic laminate colors and textures.

B. Accepted samples will establish minimum standard of quality for the work.

C. Manufacturer's Literature and Shop Drawings: Including elevations, sections, dimensions, materials, finishes, fasteners, hardware, anchorage, construction joint details and typical details. Indicate interface with adjacent materials.

D. Manufacturer's Experience Record: Name, address, owner, and architect, phone numbers for comparative work.

E. Certification from casework manufacturer that products installed meet this specification.

1.6 PREINSTALLATION MEETING

A. When work is ready for cabinet installation arrange a meeting at the job with cabinet installer, CONTRACTOR and CONTRACTING OFFICER.

B. Have approved product installation-applications recommendations available.

C. Give 5 workdays notice prior to meeting.

1.7 QUALITY ASSURANCE

A. Casework Fabricator: Company specializing in manufacturer of commercial and institutional cabinets, and casework with minimum of ten projects producing casework similar to that indicated.

B. Manufactured wood board products shall be tested and certified for reduced formaldehyde emissions under National Particleboard Association and the Hardwood Plywood Manufacturer's quality control program.

1.8 STORAGE AND HANDLING

A. Store casework out of weather, dry and off of ground.

B. Bring casework into building when building is enclosed and dry. Allow casework to acclimate at least 10 days before installing.

1.9 TEMPERATURE-HUMIDITY REQUIREMENTS

A. During and after installation of work of this Section, maintain same temperature and humidity conditions in building as will occur after occupancy.

PART 2 - PRODUCTS

2.1 CONSERVATION REQUIREMENTS

A. To the maximum extent possible provide materials with 20% minimum recycled content.

B. Provide mastics, adhesives and binders with low VOC emissions.

2.2 MATERIALS

A. Particleboard in accord with ANSI 208.1: Grade M (medium density) 40 to 50 per cubic foot pound density made with formaldehyde emission limit F09 and minimum 20% recycled wood, face screw holding of 225 pounds minimum: Roseburg Forest Products: 800-245-1115; Temple: 800-424-2311; Collins Pine: 800-547-1793

B. Medium Density Fiber Board (MDF) in accord with ANSI A208.2: Grade 130 MR 30 made with no added formaldehyde emission limit F13 and 20% recycled wood, face screw holding of 220 pounds miminum: “Sierrapine”: 800-676-3339.

C. Hardboard: Tempered high-density ¼ inch minimum thick per CS 251.

D. Plastic Dividers: acrylic Plexiglas, smoke gray color tint - smooth polished edges: thickness indicated.

E. Plywood: A C grade per PS 1.

F. High Pressure Decorative Plastic Laminate (HPDL): NEMA general purpose or post forming grade.
   1. Laminate backing may be NEMA BKL .020-inch (0.5 mm) grade or same as face.
   2. Manufacturer’s standard color finishes as specified.
   3. Acceptable Manufacturers: Wilson Art, Nevamar, Abeti Laminati, or Formica. Use only one manufacturer for entire job.
   4. Adhesive recommended by laminate manufacturer for substrate and conditions of use.

G. Laminate-faced Panel Edges:

1. Semi exposed interior surfaces: 1mm ABS, or 3mmPVC.
2. Cabinet box (s) doors, drawer fronts and backsplash: 3mm ABS.
3. Countertop exposed edges: 1mm ABS, or 3mm PVC.
4. 6mm Maple wood edges only as indicated in DRAWINGS and Section 09060 – Approved Colors and Textures.

H. Semi-Exposed interior surfaces: Factory thermally fused melamine (TFM), or polyester resin impregnated decorative overlay finish on MDF or particleboard in accordance with CPA; Plygard, Permalam or Panolam. Meet NEMA LD-3 except 125 cycle wear test.

2.3 HARDWARE

A. Finish: U.S. 32D Stainless Steel, Satin finish or brushed chrome.

B. Hinges: All Steel ANSI 156.9, Grade 2 - B01602 or AWI type “E” European Style set in plastic inserts, concealed with door closed. Independent screw adjustment for depth, side, and height of door. 120 [170] degree opening, self-closing from 2 inch out. Grass 3000, Blum 95 M or equivalent Hafele. Provide two hinges for doors to 30 inches high, 3 hinges for doors over 30 inches.

C. Pulls: ¼ inch bent wire pull 3-1/2 by 1inch; Hafele, Quality or Stanley.

D. Adjustable Shelf Supports: Minimum ANSI 156.9 - B04013 5mm diameter by ½ inch galvanized or chrome plated steel support pin into predrilled holes at 1 inch on center. Halefe: 282.27.401 or equal.

E. Drawer Slides: Full extension side or bottom mount steel with steel or polyethylene ball bearing rollers, with self closing from four inch extension, positive stop with lever latch to remove drawer; Grass, K & V, Blum, Accuride, or equal.
1. Slide manufacturer rated for 100-pound load at full extension in drawer width indicated and for up to 6 inch high drawers.
2. Slide manufacturer rated for 200 pound load at full extension for drawers over 6 inches high.

F. Provide File drawers with steel Pandex file rails.

G. Drawer and Door Locks: 6-pin tumbler Schlage G core lock for mount to material up to 7/8 inch thick with 3/4 inch minimum bolt travel: Schlage CL-Series with a 6 pin Gkeyway. No Subtitutions. Furnish 2 keys, Satin Chrome finish, each lock.

H. Wire management Grommets: 2 inch inside diameter plastic.

2.4 INSTALLATION ACCESSORIES

A. Provide fasteners, angle anchors and adapters for rigid anchorage of casework onto surrounding structure. Use threaded anchors through gyp board into solid backing. Use drilled expansion anchors into concrete and masonry and into floors.
   1. Provide stud wall backing of solid lumber or 16 gauge by 6 inch sheet steel with 2 screws into each stud across at least 3 studs.

2.5 COLOR - FINISHES

A. Exposed and semi-exposed surfaces shall be finished by the cabinet fabricator.

B. High-pressure decorative laminate (HPDL) of one manufacturer throughout job.

C. One of HPDL manufacturer's standard wood grain matte finishes shall be selected for vertical exposed surfaces.

D. Two of HPDL manufacturer's standard solid color textured matte finish shall be selected for countertops.

E. Backers, shelves, drawer interiors and similar semi-exposed areas shall be the same beige, or off-white color.

2.6 CASEWORK - FABRICATION

A. Fabricate to AWI "Custom Grade" with exposed surfaces clad with high-pressure decorative plastic laminate (HPDL). Shop assemble for delivery to site in easily handled units, which fit through building openings. Provide backing and wireways for plumbing and electrical attachments.

B. Conform to AWI "Reveal Overlay" or "Flush Overlay" design construction details.

C. Exposed Surfaces: Surface with NEMA general purpose or post forming grade HPDL.
   1. Countertops and backsplashes: 0.048 inch (1.0 mm) HPDL.
   2. Door, drawer, and cabinet outside vertical faces: 0.028 inch (0.7mm) inch minimum thick HPDL [or 1/50 inch minimum thick wood veneer: plain sliced white birch] [or red oak].
   3. Apply laminate without seams to 8-foot. Fit corners and joints hairline and flush.
   4. Apply laminate balance sheet to reverse side of laminated surfaces.

D. Semi-Exposed Surfaces: Surfaced with HPDL, Thermal fused polyester or

Melamine Overlay; inside cabinets, drawers and doors.

E. Door, Drawer and Shelf Edges: Applied with hot melt or PVA adhesive and bevel trimmed.

F. Doors and Drawer Fronts: ¾ inch particleboard or MDF core with HPDL back balance sheet. Attach drawer fronts by glued dowels, glued dovetails, glued lock shoulder or screws with glue.

G. Countertops, Cabinet Tops and Bottoms: ¾ inch particleboard or MDF core.

H. Shelves: ¾ inch particleboard or MDF core for shelves up to thirty-five inch span, one inch particleboard or MDF over thirty-five inch span.

I. Unless greater number shown, provide one adjustable shelf in base cabinets and two adjustable shelves in upper cabinets.

J. Drawers: particleboard or MDF core with thermoset decorative overlay:
   1. Back: ¾ inch.
   2. Sides: ½ inch thick.
   3. Bottom: ¼ inch thick. Set-in captured 4 sides or screw through bottom mount glides.

K. Wall Cabinet Attach Strips: Minimum ¾ by 6-inch particleboard or MDF backer - full cabinet width.

L. Provide cutting or filler trim strips for tight fit to surrounding construction as necessary.

2.7 WOOD FINISHING

A. Shop finish with transparent stain in accord with AWI custom grade lacquer systems:
   1. Wash coat
   2. Stain
   3. Sealer (open grain woods)
   4. 2 separate finish coats medium satin sheen.

PART 3 - EXECUTION

3.1 INSPECTION OF SURFACES

A. Examine spaces, surfaces, and DRAWING details to receive the work for defects that will adversely affect the completed work and for deviations beyond allowable tolerances.

B. Verify adequacy of backing and support framing.

C. Start of work shall mean acceptance of the interfacing surfaces as capable of producing an acceptable job.

3.2 CABINET INSTALLATION

A. Install cabinets and countertops plumb, level, and square or to alignment indicated in accordance with approved submittals the written recommendations of the manufacturer and AWI custom grade.

B. Verify dimensions of cabinet locations in building to insure proper fit.

C. Coordinate with interfacing and related trades as necessary. Provide cut outs required for plumbing, electrical and other inserts required.

D. Install scribe cut to fit filler strips or scribe cut countertops and cabinets to provide maximum 1/16-inch gap to surrounding building construction. Fill and touch up exposed site made holes and raw edges to match adjacent finish.

E. Secure members together and into building structure with sufficient fastener, anchors and Z or L-type clips into solid structural backing to insure rigidity and turn over resistance.
   1. Anchor wall cabinets with minimum No. 8 screws top and bottom at 16-inch maximum spacing one-inch penetration into solid backing or wall studs.
   2. Anchor free standing cabinets into floor with minimum ¼ inch drilled in anchors at each corner.

F. Seal joints smooth and watertight between countertop and adjacent construction with silicone sealant.

G. Seal all exposed, unfinished particleboard and MDF, including equipment and sink cutout edges with clear lacquer or varnish. Fill and touch up to match adjacent finish site made holes and scratches.

3.3 TOLERANCES: NON-CUMULATIVE AND EVENLY DISTRIBUTED:

A. Width, Height and Depth: plus or minus 1/8 inch.

B. Gap between doors, drawers, panels and frames: 1/8 inch plus or minus 1/16 inch.

C. Square and Plumb: plus or minus 2 degrees.

D. Scribe fit to surrounding construction: 1/16 inch maximum.

E. Flatness of doors: 1/16 inch maximum warp measured diagonally for a 36-inch span.

F. Countertop: flush, tight exposed joints: 1/32 inch maximum.

3.4 ADJUSTING

A. Adjust door, drawers, hardware and fixtures and other moving or operating parts to function smoothly and correctly.

3.5 CLEAN UP

A. Leave cabinets and surrounding areas clean and free from cartons, surplus materials, damage and soil caused by the cabinetwork installation.

3.6 SCHEDULE OF CABINETS

A. Work/Break Room.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 62 00 – Flashing and Trim

B. Section 07 92 00 - Joint Sealants

C. Section 09 21 11 – Gypsum and Cement Board Assemblies

D. Division 22 - Mechanical Equipment, Pipe Insulation and Duct Insulation

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referenced in the text by basic designation only. In case of conflict the most stringent shall govern:

1. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) “Handbook of Fundamentals”.
2. Underwriter’s Laboratories (UL) “Building Materials Directory”.
3. ASTM C177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Guarded- Hot Plate Apparatus.
4. ASTM C272 - Test for Water Absorption of Core Material for Structural Sandwich Construction.
5. ASTM C423 – Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
6. ASTM C518 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
7. ASTM C553 - Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications.
8. ASTM C578 - Specification for Rigid Cellular Polystyrene Thermal Insulation.
9. ASTM C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
10. ASTM C665 - Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
11. ASTM C764 – Specification for Mineral Fiber Loose- Fill Thermal Insulation.
12. ASTM C1104 – Test Method for Determining the Water Vapor Sorbtion of Unfaced Mineral Fiber Insulation.
13. ASTM C1338- Test Method for Deforming Fungi Resistance of Insulation Materials and Facings.

14. ASTM E84 - Tests for Surface Burning Characteristics of Building Materials.
15. ASTM E96 – Test Methods for Water Vapor Transmission of Materials.
16. ASTM E119 - Fire Tests of Building Construction and Materials.
17. ASTM E736 – Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
18. ASTM E136 – Standard Test Method for Behavior of Materials in a Ventical Tube Furnace at 750 degrees C.

1.3 SUBMITTALS

A. Manufacturer's literature including material, composition, fire hazard ratings, and application instructions.

1.4 PRODUCT LABELING

A. Insulation, or factory sealed packages of the insulation shall be marked by the insulation manufacturers as having the thermal resistance, fire hazard characteristics, water absorption, and compressive strength specified.

1.5 PROTECTION

A. Store and protect insulation from moisture until permanently enclosed.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Thermal Resistance Values R:
   1. Fill cavities as shown on DRAWINGS and provide minimum "R" indicated.
   2. Indicated "R" shall be for the insulation material by itself per ASHRAE.

B. No added asbestos.

C. No added formaldehyde.

D. Blanket fibrous glass insulation: Green Guard Certified.

2.2 ACOUSTICAL SOUND BATT INSULATION

A. Kraft paper facing attachment flanges on blanket of mineral wool or fibrous glass per ASTM C553 or ASTM C665: Minimum 2-1/2 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and verify field conditions to receive insulation for defects that will adversely affect the completed installation, and for deviation beyond allowable tolerances.

B. Installation shall be done only after other trade work in the area is sufficiently complete to prevent subsequent disturbance of insulation.

C. Beginning of installation shall mean acceptance of the interfacing surfaces as capable of producing an acceptable job.

3.2 PREPARATION

A. Verify substrates are clean and dry. Remove loose or foreign matter.

3.3 INSTALLATION

A. Install in accordance with approved submittals and manufacturers written instructions using necessary primers and accessories.

B. Install continuously where indicated without voids. Fill spaces completely. Trim and fit closely around structure, door rough openings and frames, conduit, piping, obstructions and penetrations in accord with manufacturer's written instructions. Install clearance baffles around heat producing lights and heat producing appliances in accord with appliance manufacturer's instructions.

C. Where pipe or conduit is located in space to be insulated, place portion of insulation batt between pipe or conduit and building exterior. Compress insulation only slightly to keep in place.

D. Batt Insulation and Acoustical Batt Insulation:
   1. Friction fit unfaced batts between rough openings and doors and windows and voids as indicated on DRAWINGS, using fasteners as necessary for permanent, snug installation without sagging or excess compression.
   2. Attach faced insulation with sufficient compatible tape, adhesives, or mechanical fasteners to permanently anchor insulation in accordance with insulation manufacturer's written instructions.
   3. Attach faced insulation flanges to studs and top edge.

3.4 INSULATION SCHEDULE

A. Install insulation as specified in the following locations and other areas as specifically detailed on DRAWINGS.

END OF SECTION

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SECTION 07 62 00
FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 92 00 - Joint Sealants

B. Section 09 91 00 – Painting

C. Division 23 – Mechanical – Heat Vent and Air Conditioning

1.2 WORK FURNISHED BUT NOT INSTALLED

A. Flashing that is incorporated into roofing and Wall Panels.

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. Publications may be referenced in the text by basic reference only. In case of conflict, the most stringent shall govern.
   1. American Society For Testing Materials (ASTM) specific references as noted.
   2. ANSI/ASTM A167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   3. ASTM A480 - Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
   4. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   5. ASTM B117 – Practice for Operating Salt Spray (Fog) Apparatus.
   6. ASTM B209 - Specification for Aluminum and Aluminum-Alloy, Sheet and Plate.
   7. ASTM B749 – Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
   8. ASTM C920 - Specification for Elastomeric Joint Sealant.
   9. ASTM D146 - Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.
   10. ASTM D779 – Standard Test Method for Water Resistance of Paper, Paperboard, and other sheet materials by Dry Indicator Method
   11. ASTM D828 – Tensile Properties of paper and papeboard using Constant-Rate of Elongation Apparatus.
   12. ASTM D1004 - Test Methods for Initial Tear Resistance of Plastic Film and Sheeting.
   13. ASTM D1876 - Test Methods for Peel Resistance of Adhesives.

14. ASTM D1970 - Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials used as Steep Roofing Underlayment for Ice Dam Protection.
15. Sheet Metal and Air Condition Contractor's National Association (SMACNA) "Architectural Sheet Metal Manual".
16. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
17. American Welding Society (AWS) "Code For Welding in Building Construction".
18. Society for Protective Coatings (SSPC) Systems and Specifications.

1.4 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature: Including dimensions, materials, joints, fasteners, anchorage, installation recommendations, details and location in complete work if work proposed differs from Contract DRAWINGS.

PART 2 - PRODUCTS

2.1 GALVANNEALED STEEL SHEET

A. American Society for Testing and Materials ASTM A653 cold rolled steel sheet, lock-forming quality. Hot-dip Galvannealed zinc coating both sides of at least 0.90 ounce per square foot total. (G90).

B. Minimum thickness 24 gage except unbacked spans over 12 inches 20 gage unless indicated otherwise. Special thickness per DRAWING details. Anchor clips and hook strips 20-gage.

2.2 ALUMINUM SHEET

A. 5005 or 3003 alloy with temper required for forming, per ASTM B209. Minimum thickness: .040 inch.

2.3 FLEXIBLE RUBBER-ASPHALT FLASHING

A. Pre-Manufactured, elastomeric, self-adhering, self-sealing sheet membrane waterproofing composed of high-strength polyethylene sheet plastic bonded to rubberized asphalt per ASTM D1970 recommended by manufacturer for application as concealed flashing meeting the following requirements.
   1. Total thickness: 40 mil minimum.
   2. Maximum load at break: 25 pounds per inch per ASTM D1970.
   3. Elongation at break, asphalt: 10 percent minimum per ASTM D1970.
   4. Low Temperature Flexibility: 180 degree bend over 1 inch mandrel at minus 20 degree F without cracking per ASTM D1970.

5. Overall adhesion between Plywood and to adjacent membrane at 40 degrees F: 3.0 pound per inch width minimum per ASTM D1970.
6. Sealability around nail: pass per ASTM D1970.
7. Removable release paper.
8. Primer: as recommended by underlayment manufacturer for conditions of use.

B. Approved manufacturer subject to meeting specified criteria:
1. Bituthene Ice and Water Shield roof flashing or Perm–A-Barrier wall flashing by W. R. Grace, Cambridge, MA 617/876-1400.

C. Substitutions in accordance with Section 01 60 00 - Product Requirements.

2.4 FASTENERS

A. Number 14 (1/4 inch) stainless steel or corrosion and abrasion resistant coated carbon steel resistant to 1000 hours salt spray per ASTM B117 or 15 cycles per ASTM G87 – Kesternich Cabinet Testing;testing with 15 percent maximum red rust, and no coating blistering or cracking on head or shank.

B. Exposed fasteners: Number 14 (1/4 inch) diameter screws preassembled with a 3/4 inch diameter 18-gage tapered lip stainless steel washer bonded to an EPDM sealing gasket washer. Factory paint heads to match adjacent metal color.

C. Use button or pan head Phillips screws for concealed work.

D. Nails and pop rivets not permitted.

E. Screws shall penetrate metal substrate 1/2 inch or penetrate wood substrate 1-1/2 inches.

2.5 ACCESSORIES-ATTACHMENTS

A. Primers, clips, hook strips, angles, cover plates, inserts and other accessories, as necessary for secure attachment shall be the same material as flashing and in accordance with SMACNA and NRCA recommendations. Fabricate anchor clips and hook strips one gage thicker than attached flashing.

B. Reglets: Surface mounted type, 5 inches high minimum, for continuous sealant fillet, Fry type SM or equal substitution.

2.6 ANCHORS INTO CONCRETE AND MASONRY

A. Standard commercial drilled expansion or epoxy anchors recommended for intended use by their manufacturer may be used if approved by the ARCHITECT. Submit manufacturer's literature indicating lateral (shear) and pullout (tension) data for approval. Explosive driven anchors not allowed.

B. Minimum Diameter: 1/4 inch.

C. Each anchor shall be capable of developing at least 200-pound lateral and 400-pound pullout load.

2.7 SEALANTS

A. Single component silicone or urethane per ASTM C920.
   1. Tape sealant may be used for straight lap joints: 50 percent butyl, 1/4 to 1/2 inch width and thickness.

B. Color: Standard color nearest match to flashing finish color for exposed sealants.

2.8 PAINT

A. Shop prime and shop finish paint exposed surfaces.
   1. One coat zinc-base topcoat compatible primer.
   2. Two coats urethane enamel, semigloss.

B. Coil factory coated 70 percent Kynar or Hylar enamel finish is acceptable in lieu of shop paint if steel thickness is equal to that specified.

2.9 METAL FABRICATION

A. Fabricate per approved submittals and the best commercial practice of SMACNA, NRCA and manufacturer's written instructions. Form sections square, true and accurate to size, free from distortion and to fit substrate.

B. Fabricate sheets or panels in longest lengths practical, true to details, free of dents, scratches and tool marks. Make allowances for thermal expansion-contraction at joints.

C. Cross break as necessary to prevent "oil canning". Form lines and edges straight and neat. Form bent-metal corners to smallest radius possible without causing grain separation. Roll exposed edges back on underside to form folded, hemmed edge, 1/2 inch minimum (3/4 inch minimum to engage hold down). Slope exposed vertical bottom edges 45 degrees to form drip.

D. Welding shall be per AWS for type of weld and material. Grind exposed welds smooth and flush. Coat welds and bare metal abrasions in galvannealed steel with SSPC zinc rich primer paint.

E. Joints shall be weathertight and have provisions for expansion and contraction. Lap joints and corners watertight. Lap in direction of water flow. Provide slotted holes at exposed gasketed screws.

2.10 SHOP CLEANING AND PAINTING

A. Clean metal prior to painting by “solvent cleaning” SP-1, followed by acid etch and “hand cleaning” SP-2 per SSPC.

B. Shop paint 1 primer coat and 2 finish coats per finish paint manufacturer’s instructions.

C. Factory Coil Kynar paint coating is acceptable in lieu of shop paint.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the DRAWING details and field conditions to receive the work for defects that will adversely effect the completed work and for deviations beyond allowable tolerances.

B. Beginning of installation shall mean acceptance of existing conditions as capable of producing an acceptable job.

3.2 DISSIMILAR MATERIALS

A. Aluminum or steel contacting, concrete, masonry, treated wood and the like shall have contact surfaces separated by a heavy coat of bituminous paint, 40 mil self-adhering rubber sheet or by non-absorptive tape.

B. Separation materials shall be trimmed to not be visible in exposed completed work.

3.3 INSTALLATION

A. Install all flashings in accordance with the best commercial practice of SMACNA, NRCA and in accordance with approved submittals, manufacturer’s written instructions, plumb, level, or to alignment shown on the DRAWINGS.

B. Joints shall be weathertight and have provisions for expansion and contraction. Lap to shed water flow outside.
   1. Lap flexible flashing under metal flashing.

2. Lap flexible flashing over door and window head and wall penetration flashing to shed water.
3. Lap metal flashing 4-inch minimum with sealant tape to shed water.
4. Extend flashing 8-inch minimum above roofing.

C. Cut components neatly to fit against adjacent member.

D. Field cut members exposed in the completed work so that finish is not damaged. Leave no exposed sharp edges.

E. Length of screws shall be sufficient to fully penetrate sheet metal or plywood fastened and 1 1/2-inch minimum into any solid wood backing.

F. Cutting or drilling of building structural components shall not be permitted unless approved by ARCHITECT in writing.

G. Touch-up steel with paint primer and finish coat equal to adjacent panel finish coating at bare metal abrasions.

H. Fasten metal flashing at exterior edges with continuous galvanized hook strip, 20 gage minimum, screwed at 12 inch on center, with No. 14 screws, holding cleat, penetrating at least 1 inch into solid backing. Fasten interior side of parapet flashing 12 inches on center with 1/4 inch steel screws and seal washers through slotted flashing holes.

I. Secure metal counterflashing into a reglet joint by use of screws. Fill the reglet continuously after flashing installation with silicone-based sealant sloped to shed waste.

3.4 ANCHORAGE AND ATTACHMENT

A. Spacing and quantity of anchor fasteners as indicated and required to develop permanent weather tight joints on exterior work.

B. Maximum spacing of exposed fasteners shall be 12-inches evenly spaced within 1-1/2 inches of panel edges unless closer spacing is indicated.

3.5 SEALANT APPLICATION

A. As recommended by sealant manufacturer approved submittals, to provide permanent, weathertight joints. Set lapped seams and entire roof flashing in sealant bed or sealant tape.

B. Joints shall be sealed continuously against the weather and have provisions for expansion and contraction.

C. Seal moving lap flashing joints with 2 rows of sealant tape.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 06 23 00 - Finish Carpentry and Architectural Woodwork

B. Section 08 11 00 - Steel Door and Window Frames

C. Section 08 80 00 – Glazing

D. 08 44 00 – Aluminum Windows

E. Section 09 91 00 – Painting

F. Division 23 - Mechanical

G. Division 26 – Electrical

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications are referred to in the text by basic designation only. In case of conflict only the most stringent shall govern.
   1. Federal Specification (FS): Specific References as noted.
   2. American Society for Testing and Materials (ASTM) ASTM C510 - Test Method for Staining and Color Change of Single or Multicomponent Joint Sealants.
   3. ASTM C717 - Terminology of Building Seals and Sealants.
   4. ASTM C834 - Specifications for Latex Sealants.
   5. ASTM C919 - Practice for Use of Sealants in Acoustical Applications.
   6. ASTM C920 - Specification for Elastomeric Joint Sealants.
   7. ASTM C1193 - Guide for Use of Joint Sealants.
   8. ASTM D1667 - Specification for Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
   9. ASTM C1330 – Specification for Cylindrical Sealant Backing for use with Cold Liquid Applied Sealants

1.3 SUBMITTALS

A. Sealants including colors, backing, bond breaker: Manufacturer’s Literature: Including recommendations for cleaning substrate, application temperatures and compatibility with adjoining surfaces and application.
   1. Verify Sealant adhesion, primer and staining requirements.

B. Product Labeling: Each sealant material container shall bear manufacturer's label and name, type, color, and applicable standards.

C. Manufacturer qualifications.

1.4 QUALITY ASSURANCE

A. Manufacturer of sealant shall have been in business of manufacturing construction sealants with at least 500 successful projects of similar size.

B. Applicator shall be responsible for verifying sealants used are compatible with joint substrates.

1.5 DELIVERY AND STORAGE

A. Deliver in manufacturer's original unopened container, clearly indentifying each product.

B. Store in accord with manufacturer's recommendations.

1.6 TEMPERATURE REQUIREMENTS

A. Do not apply sealants at ambient temperatures below those recommended in writing by the manufacturer, and in no case, in rain or snow, or with, dirt, frost or water on the components.

B. Install sealants in metal flashing and glazing with temperature between 25 and 55 degrees F. by temporary enclosure and heating as necessary for 12 hours before, during and 24 hours after installation.

C. Protect sealants until cured.

PART 2 - PRODUCTS

2.1 GENERAL

A. Compatibility: Provide sealants, backing, and primers that are compatible with one another and recommended by manufacturer for substrates and for conditions of service.

B. Acceptable Sealant Manufacturers: Subject to compliance with specified criteria:
1. Dow Corning http://www.dowcorning.com
2. General Electric http://www.gesealants.com
3. Tremco http://www.tremco.com
4. Sika Corporation http://www.sikaindustry.com
5. Sonneborn Chemrex Inc http://www.chemrex.com

2.2 TYPICAL JOINT SEALANTS

A. Typical use unless otherwise noted:
   1. Single component non-sag, non-staining, silicone type.
   2. Movement range 50 percent, plus or minus.
   3. Shore A hardness 15-25.
   4. Recommended in writing by manufacturer for condition of use.
   5. Federal Specification (FS) TT-S-00230C or ASTM C920.
   6. Color: match adjacent surfaces as closely as possible unless indicated otherwise on the DRAWINGS, using one of the manufacturer's standard colors of including black, white, brown, grey and translucent.
   7. Paintable type for interior.

B. For metal flashing, tile and vapor retarder and as indicated or specified in applicable product sections:
   1. Single component non-sag non-staining polyurethane type.
   2. Movement range plus or minus 25 percent.
   3. Shore A hardness 25-40.
   4. FS TT-S-00230C or ASTM C920.
   5. Color: Same as those specified for silicone.

2.3 ACOUSTICAL (SOUND) SEALANT

A. Single component non-sag FS TT-S-00230, and ASTM C834 non hardening acrylic, or synthetic rubber recommended in writing for condition of use.

B. Surface fire characteristics: flame spread 5, smoke developed 0.

2.4 BACKING MATERIALS AND BOND BREAKERS

A. Flexible non-gassing polyethylene or polyurethane foam backing filler rod and bond break tips in accord with ASTM C1330 and recommended in writing by the sealant manufacturer for joint conditions. Bond breaker materials shall not stain adjacent materials.

B. Oversized thirty to fifty percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application to prevent 3 sided adhesion where backer rod cannot be used.

2.5 PRIMERS AND CLEANERS

A. Recommended in writing by the sealant manufacturer for the joint material and condition of use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions to receive sealants for defects that will adversely affect the work, and for deviations beyond allowable tolerances.

B. Beginning of installation shall mean installer accepts existing conditions as capable of producing an acceptable job.

3.2 PREPARATION

A. Clean and remove loose dirt, oil, corrosion, curing agents, protective coatings, existing sealants, waterproofers, moisture, frost and other foreign material from surfaces to receive sealants and primers using approved techniques and cleaning agents recommended by sealant manufacturer.

B. Paint: Where scheduled shall be applied after sealant application.

C. Primer: Where recommended by sealant manufacturer shall be neatly applied before back-up materials and sealant application. Mask or otherwise protect adjacent surfaces from excess primer.

3.3 BACKING MATERIALS AND BOND BREAKERS INSTALLATION

A. Install in accordance with ASTM C1193, approved sealant manufacturer's written recommendations and the following. Apply acoustical sealants in accord with ASTM C919. Verify non-staining of adjacent porous materials and compatibility.

B. Use joint backer bond breaker filler rod for joints over 1/4 inch wide.

C. Allow for manufacturer's recommended width to depth ratio. Do not set deeper than width of joint.

D. Do not stretch lengthwise to joint.

3.4 SEALANT INSTALLATION

A. Apply in accordance with manufacturers written recommendations for conditions of use.

B. Mask as necessary.

C. Size sealant materials to achieve sealant manufacturer's recommended width to depth ratio: typical depth in joint shall be 1/2 width of joint. Sealant depth shall be 1/4 to 3/8 inch and joint width at least 2 times expected

movement.

D. Install weep tubes to drain exterior cavities to outside at 16 inch maximum spacing.

E. Lapped joints: shall receive continuous bed of sealant or sealant tape before assembly. Whenever practical, joints shall be bedded or coated continuously before assembly. Lap joint sealant shall have a minimum lap width of 3/8 inch by 1/4 inch minimum depth.

F. Apply under continuous pressure ahead of sealant gun.

G. Tool joints as soon as possible to produce a consistent smooth joint without voids and foreign matter shape sealant to shed water.

H. Completed sealed joints shall have uniform, straight sealant bead free of voids, sags, and foreign material.

3.5 JOINTS TO RECEIVE SEALANT

A. Exterior: Building joints exposed to the weather and moisture in the completed work as specifically indicated on DRAWINGS and including:
   1. Door and window frames.
   2. Thresholds.

B. Interior as specifically indicated on DRAWINGS and including:
   1. Concrete floor joints.
   2. Tile wall control joints.
   3. Expansion joints between wall and floor ceramic tile.
   4. Around edges of electrical and telephone outlet boxes in gypsum board walls and cover entire back of box in offices, conference room and toilet room walls (acoustical Sealant).
   5. Around mounting flanges of plumbing fixtures such as sinks, lavatories and water closets.
   6. At floor and untaped top of gypsum wallboard at deflection head of walls.
   7. Floor joints to wall joints in mechanical rooms.
   8. Countertop joints to adjacent surfaces.
   9. Around door frames.
   10. Around window frames.

C. Other Joints: As indicated on DRAWINGS and SPECIFICATIONS.

D. Pipe, conduit and duct penetrations in fire-resistance rated walls, floors and ceilings.

3.6 CLEAN UP

A. Remove surplus materials and excess sealant from surrounding surfaces at completion of each day's work.

END OF SECTION

SECTION 08 11 00
STEEL DOOR AND WINDOWFRAMES

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 92 00 – Joint Sealants

B. Section 08 14 00 – Wood Doors

C. Section 08 71 00 – Door Hardware

D. Section 08 80 00 – Glazing

E. Section 09 21 11 – Gypsum and Cement Board Assemblies

F. Section 09 91 00 – Painting: Field painting of doors and frames

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent shall apply.

1. A568 – Standard Specification for Steel, Sheet, Carbon and High Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
2. ASTM A924 – Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
3. ASTM A653 - Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.
4. ASTM C1036 - Specification for Flat Glass.
5. ASTM C1048 - Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
6. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.
7. ASTM E2190 – Specification for Sealed Insulating Glass Unit Performance and Evaluation.
8. National Fire Protection Association (NFPA) NFPA 80 – Standard for Fire Doors and Windows.
9. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.
10. Steel Door Institute (SDI) /ANSI A 250.8-Recommended Specifications for Standard Steel Doors and Frames.
11. Steel Door Institute (SDI)/ SDI-105 (ANSI A250.11 - Recommended Erection Instructions for Steel Frames.
12. Underwriters Laboratories (UL) 10C – Positive Pressure Fire Tests of Door Assemblies.

13. National Association of Architectural Metal Manufacturers (NAAMM) Hollow Metal Manufacturers Association Division (HMMA) Standard NAAMM:HMMA 810 – Hollow Metal Doors 820 - Hollow Metal Frames.
14. NAAMM: HMMA - Standard 840 - Installation and Storage of Hollow Metal Doors and Frames.
15. Society for Protective Coatings (SPC) - Systems and Specifications.
16. (NAAMM): HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames.
17. International Building Code (IBC) 2009.
18. ANSI Z 97.1 – Safety Glazing Material Used in Buildings – Safety Performance Specifications and Methods of Test.

1.3 SUBMITTALS

A. Indicate frame profile, construction, thickness, finish, anchor types and locations, location of cutouts for hardware, reinforcement, glass construction and installation-adjustment instructions.

B. Indicate door elevations, construction, thickness, finish, internal reinforcement, construction method at edges, top and bottom, cutouts for glazing, and installation-adjustment instructions.

C. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the DRAWINGS.

D. Certificate from Installer that installation meets these SPECIFICATIONS.

1.4 QUALITY ASSURANCE

A. Conform to requirements of HMMA and these SPECIFICATIONS.

B. Insulating glass fabricator: 25 similar successful jobs.

1.5 STORAGE AND PROTECTION

A. Store above ground, vertical in dry area, spaced and vented, protected from weather.

PART 2 - PRODUCTS

2.1 FRAMES

A. HMMA 861 or SDI/ANSI A250 hollow steel construction meeting this specification.
   1. Interior Frames: Face sheets 0.053 inch (18 gage) thick.

2. Continuously welded corners finished smooth at exterior and for openings over 3 feet wide. Reinforce knocked down frame corners with joint backer to align joint and mechanical lock in assembled position.
3. Minimum 0.093 (12-gage) reinforcing plates around hardware. Continuous reinforcing along continuous hinges.

B. Jamb Anchors: 0.042 inch (18 gage) minimum hot-dip galvanized evenly spaced not over 24-inches apart and 6-inches maximum from top and bottom of door.
1. Existing openings: provide 1/4-inch minimum diameter countersunk head anchors through each jamb in rough opening framing, spaced as indicated above.
2. Pairs of doors: anchor header 8 inches from side jambs and not over 24 inch spacing.
3. Floor Sill Anchors: 16 gage galvanized.

2.2 MINIMUM EQUIVALENT GAGE THICKNESS

A. Minimum uncoated steel thickness:
1. 10 gage 0.123 inches.
2. 12 gage 0.093 inches.
3. 14 gage 0.067 inches.
4. 16 gage 0.053 inches.
5. 18 gage 0.042 inches.

2.3 ACCESSORIES

A. Louvers: Roll formed steel, 24 gage slat blades, with frame 50 percent free area, no see through.

B. Frame Silencers: shop drill holes and provide 3 resilient rubber bumpers, each jamb 3/8 inch diameter for force fit into drilled hole per ANSI A156.16 type L03011.
1. Not required on doors with gaskets or weather strip.

C. Glazing Stops: rolled steel channel wrap-around shape height and mitered corners for thickness of glass required to allow U.L. or W.I.I. fire label: Countersunk, corrosion resistant tamperproof screws.

D. Concealed wire ways: water tight sheet metal block out around frame mounted electrical devices with wire-way to single location at frame head.

2.4 GLAZING

A. Glass and glazing in accord with Section 08 80 00 – Glazing.

B. Glaze interior non-fire rated doors and frames with 1/4 inch tempered safety

glass per ASTM C1048, roll marks horizontal.

C. Permanently label glass identifying manufacturer, standard complied with and glass thickness in accord with IBC 715 and 2406.

2.5 HARDWARE

A. Coordinate Hardware with Section 08 71 00 – Door Hardware.

2.6 FABRICATION

A. Fabricate in accordance with HMMA 861, SDI/ANSI A250, these specifications, and approved submittals. Doors and frames shall be rigid, exposed welds and fabrication marks ground flush, smooth, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Close joints tight, even space and flush.

B. Fabricate typical doorframes with 5/8-inch high integral stops and 2-inch faces except frames in concrete masonry shall have 4-inch header.
   1. Provide window stops with Torx security head screws.
   2. Provide 2-1/2 inch faces with sheet steel enclosure box and wireway or 1/2 inch conduit to allow electrical device installations and wiring connect after frame is installed. Provide wireway from each electrical hardware location to a single electrical connect at frame head on openings scheduled for electric devices. For future electrical installations, provide wireway to strike and middle hinge locations.

C. Prepare doors and frames to receive finish hardware, and glazing specified: Including cutouts, hardware, reinforcing plates welded in place around hardware attachment areas, drilling and tapping for mortised hardware in accordance with approved finish hardware schedule.

D. Reinforce frames wider than 48 inches with formed steel channels, or angles fitted tightly into frame head, flush with top.

E. Prepare frames for silencers specified in Section 08 71 00 – Door Hardware.

F. Attach fire-rating label to each rated frame and door.

G. Close top edge of exterior doors flush with inverted steel channel closure. Seal joints watertight. Provide weep holes in bottom edge.

H. Factory install door louvers.

2.7 DOOR AND FRAME FINISH

A. At building exterior and where indicated: hot dip galvanealed doors and

frames with 0.40 ounce zinc coating total both sides, conforming to ASTM A653 or A924 prior to factory preparation and factory prime painting.

B. Typical: factory chemically clean and phosphate treat for paint adhesion of door surfaces and each side of frames and factory prime paint with rust inhibiting prime paint in accordance with SPC or HMMA recommendations and for compatibility with field finish in accordance with Section 09 91 00 - Painting. Exposed surfaces to be smooth and free of scratches and paint runs.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and verify field conditions to receive frames for defects that will adversely affect the work and for deviations beyond allowable tolerances.

B. Beginning of Work shall mean acceptance of existing conditions as capable of producing an acceptable job.

3.2 INSTALLATION

A. Install frames in accordance with SDI-105, or HMMA 861 and approved submittal rigidly attached to walls. Install any knocked down frames with tight flush joints.
   1. Install frames with electrical hardware to provide continuous wireway from frame mount electrical device to frame head for concealed inside wall wiring.

B. Frame Insulation:
   1. Fill frames in sound-acoustic walls with unfaced batts of fiberglass insulation.
   2. Fill exterior frames with foamed in place urethane insulation before installation.

C. Seal both sides of frame to adjoining wall surfaces with a continuous bead of silicone sealant in accordance with Section 07 92 00 - Joint Sealants.

D. Do not remove or deface factory applied fire labels during construction. Fire doors and frames without fire labels in place at the time of contract closeout will be rejected.

3.3 GLAZING

A. Install glazing in hollow steel frames and stops in accordance with Section 08 80 00 Glazing and Glass Association of North America Glazing Manual

and IBC and as required to meet fire resistance.

3.4 TOLERANCES

A. Smooth, visually flat surfaces with maximum Diagonal Distortion (Warp) 1/16 inch gap under a straight edge, corner to corner.

B. Plumb and square within 1/16 inch.

C. Doors centered in frames with the following clearances:
   1. Jambs and Head: 1/16 to 1/8 inches.
   2. Bottom: 1/8 to 1/2 inch from threshold or floor finish.

D. Knocked down frame corners: even hairline crack joint, 1mm maximum, faces flush.

E. Allow for and accommodate interfacing indicated substrate tolerances.

3.5 HARDWARE

A. Install after finish painting.

B. Install in accordance with hardware manufacturer's written recommendations, using proper templates for approved hardware in accordance with Section 08 71 00 - Door Hardware.

3.6 ADJUSTING

A. Adjust completed door assemblies to swing freely, close smoothly and latch easily with the latched door in uniform, continuous contact with stops.

B. Closed door shall not rattle.

C. Doors with closers shall self-latch.

END OF SECTION

SECTION 08 14 00
WOOD DOORS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 08 11 00 - Steel Door and Window Frames

B. Section 08 71 00- Door Hardware

C. Section 08 80 00 - Glazing

D. Section 09 91 00 - Painting

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent requirements shall govern:
   1. ASTM C1048 - Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
   2. National Wood Window and Door Association (NWWDA) Architectural Wood Flush Doors" I.S. I-A.
   3. Architectural Woodwork Institute (AWI) "Architectural Woodwork Quality Standards and Guide Specifications".
   4. Underwriter's Laboratories (UL) UL 10C "Positive Pressure Fire Tests of Door Assemblies".
   5. National Fire Protection Association (NFPA) "Standard for Fire Doors and Windows", No. 80.
   6. International Building Code (IBC).

1.3 SUBMITTALS

A. Manufacturer's Literature: Indicating face elevations, dimensions, materials, construction details, and fire ratings and installation instructions.

B. Samples: Proposed door face with specified finish, minimum size 8 by 8 inches.

1.4 PRODUCT STORAGE

A. Protect doors with resilient packaging.

B. Store doors above ground protected from moisture and excessive humidity or dryness in accordance with NWDA instructions.

1.5 WARRANTY

A. Provide 5 year manufacturer's warranty against show-through, warping and delamination.

B. Warranty shall include refinishing and installation of replacement if necessary.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. Typical: Wood flush face and solid core, five ply, conforming to I.S.I-A, with fully bonded construction.

B. Hardware Provisions: Solid blocking at hardware locations. Coordinate with hardware supplier.

C. Face Veneers:
   1. Type I, 1/50-inch minimum NWDA I.S. I-A Grade "AA" plain sliced book matched centered balance Birch veneers species smoothly sanded. Use same species throughout, with uniform similar consistent grain and colors without sharp contrast across door face with centered balanced veneers.
   2. Match pair doors for consistent appearance.

D. Finish: Transparent stain type equal to or exceeding AWI finish systems for custom grade medium stain, medium satin sheen, filled grain effect as specified under Section 09 91 00 - Painting.
   1. Finish may be factory applied at CONTRACTOR'S option.
   2. Door in installed and adjusted condition shall have 2 coats of waterproof clear lacquer or the same finish as door face on top, bottom and jamb edges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accord with door manufacturer's written instructions and approved submittals.

B. Seal raw edges with moisture resistant clear lacquer.

C. Finish per Section 09 91 00 - Painting.

D. Do not deface or remove fire door labels.

3.2 TOLERANCES

A. Maximum Diagonal Distortion (Warp): 1/4 inch gap measured under a straight edge, from any door edges.

B. Door centered in frame with following clearances:
   1. Jambs and Head: 1/16 to 1/8 inch.
   2. Bottom: 1/8 to 1/4 inch from threshold or floor finish.

3.3 HARDWARE

A. Prepare doors to receive finish hardware and glazing per schedule in accordance with AWI.

B. Install after paint and stain finishing.

C. Install in accord with hardware and doorframe manufacturer's written instructions, using proper templates as specified in Section 08 71 00 - Door Hardware.

3.4 ADJUSTMENT

A. Adjust completed door assembly to swing freely, close smoothly and latch freely with the latched door centered and in uniform continuous contact with stops. Doors with closers shall self-latch.

END OF SECTION

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SECTION 08 44 00
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 62 00 - Flashing and Trim

B. Section 07 92 00 - Joint Sealants

C. Section 08 71 00 - Door Hardware

D. Section 08 80 00 - Glazing

1.2 APPLICABLE PUBLICATIONS

A. The publications listed form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent shall govern.
   1. ANSI/ASTM A36 - Specification for Carbon Structural Steel.
   2. ANSI/ASTM A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   3. ANSI/ASTM A153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   4. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints.
   5. ASTM B117 – Practice for Operating Salt Spray (Fog) Apparatus.
   6. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   7. ANSI/ASTM B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
   8. ASTM C665 – Specified for Mineral-Fiber Blanket Insulation for Light Frame Construction and Manufactured Housing.
   9. ANSI/ASTM E283 - Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
   10. ANSI/ASTM E330 - Test for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   11. ASTM E331 - Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
   12. ASTM E1233 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
   13. ASTM F593 - Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
   14. American Welding Society - AWS D1.1 - Structural Welding Code.

15. American Architectural Manufacturer's Association (AAMA) - Metal Curtain Wall Manual-Guide Specifications.
16. AAMA-1503 - Voluntary Specification for Field Testing of Metal Storefronts, Curtain Walls and Sloped Glazing Systems.
17. Glass Association of North America (GANA) - Glazing Manual.
18. Society for Protective Coatings (SPC) Painting Manual.

1.3 PERFORMANCE REQUIREMENTS

A. General: Meet performance requirements without failure of joint seals, glass breakage, or permanent deformation of the wall system or its perimeter seal to adjacent surfaces. Not permitted: vibration harmonics, wind whistles, or thermal movement noise.

B. Provide for expansion and contraction within system components caused by a cycling temperature range of 180 degrees F with a low of minus 30 degrees F.

C. Size components to withstand seismic and wind loads without damage in accordance with the following: as tested in accordance with ANSI/ASTM E330. Anchor to structure floors as necessary.
   1. General: 2009 IBC as amended by the Municipality of Anchorage.
   2. Wind: IBC Chapter 16 with a basic wind speed of 100 miles per hour exposure D.
   3. Seismic: IBC, Chapter 16, and per Structural Drawing notes. Window walls shall accommodate relative movement between stories.
   4. Size fasteners for up to 4 times the performance forces.

D. Accommodate floor edge deflection of one inch.

E. Limit mullion deflection to flexure limit of glass with full recovery of glazing materials. Limit vertical deflection so that glass bite is at least 75 percent of design dimension and the glass has 1/8-inch minimum top clearance.

F. No water penetration when laboratory tested with ASTM E331 at 25 percent of inward acting wind load or 15 psf minimum.
   1. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior at each light. No uncontrolled water shall penetrate to interior face of system from exterior.

G. Limit air infiltration through fixed assembly to 0.06 cubic feet per minute per square feet of fixed wall area, measured at a differential pressure across assembly of [12-Curtain Wall] 6.24 psf as laboratory tested and measured in accordance with ANSI/ASTM E283.

H. Maintain continuous air and vapor barrier throughout the assembly primarily in line with inside pane of glass and heel bead of glazing sealant.

I. Reinforce curtain wall system vertical mullions sufficiently rigid to resist 600 pound load normal to or parallel to, not simultaneous, wall face caused by roof suspended window washing platform without damage to wall system.
   1. Provide window washing tie-in guides 20 feet on center vertically and 15 feet maximum horizontally along vertical mullion over 40 feet above ground: Stainless steel 1 inch eye bolts.

J. Thermal "U" value not exceeding 0.42 BTU per square foot per AAMA 1503 for fixed glass and metal framing area.

K. Condensation Resistance Factor (CRF): not less than 60 per AAMA 1502 for fixed glass and metal framing area.

1.4 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

B. Manufacturer and installer experience.

C. System and component finishes, dimensions, elevations and sections; components within assembly; hardware, framed opening requirements and tolerances; anchorage brackets, field connections and fasteners; anticipated deflection under load; affected related work; expansion and contraction joint locations and details; drainage details and flow diagrams; field welding; and installation instructions.

D. Submit substantiating engineering data, results of testing meeting performance requirements certified by AAMA accredited laboratories, and other supportive data. Certify by signature and seal of a professional civil (structural) engineer registered in the state of Alaska that the curtain and window walls meet the performance requirements.

1.5 SAMPLES

A. Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

B. Submit three samples including typical glazing member flashing and panel, 12 inches minimum in size, illustrating prefinished aluminum surface, and size for each different product proposed.

1.6 QUALITY ASSURANCE

A. System Manufacturer: Company with at least 25 successful aluminum window wall systems in service similar to one proposed.

B. One Installer for Complete System: Company approved for this job by window wall manufacturer, with minimum of 10 successful similar installations.
   1. Submit list of previous installations with location, owner, contractor and architect phone numbers.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and handle system components in accordance with Section 01 60 00 - Product Requirements.

B. Store and protect system components clean, dry and vented in accordance with Section 01 60 00 - Product Requirements.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Install sealant at aluminum and glass with temperatures between 35 and 55 degrees F. and no moisture present. Maintain temperature by temporary enclosures and heating as necessary for 12 hours prior, during and 24 hours after sealant installation.

1.9 WARRANTY

A. Provide 5 year manufacturer's and installer's warranty.

B. Warranty:
   1. Cover complete system for failure to meet specified requirements.
   2. Conformance with approved submittals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to meeting specified criteria:
   1. United States Aluminum Corporation: 800-627-6440.
   2. Tubelite Architectural Products: 616-832-2211.
   3. Kawneer Company, Inc.: 770-449-5555.
   4. Vistawall Architectural Products: 800-869-4567.
   5. CMI-Cronstroms, Inc.: 800-334-1533.
   6. EFCO Corporation: 800-221-4169

B. Substitutions: In accordance with Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Extruded Aluminum: per ANSI/ASTM B221.

B. Sheet Aluminum: per ASTM B209.

C. Steel Sections: per ANSI/ASTM A36 hot-dip galvanized per ASTM A153 or shop primed.

D. Steel Primer: SPC Paint II red iron oxide, zinc chromate alkyd type.

E. Fasteners:
   1. Stainless steel ASTM F593, 300 series up to 1/2 inch diameter.
   2. ASTM A325 bolts hot zinc coated per ASTM A153 for larger than 1/2 inch diameter.

F. Anchors: galvanized steel or aluminum 3-way adjustable to accommodate tolerances.

2.3 COMPONENTS

A. Typical Glazing Member Profile; extruded aluminum with interior tubular section thermally broken insulated from exterior.
   1. Matching stops and pressure plate of sufficient size and strength to provide bite on glass and infill panels per GANA.
   2. Drainage holes, deflector plates and internal flashings to accommodate internal weep drainage system.

2.4 OPERABLE WINDOWS

A. Extruded thermally broken matching typical glazing profiles.

B. Fully weather-stripped with EPDM elastomeric installed into extruded pocket.

C. Hardware for top hinged or horizontal pivoted opening with positive hold-stop in any open position. Lever handles latch into closed position.

D. Provide aluminum mesh removable aluminum framed insect screens.

2.5 WEATHERSTRIP

A. Jambs and head.

B. Resilient EPDM elastomeric or nylon brush installed into extruded pockets.

2.6 GLASS AND GLAZING MATERIALS

A. As specified in Section 08 80 00 - Glazing.

2.7 ANCHORS, BRACKETS AND ATTACHMENTS

A. Attach to structure as necessary to meet performance requirements with minimum Safety factor of 4.

B. Field adjustable in three directions to construction tolerances.

C. Provide 300 series non-magnetic stainless steel or corrosion and abrasion resistant finish to 500 hours salt spray per ASTM B117 testing with 5 percent maximum red rust and no coating blistering or cracking finish and dissimilar material protection.

D. Insulation and Flashing Void Insulation: at edge of glazing to surrounding construction, unfaced fibrous blanket of mineral wool per ASTM C665.

2.8 SEALANTS

A. Sealants and Sealant Accessories: Silicone type as specified in Section 07 92 00 - Joint Sealants and as recommended by glazing system manufacturer. Provide U.L. or W.H. listed firestop sealants at floor slab edges.

2.9 FABRICATION

A. Fabricate curtain wall components in accordance with approved submittals allowing minimum clearances and shim spacing around perimeter of assembly.

B. Rigidly fit and secure joints and corners. Make joints and connections flush, hairline, and weatherproof.

C. As far as practicable, fit and assemble work in shop.

D. Weld per AWS.

E. Develop interior drainage path with moisture path to exterior weep holes.

F. Prepare components to receive anchor devices. Fabricate anchorage to suit substrate.

G. Arrange fasteners, attachments, and jointing to ensure concealment from view.

H. Reinforce framing members and attachments for window washing platform imposed loads.

2.10 FINISHES

A. Exposed Aluminum Surfaces:
   1. Anodized medium bronze architectural finish coating for exterior surfaces: AAMA Specification AAM12C2242/44.
   2. 0.7 mil 0.018mm minimum thickness.

B. Match existing Ward Building window color and finish.

C. Concealed Steel Items: Hot-dip galvanized in accordance with ASTM A123 or 153 or Stainless per ASTM F593.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions indicated to receive work for defects that will effect the work and for deviations beyond allowable tolerances.

B. Beginning of installation means acceptance of existing conditions as capable of producing an acceptable job.

3.2 PREPARATION

A. Coordinate dimensions, tolerances, and method of attachment with other work.

3.3 DISSIMILAR MATERIALS

A. Aluminum contacting steel, concrete, masonry or unpainted wood shall have the surfaces separated by a heavy coat of bituminous paint, or with non-absorptive tape.

B. Trim or mask so separating materials is not visible in completed work.

3.4 INSTALLATION

A. Provide alignment attachments and shims required to permanently fasten to building structure.

B. Align assembly plumb and level, free of warp and twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

C. Provide thermal isolation where components penetrate thermal insulation. Seal air barrier around any penetrations.

D. Coordinate attachment and seal of air and vapor barrier materials. Install flashings.

E. Pack mineral wool insulation in shim spaces at perimeter and into voids inside closures and flashings of assembly to maintain continuity of thermal barrier.

F. Seal perimeter with silicone type sealant, backing materials, and installation requirements in accordance with Section 07 92 00 - Joint Sealants.

3.5 TOLERANCES

A. Completed Tolerances:
   1. Variation from Plane or Location: 1/8 inches every 12
   2. Misalignment of Two Adjoining Members Abutting in Plane: 1/16 inch.

3. Door and window edge clearance: 1/8 inch to 3/16 inch.

B. Erection Tolerances:
   1. Accommodate variation from plumb, faces of exterior frame anchor points plus or minus 3/4 inch.
   2. Accommodate variation from levels indicated on DRAWINGS: plus or minus 3/4 inch.

3.6 CLEANING

A. Remove any protective material from prefinished aluminum surfaces.

B. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean and dry.

C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

D. Remove excess materials and debris caused by installation as work progresses.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 PRODUCTS FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Templates and other installation data required prior to hardware delivery, or at fabricators located off the job site. Furnish in a timely manner per construction schedule.

1.2 RELATED SECTIONS

A. Section 08 11 00 - Steel Door Frames

B. Section 08 14 00 – Wood Doors

C. Section 08 80 00 – GlazingAluminum Windows

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. Publications may be referred to in the text by basic designation only. In case of conflict the most stringent shall govern:
   1. Underwriters Laboratories, Inc. (UL) - Fire Resistance Index, and Building Materials Directory.
   2. National Fire Protection Association (NFPA) - Standard for Fire Doors and Windows, No. 80.
   3. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156 series as specified.
   4. American Society of Testing and Materials (ASTM) ASTM D1056 - Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
   5. ASTM D2497 - Tolerances for Man-Made Organic Base Filament Single Yarns.
   6. Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG).
   7. International Building Code (IBC) 2009.

1.4 PERFORMANCE REQUIREMENTS

A. When manufacturer and model number is given, it shall be used to establish minimum equivalent technical data and performance requirements for other manufacturers unless "no substitute" is specified.

B. Substitutions per Specification Section 01 60 00 - Product Requirements.

1.5 SUBMITTALS

A. Samples may be required for any proposed alternatives to hardware listed to establish equivalency. Samples will be returned after inspection.

B. List Manufacturers, model numbers, key schedule, and location and mounting heights of hardware in completed work. Use Contract Document door designations.

C. Provide abbreviation legend for abbreviations

D. List each door opening separately.

E. Manufacturer’s certificate that fire rated hardware meets specified requirements.

F. Manufacturer’s descriptive literature for each different item.
   1. Detail interface between electrical door hardware and fire alarm and security access systems.
      a. Provide point-to-point wiring diagrams for power, signal and control.

G. Maintenance-Adjustment Manuals and parts lists with name and telephone number of stock location.

H. Indicate location of closers on doors and frames.

I. Supply templates to door and frame manufacturers to enable proper sizing and locations of cut outs and reinforcements for hardware.

J. Manufacturers experience qualifications.

1.6 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in commercial building hardware in the U.S. for the past 5 years minimum.

1.7 PACKAGING AND MARKING

A. Single group of hardware packaged separately for each opening complete with all necessary accessories, fasteners, key instruction and templates.

B. Mark each package with a group number corresponding to the approved hardware schedule identifying its contents and location in the completed work.

1.8 DELIVERY AND STORAGE

A. Hardware shall be checked upon arrival to job site and acceptance verified by the CONTRACTOR'S Representative in writing.

B. Hardware shall be adequately protected from corrosion and pilferage until acceptance of building.

C. Deliver keys to OWNER by security shipment direct from Manufacturer.

1.9 MAINTENANCE ACCESSORIES

A. Provide special field adjustment and maintenance tools, such as special screwdrivers and wrenches, and dogging keys for each different item supplied.

1.10 EXTRA HARDWARE

A. For repair and maintenance by OWNER provide hardware matching that installed in new work.
   1. 1 Locksets: Salto Lockset with thumb-turn latch bolt. Prep for use on a Millennium-Salto access control system.

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturers are named to provide standard of quality and are subject to specified criteria.

2.2 FINISHES

A. Interior: ANSI A156.18 No. 626 Satin Chrome plated (US 26D Brushed Chrome).

B. Matte Aluminum paint for door closers.

C. Mill finish aluminum for weatherstrip and gasket seal moldings.

2.3 MOUNTING ACCESSORIES

A. Screws, bolts, escutcheons, brackets and similar supplemental items as necessary and recommended by manufacturer for conditions of use for complete functional use. Provide stainless steel fasteners which are compatible with both hardware and substrate, and which will not cause dissimilar metal corrosion. Mount surface hardware on doors with shouldered thru-bolts.

2.4 BUTT HINGES (TYPICAL)

A. Provide for doors not scheduled for continuous hinges.

B. Full mortise, plated steel with steel pins at interior, stainless steel with

stainless steel pins at exterior:

1. U. L. listed where used on fire doors: Stanley, Hager, McKinney or Lawrence.

C. Heavy weight hinges not less than 0.180 inches thick on exterior doors, doors over 3 feet wide, and doors over 100 pounds.

D. Standard weight hinges not less than 0.134 inches thick on interior doors three feet and less in width.

E. Doors up to 7 feet high shall have 3 hinges.

F. Doors over 7 feet high shall have a hinge for each 30-inch of door height.

G. Provide ball bearing hinges on doors with closers.

H. Hinges on lockable doors shall have non-removable pins secured with setscrew in barrel or other method tamperproof when door is closed.

I. Width of hinges shall be sufficient to clear trim detail conditions and provide up to 180-degree door swing or until door returns to adjacent wall.

J. 4-1/2 inch minimum height of hinges. For doors over 3 feet wide use continuous hinges.

2.5 MORTISE LOCKSETS

A. Heavy duty commercial mortise type: Salto Marks ANSI GR1 with escutcheons Grade 1: Schlage L series with threaded cylinder enclosure with key removable interchangeable key core 7-pin tumbler.

B. Backset 2-3/4 inch.

C. 3/4-inch latch throw typical, except one-inch dead bolt throw.

D. Operating Handles: approximately 4-1/2 inch cast lever handle curved to within ½ inch of door face with wrought 7-1/2 by 2-1/4 inch escutcheon trim plate. Knurled or abrasive coating at janitor, mechanical and electrical rooms.

E. UL listed for use on fire resistive doors.

F. Boxed strike with extended curved lip to fit jamb.

G. Salto locks must be prepped for use on a Millenuium –Salto access system.

2.6 CABINET LOCKS

A. Key cabinet locks into building master key system.

1. ANSI A156.11, grade 2 6 pin Schlage G core lock mounted to 7/8" thick material with a minimum 3/4 inch bolt travel. Schlage CL Series with a 6 pin G keyway Satin chrome finish; No substitutions.

2.7 LOCK CYLINDERS

A. Standard full-face seven pin interchangeable core cylinder same manufacturer as locksets.

2.8 KEYING

A. Keying system will be as directed by the CONTRACTING OFFICER. The CONTRACTOR shall have a qualified representative of the hardware supplier available for the purpose of establishing All Keyed Products (Locksets, Cylinders, Cabinet Locks, etc.).

B. Provide interchangeable core construction keying. Only construction keys allowed during construction.

C. Stamp keys "DND".

2.9 CLOSERS

A. UL IOC or NFPA 252 positive pressure fire listed cast iron shell with steel rack and pinion-piston type surface mount rectangular enclosure.
   1. Non-handed, field adjustable for interior and exterior doors to 48 inch wide.
   2. Rated for heavy duty high-use for door sizes indicated by manufacturer: LCN 4000 series.

B. Adjustable closing speed, 3 second minimum from 70 degrees to 3 inches from the latch for accessible use. Separate adjustable latching speed and separate adjustable back check.

C. 5-pound adjustable maximum opening pressure on interior non-fire rated doors.

D. Through mounting bolts with spacers or sex bolts and mounting bracket adaptors as necessary for door and frame conditions. Security screws into threaded backing at security openings.
   1. Special extra clearances mount arms so that weatherstripping and sound seals and smoke seals are not cut, and provide clearance for overhead stops and coordinators.

E. Fire resistant and low temperature fluid for satisfactory operation to 30 degrees F and no permanent damage if subjected to minus 30 degrees F.

F. Closers shall be heavy-duty forged steel arm type, with spring stop, parallel

arm hold open arm as scheduled for mounting on room side of corridor doors and inside of exterior door.

2.10 DOOR KICK AND ARMOR PROTECTION PLATES

A. Stainless steel, at least 0.05 inch thick and 2 inches less than door width, or as required to fit special door seals per ANSI A156.6.

B. Kick plates: 10 inches high.

C. Mop plates: 4 inches high.

D. Armor plates: 40 inches high.

E. When kick plate is scheduled together with armor plate, install kick plate on pull side. Kick plates, both sides scheduled as “2 kick plates”.

2.11 DOOR STOPS (TYPICAL INTERIOR DOOR)

A. Provide for all interior doors, preventing knobs, lever handles and pulls from striking wall surfaces or other doors. Provide floor stops where wall stops not possible. Not required when overhead door stop scheduled.
   1. Wall stops: 2-3/8 inch round resilient-rubber: with metal mount screw attach: ANSI A156.16 grade 1, type L0210.

B. Floor stops: Metal-rubber: dome type screw and peg attach: ANSI A156.16 Grade 1, Type L0214 as necessary for door and floor construction.

2.12 DOOR SILENCERS (TYPICAL INTERIOR DOOR)

A. Rubber door bumpers silencers 3/8-inch diameter resilient rubber-for force fit into drilled hole per ANSI A156.16 type L03011.
   1. Provide 3 evenly spaced at each swing doorjamb steel frame. Not required on doors with seals or weather-strip.

2.13 THRESHOLDS

A. Exterior: Extruded aluminum full width single piece at exterior openings. 6 inch by 1/4 inch saddle with beveled edges and fluted top with integral plastic thermal barrier in accord with ANSI/BHMA A156.21, PEMKO 250 Series, Zero, Reese or equivalent.

B. Interior: Extruded beveled edge fluted aluminum full width single piece at fire-rated doors. 4-inch by 1/4 inch PEMKO 270, Zero, Reese, or equivalent. Not required at 20-minute doors. Use carpet separator threshold specified below where carpet occurs on both sides of door fire rated over 20-minutes, and at exterior vestibules.

1. Carpet Separator Threshold: Extruded aluminum full width single piece 4 inch wide by 7/16 inch high saddle with fluted top in accord with ANSI/BHMA A156.21 J32140: PEMKO 230 Series or equivalent Zero or Reese.
2. Carpet-to-sheet flooring, carpet-to-concrete, and sheet flooring-to-concrete separator threshold: Extruded aluminum full width single piece 2 1/2 inch wide by 3/8 inch high saddle with fluted top and offset in accord with ANSI/BHMA A156.21 J32180: PEMKO 170 Series or equivalent Zero or Reese.

C. Fasten thresholds with countersunk-head screws 12-inches spacing maximum: provide two screw rows for thresholds over 6-inches wide.

2.14 SOUND SEALS

A. Continuous surface mount metal molding attachment, screw adjustable closed cell EPDM or neoprene sponge rubber insert seal. Do not notch side jambs, use full length.

B. Door head and side jambs: PEMKO 379.

2.15 MANUAL SLIDING GLASS DOOR SYSTEM

A. Stainless Steel system with single point fixings

B. Solid track rail and roller carrier with mechanical stops

C. Basis of Design: Dorma “Manet” System

2.16 DOOR PULLS @ SLIDING GLASS DOORS

A. 1 inch round solid brushed stainless steel bar - 30 inch long with 2 anchors per bar. First Impressions Inc. or Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the DRAWING details and field conditions for defects that will adversely affect the work, and for deviations beyond allowable tolerances.

B. Beginning of installation shall mean acceptance of the interfacing surfaces as capable of producing an acceptable job.

3.2 SOLID BACKING

A. Provide within structure and doors for hardware mounting, including wall doorstops and closers. Coordinate as required during construction. Provide special mounting accessories, built-in if required.

3.3 MOUNTING LOCATIONS

A. Per ANSI A117.1- Accessible Buildings approved submittals, manufacturer's standard practice and coordinated with door and frame manufacturer.

B. Mount closers on interior side of exterior doors and on room side of corridor doors.

C. Mount resilient weatherstrip on inside of door assembly to form vapor retarder.

D. Other Mounting Shall Be As Follows:
   1. Wall Doorstop: lockset handle to strike center of stop.
   2. Exit Device Operating Bar: 37 inches from finished floor to center.
   3. Push and Pull Bars: 42 inches from finished floor to center and 4-inch backset to center of push and pulls from door edge.

3.4 INSTALLATION

A. In accord with applicable ANSI standards, approved submittals, the manufacturer's written instructions and ADAG for the conditions of use. Install closers and closer arm with bolts through doors and frames.

B. Do not install surface mounted items until finishes are completed on substrate. Coordinate as necessary. Remove hardware after fitting if necessary for painting and reinstall.

C. Apply exterior hardware and thresholds with gaskets or in continuous silicone sealant bed. Do not cut weather seal at closers.

3.5 FINAL ADJUSTMENT

A. Per manufacturer's written instructions, including, cleaning and lubrication to meet ADAG.

B. Adjust doors, compensating for completed, operating heating and vent system. Latches and bolts shall engage keepers in latched position and not rattle.

C. Doors with closers shall close and latch without assistance.

D. Doors shall open and close smoothly and easily with 1 hand. Weatherstrips smoke seals, and sound seals shall be in continuous contact in latched position.

3.6 CLEANING

A. Remove shipping labels and leave hardware surfaces clean.

3.7 TYPICAL HARDWARE SETS

A. Provide 1 set for each opening.

B. Provide items noted “TYPICAL” such as hinges, doorstops, thresholds, seals, and weatherstrips as specified under "PRODUCTS" for each set.
   1. Provide unique items such as locksets and closers according to Door Hardware Schedule. ANSI A156.13 lock functions listed.
      a. F04 (F40) “Entry” function: Latch bolt operated by lever either side except when outside lever is made inoperative by key outside or inside turn piece. When outside lever locked, latch bolt is retracted by Key outside or by operating lever inside. Auxiliary dead latch.

C. Include any special maintenance adjustment tools necessary.

D. Refer to DRAWINGS for locations and details.

3.8 DOOR HARDWARE SCHEDULE

Hardware Set 1: Typical Office and Work/Break Openings
Interior Single Leaf - Office F07 Classroom Function
3 Hinges
1 Salto Electrified Mortise Lockset –F04 Entry Function
No Closer
1 Set of Sound Seals
1 Door Stop
1 Kickplate.

Hardware Set 2: Hall Entry Door Openings, 200D and 200F
Interior Single Leaf
3 Hinges
1 Salto Electrified Mortise Lockset - F04 Entry Function
1 Closer with hold open arm
1 Kickplate
1 Set of Sound Seals
1 Magnetic Hold Open Device

Hardware Set 3: Sliding Glass Doors
Interior Single Panels
Overhead Sliding Hardware on Operable Panel

Stainless Steel Pull Bars
Locking Mechanism

Hardware Set 4: Comm Room Opening 206
Interior Single Leaf
3 Hinges
1 Salto Electrified Mortise Lockset - Storeroom Function
1 Door Stop
1 Closer
1 Kickplate

Hardware Set 5: Toilet Room Openings 200W1, 200M1
3 Hinges
1 Push/1 Pull with Plates
1 Latchbolt – Key lock
1 Door Stop
1 Closer
Sound Seal Gaskets
1 Kickplate

NOTE: Coordinate electronic access hardware with Owner's Representative, Phillip Miller.

END OF SECTION

SECTION 08 74 00
ELECTRONIC ACCESS CONTROL SYSTEM

1.0 GENERAL INSRUCTION & INFORMATION

1. The intent of this document is to specify the criteria for the design, supply, installation, and commissioning of the Electric Battery operated Access Control System.

1.02 ACCEPTABLE MANUFACTURER

1. Salto Systems, Inc., Salto Systems
   3073 McCall Drive, Suite 1, Atlanta, GA 30340
   866-GO SALTO (866-467 2586)
   Email: info@Salto.us, Internet: www.Salto.us
2. Substitutions**: None**
3. All modules shall be supplied by SALTO inclusive of:
   i. Card Readers Units with and without Keypad
   ii. Door Locks SVN and Wireless Versions
   iii. Control Units Relay and Expansion Boards
   iv. UPS Network for Lock
   v. Power Reader Switches
   vi. Card Encoders or Enrollment Reader
   vii. Portable Programmer Devices

4. DEFINITIONS:

   a. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

   b. CPU: Central processing unit.

c. Credential: Data assigned to an entity and used to identify that entity, also called a Token or ID Card

d. CU: Control Unit, Control unit either stand alone or hardwired

e. I/O: Input/Output.

f. LAN: Local area network.

g. LED: Light-emitting diode.

h. Mantrap: A man-trap in physical security protocols refers to a space having two sets of interlocking doors such that the first set of doors must close before the second set opens.

i. PC: Personal computer. This acronym applies to the workstations Computers, and file Servers Computers.

j. USB: Universal Serial Bus – The most widely used hardware interface for attaching peripherals to a computer.

k. SQL: Database engine, a Microsoft product

l. WiFi: Wireless Communication (802.15.4 – Zigby)

m. RS-232: A TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

n. RS-485: A TIA/EIA standard for multipoint communications.

o. TCP/IP: Transport Control Protocol/Internet protocol incorporated into Microsoft Windows.

p. Smart Card: ID Token or Credential that can retain or store data and information and transmit the data upon request. (read & write of data)

q. Contactless Smart Card: ID Token or Credential that can retain or store data and information and transmit the data without contact with a reading device. (read & write of data)

r. NFC: Near Field Communication

s. RFID: Radio Frequency Identification Device

t. Black List: A list of invalid tokens/cards stored in the door unit

u. UPS: Uninterruptible Power Supply

v. WAN: Wide area network.

w. LAN: Local area network

x. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

y. Windows: Operating System by Microsoft Corporation Inc.

z. Workstation: A PC with software that is configured for specific limited security system functions.

aa. EAC: Electronic Access Control

1.01 Summary

1. The Physical Access Control System has two primary component areas, door control hardware and the management application software.
2. The system shall provide for a combination of wireless (wire–free) and online (hardwired) wall readers to secure perimeter doors as well as battery powered electronic locks to secure all interior doors, all produced, supported by the same US Based Manufacture.
3. The system shall be centrally managed by one single database/software and one single credential system for all doors in the System.

1.02 Token and Credential

1. Token, Credentials, and RFID Contact-less Smart Card Features and Technical Requirements
2. Secured RFID Contactless Smart Cards
    i. Contactless smart card technology provides high-speed, reliable communications with data integrity.
    ii. Ensures high security with mutual authentication, encrypted data transfer.

3. Read/write capable is mandatory; any system that does not use a two way encrypted Smart Card (RFID) communication format **will be considered Unacceptable** by the Owner.
4. Multi-application cards: have to be capable of storing information for future applications and integration.

1.03 RFID Contact-less Smart Card Technology supported

1. Salto is compatible with a wide range of Smart Card (RFID) Technologies, operating on the industry standard frequency of 13.56MHz
2. To Meet the owners needs, the Read & Write credentials may be any one of the following type products:

a. **HID iClass**: Memory capacity: 32K bit with 2 application area configurations.

HID-IClass credential shall have a minimum of 16 kb, 32kb preferred, of

available memory and allow the possibility for use with multiple vendors

across multiple applications.

b. **MIFARE:** 4k Bytes

c. **DESFire:** 4k Bytes

d. **Desfire EVI**: 4K Bytes

e. **Sony FeliCa:** 4K Bytes

f. **Legic:** 4K Bytes, **[enter customers custom card needs, or remove]**

e. **Pico Pass:** 4k Bytes,

1. Access profile for the individual user, encoded on to the card, shall be encrypted and in such a format as to negate the potential for cloning.
2. Standard 16 kb, 32kb preferred memory on each credential shall be secured with a unique set of Keys A&B for the Electronic Access Control (EAC) system and to enable, as and when required, the collection and transfer of information pertaining to audit trails, lost and stolen cards etc via a data on card functionality
3. Token's or Credentials we be available in mutiable form. They will be but not limited to; standard ID card format, Printable ID card format, Key Fob format, wrist watch format, rubber wrist band format.

1.04 Features and technical requirements:

1. Online CU (Control Unit) and wall readers will be manufactured and supported by the same manufacture of the Electronic door locks and System Software. The following is a minimum list of features, take the online unit must contain.
    i. Provide real time door access monitoring with the on-line hot-spots.
    ii. Continue operating and store historical data (audit trail) in the event of a network or server failure. System door Units will provide a Minimum of 1000 transactions.
    iii. Ethernet connectivity of all on-line devices via IP4 or IP6 addressing, either hardwired or through a Salto Zigby 16 Channel WiFi Connection.(802.15.4)
    iv. Provide automatic card updating, to all Contactless Smart Card regardless of brand.
    v. Provide the ablity to Support 2 Readers and 2 locking device's with on board auxiliary programmable on-board outputs (relay's)
    vi. Provide for up to 16 Auxiliary output boards with a total of not less then 128 outputs available for end-user programming.

vii. Provide the flexibility for either online wireless or offline battery operated locks, allowing for the 2 types of system ingrate into the same facility.

A. Battery Powered Wireless Networked locks.

1. RFID Keycard operated: unlocking by means of contact-less smart carriers, which most include the following formats; card, key-fob, wrist watch, RFID stickers and wrist band. All devices will perform at the same level.
2. The EAC Locking Unit shall have typical access control features and be able to mimic traditional door hardware functions. The following is a Minium of the required door operational features:
    a. Standard
    b. Office
    c. Automatic Changes
    d. Automatic Opening
    e. Automatic Opening Plus Office
    f. Automatic Opening Plus Toggle
    g. Key Card Plus Pin Number (Keypad)
    h. Pin Number Only (Keypad)
    i. Timed Key Card Plus Pin Number (Keypad)
    j. Timed Pin Number (Keypad)
    k. Timed Office
    l. Timed Toggle
    m. Toggle Only
    n. Emergency Lockdown (AMOK Crisis)
    o. Anti Passback – Soft/Timed

3. Internal Door Lock Memory will be a minimum of 1,000 transactions. This will include valid, invalid attempts, request to exit, door Status, door ajar and mechanical key used.

4. Automatic Unlocking, all locks shall be able to be programmed to remain unlocked during certain hours and days, automatically changing to a locked down mode outside of these times. I.e. go into office, card only, card plus pin mode, etc. Each lock will have a minimum of 8 different automatic locking and unlock schedules. This feature will also be able to be manipulated by day of the week and by system holidays for each door lock.
5. Automatic Locking (lock down mode), all locks shall be able to lockdown from the inside in an emergency. While the lock is in Lockdown mode, one designated tokens will be able to enter the locked down door unit. Once the unit is returned to normal programming mode, it will operate as previously programmed. Activation and resetting of the Lockdown mode (AMOK) will be down with a Card holders Token. This privilege will be given to the desired card holder on a person by person basis. Blanket lockdown setting or lockdown by a lock thumb turn will be unacceptable.
6. Lost cards shall be able to be deleted from the system without waiting for card expiration or having to visit the locks with a handheld programmer.
7. Water resistance application lock units, must be an option for outdoor and wet environments.
8. Batteries:
    a. Battery life benchmarked to 65,000 Operations or 2.5- 3.0 years.
    b. Shall be powered by standard off the shelf batteries (AAA).
    c. Proprietary batteries or proprietary battery packs are **not** acceptable.
9. Low battery warning shall be at minimally via visual LED's and should also automatically report through the system software. This will happen without the need to visiting the door lock with a programming device. For Wireless lock units, they will also report via a link through the RFID

Cards through a hotspot for direct communications back to the software to report current battery status.

10. Shall automatically adjust for daylight saving time. This feature will be Flexible enough to provide changeable dates from year to year. This feature will **not** require a visit to the lock with a programming device.

11. A door lockset shall be deemed to include all of the components necessary for the EAC to function as per manufacturer's specification; namely UL approved and listed internal and external lock parts. The following locking hardware types will be available:
    a. UL Listed, ANSI Grade 1 American Mortise Lock
    b. UL Listed, ANSI Grade 1 American Mortise Lock, with deadbolt
    c. UL Listed, ANSI Grade 1 Glass Door Lock
    d. UL Listed, ANSI Grade 1 American Cylindrical Lock
    e. UL Listed, ANSI Grade 2 American Cylindrical Lock
    f. UL Listed Locker Lock, Pad Lock
    g. UL Listed, ANSI Grade 1 Exit Device
    h. UL Listed, European Mortise Lock
    i. Mortise Cylinder (Salto GEO)

12. External and internal lever handles shall comply with ADA requirements and specifications, and also be available with antibacterial finishes.

13. The length of time "allowed" to open the door after a valid credential is presented shall be variable and managed by the software, allowing for users with physical disabilities additional time when needed to access their quarters.

14. At all times the internal lever shall be free to operate and retract all latches and deadbolts, allowing free egress by way of a single action.

15. A mechanical master key override shall be provided where necessary and shall operate in conjunction with the lever clutching mechanism, rather than directly on the door latch. Operation of the Key Override will be recorded in the lock units audit trail memory to provide increased security and track key usage. A standard American Mortise cylinder will provide the key override function.

B. Off-line Reader & Battery Powered SVN Lock Operations

1. The Smartcard will transfer data to/from both off-line locksets to the on-line hot-spots. Token may be Card, Wrist Watch or Band, Key Fob formats. All formats will have the same system performance.
2. A door lockset shall be deemed to include all of the components necessary for the EAC to function as per manufacturer's specification; namely UL approved and listed internal and external lock parts. The following locking hardware types will be available:
    a. UL Listed, ANSI Grade 1 American Mortise Lock
    b. UL Listed, ANSI Grade 1 American Mortise Lock, with deadbolt
    c. UL Listed, ANSI Grade 1 Glass Door Lock
    d. UL Listed, ANSI Grade 1 American Cylindrical Lock
    e. UL Listed, ANSI Grade 2 American Cylindrical Lock
    f. UL Listed Locker Lock, Pad Lock
    g. UL Listed, European Mortise Lock
    h. UL Listed, ANSI Grade 1 Exit Device
    i. Mortise Cylinder (Salto GEO)

3. Retrofit Locks, wherever possible and as needed, the manufacture will have a option to reuse existing locks that are in good working order and can support the new Salto trim and controls.

4. External & Internal Lever handles shall comply with ADA requirements and specifications. Lever and trim should also be available with antibacterial finishes. Traditional door hardware finishes and a choice of lever styles to as closely as possible match existing door hardware.

5. At all times the internal lever shall be free to operate and retract all latches and deadbolts, allowing free egress by way of a single action.

6. A mechanical key override shall be provided where necessary and shall operate in conjunction with the lever clutching mechanism, rather than directly on the door latch. To provide increased security the key operation will leave an audit in the lock memory that the mechanical key was used to open the door.

7. The unit shall initially be delivered with 3 “standard” AA batteries, sufficient for up to 65,000 transactions or approximately 2.5 – 3.0 years operational life. No proprietary or rechargeable battery packs shall be accepted.

8. Low battery status shall be, by default, recorded on the User’s credential and transferred to the management system when the credential is used at an on-line wall reader or update point (Hotspot). No handheld Device will be needed to retrieve battery status.

9. In the event of a battery failure, the door shall be able to be opened with a small portable handheld device in conjunction with a **valid** credential (Smartcard or Token).

10. Networked and non-networked locks of all hardware styles shall always allow free egress if the batteries fail.

11. An audit trail of the last 1,000 events (including failed attempts at access by unauthorised key holders) shall be stored on the networked lock's memory for collection using the portable handheld device at anytime and without requiring access to the inside component of the door lock.
12. The networked lock shall hold its designation, the zones that it belongs to, operational configuration, audit trail and "black list" of cancelled keys in non-volatile memory.

13. Current date and time shall be synchronised with the server on a daily basis, and/or when collecting audit trails with the portable handheld device or replacing batteries.
14. The networked lock shall incorporate such measures as hardened high resistance steel drill plates, floating axes and steel ball bearings to prevent unauthorised access or tampering by physical means.

15. The external lever mechanism shall incorporate a clutching system to minimise the potential for vandal damage by allowing free travel up and down until a valid credential is presented for the door to be opened.

16. The length of time "allowed" to open the door after a valid credential is presented shall be variable and managed by the software, allowing for users with physical disabilities additional time when needed to access their quarters.
17. When the lever returns to the zero position, no matter the time elapsed since the valid credential was presented, the clutch shall automatically disengage, limiting the potential for an unauthorised person to enter after the authorized entry.

18. Internal covers may be secured with tamper restante screws to restrict access to authorised personnel only.

19. Where appropriate the internal clock of the networked lock shall be programmed to allow for the start and finish of Daylight Saving Time.

20. In an office, meeting room or services environment (where applicable) the networked lock shall be able to either automatically or manually be set into “free passage” mode by authorised key holders, reverting to standard operating mode at a prescribed time.

21. In the event a “User” key is lost, an authorised operator shall be able to cancel and re-issue a new key for the User. Information regarding cancelled keys shall be transmitted to all off line doors via the “black list”, placed on credentials when passing through an on-line “hotspot” or by visiting the doors with the portable programming device.

22. When the system is being operated using the hotel functionality, if a Room key is reported lost or stolen (or the key holder is AWOL), simply presenting a “Guest cancel key” shall cancel access for that key without providing access to the Room.

23. The EAC Locking Unit shall have typical access control features and be able to mimic traditional door hardware functions. The following is a Minium of the required door operational features:
    a. Standard
    b. Office
    c. Automatic Changes
    d. Automatic Opening
    e. Automatic Opening Plus Office
    f. Automatic Opening Plus Toggle

g. Key Card Plus Pin Number (Keypad)
h. Pin Number Only (Keypad)
i. Timed Key Card Plus Pin Number (Keypad)
j. Timed Pin Number (Keypad)
k. Timed Office
l. Timed Toggle
m. Toggle Only
n. Emergency Lockdown (AMOK Crisis)
o. Anti Passback – Soft/Timed

C. HOT SPOT - Wall readers operations

1. A Wall Reader Device includes support for one (1) or two (2) wall readers. These readers may be; Mifare, Pico pass, Iclass and NFC. Reader Plus pin will also be available if needed. The Unit will controlled access and egress, where applicable, secured to the wall with a vandal Resistant frame and tamper-proof fixings; plus a Control Unit (CU) housed with 12V DC power supply, ready for connection to 110V AC outlet. Additionally the power supply shall be prepared to interface with the local fire alarm system to cut power to the door locks, if required, and have connections for 12V DC battery back-up supply (provided by others).

2. Shall be ISO 15.93, and FCC Part 15 compliant

3. The Wall reader Control Unit set shall have the capability to operate both as an off-line stand-alone door controller or, be easily upgraded with additional (not replacement) hardware to function as an integrated part of the on-line EAC system.

4. Connection between the Wall Reader and Control Unit shall be via UTP CAT5 cable.

5. If required for security or logistical reasons the CU shall be able to be placed up to 100 metres or 328 feet remotely from the Wall Reader(s).

6. The CU shall hold its designation, the zones that it belongs to, operational configuration, audit trail and “black list” of cancelled keys in non-volatile memory.

7. For the off-line CU, the current date and time shall be synchronised with the server on a yearly basis, and or when collecting audit trails with the portable handheld device.

8. The on-line CU shall connect directly to the EAC application and be capable of making changes to the individual “User” access profile when a credential is presented. At the same time the CU shall pass the “black list” of recent cancelled cards on to the key and upload any stored “on key” audits of attempts to access doors and “low battery warnings” from the stand-alone locks.

9. The EAC system shall synchronise the server clock with the on-line CU approximately every 30 seconds.

10. The (off-line and on-line) CU shall be capable of integrating with the lift management system to control access to individual floors for individual “Users”. Connection to the CU shall be via RS485 Serial BUS to Extension Relay Boards (ERB) consisting of 8 NO/NC 12VDC dry contact switches. The EAC system shall allow for up to 16 ERB to be connected in series to each Control Unit.

PART 2. SYSTEM OPERATIOIAL PREFORMANCE FEATURES

2.01 **A. Basic System Performance requirements**

1. Shall provide central management of user rights, access policies, and credentialing.
2. The application shall be capable of implementing access policies through the assignment of entry permission based on door groupings and time schedules.
3. The system shall allow for schedules to be applied at doors, governing their remaining open or locked condition.
4. The application shall permit flexible assignment of user rights and privileges.
5. The application shall allow for creation and editing of cardholder credentials, including system wide card formats.
6. The application shall provide views of events and alarms throughout the installation and shall be capable of triggering hardware and communicative actions, based on system configuration.
7. The application shall be capable of generating standard and custom reports, and provide a detailed and complete log of all system events, as defined by the system operator.

B. System Software Features

1. The system shall provide 128 bit AES encrypted data.
2. Operating System shall be Microsoft Windows XP SP2, Vista, and Windows Seven.
3. The Database will be SQL 2003, 2008, or SQL Express.
4. The system shall have an operating temperature of 0°C to 50°C, ambient, a storage temperature of -40°C to +85°C, ambient, a relative humidity ability of 0% to 95% (non-condensing) at 50°C, and a MTBF of > 100,000 hours.
5. The system-radiated emissions shall be compliant with FCC Part 15, Class A, and EN55022 specifications.

6. The Proposed System must be capable of Managing 4 Million users, 64,000 doors, 256 Calendars, 256 time zones, 256 time periods, both with 8 intervals each.
7. Integration with other software systems through dynamic database synchronization, Microsoft SQL is preferred.
8. Able to store all historical data on the system server without having to individually use a handheld device to download audit trail data from individual locks.
9. System capable of being expanded throughout the site. Each area (department) can manage their own doors and users without a chance of accidentally interfering with other areas (departments).
10. Capable of dynamic master-keying: each credential can change access privileges transparently “on the fly” without the need to visit the access control administrator to reprogram keycards and without the need to reprogram the electronic locks with a handheld programmer.
11. No predefined profiles are necessary to issue keycards. Each and every keycard can be individually enabled to access any combination of doors.
12. Lost keycard cancellation: “blacklist”. Contactless smart cards need to be capable of conveying lists of cancelled keys to avoid having to reprogram locks with a handheld device each time a keycard is lost.
13. No WI-FI or Radio infrastructure shall be required.
14. The locks will have built-in anti- Passback feature. The EAC Locks will have the ability to control card holders from reentering without presenting there token to the out reader. This feature will be in both One Line/Wireless, or in the off-line EAC lock units.

C. System Software

Develop, install, program and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner. The following is required of the EAC Software:

1. The software shall be supplied ready to support any number and configuration of off-line and on-line stand-alone locks and wall readers, with the capacity to manage multiple or single sites including up to 64,000 doors and individual Users.
2. A Portable Programming Device (PPD) for transferring information to and from the database for all off-line locks and wall readers shall also be included.
3. 256 Time Periods that determine the time intervals at which a lock shall operate in a special mode, timed office mode, automatic opening mode etc.
4. 256 Time Zones, that determine the interval of time in which a user has access to a particular door or zone
5. 256 Calendars, for user access or used by the electronic locks when they operate in a timed mode.
6. 1024+ Zones to group doors into sets making programming user access simpler and more efficient
7. User Groups enable the system manager to group users according to their privileges of access
8. Operator Groups can be defined hierarchically and be password protected to allow only authorised staff to make amendments to sections of the database for which they have responsibility
9. Multiple simultaneous access, allows multiple authorised operators to make dynamic changes to the database at any one time
10. Must have a proven API for interfacing with existing and well established traditional Access control systems.

D. On line Hot-spot for Virtual Network

1. The Systems' Virtual Network (SVN) shall provide the capacity to combine the efficiencies of on-line access control with the (cost) advantages of off-line hardware, using a data on card functionality.
2. With SVN is enabled all on-line readers shall update access protocols on valid staff & user keys when they are presented to a desktop updater or on-

line Wall Reader can also be used at a security entry check point to update any changes to the users access rights as they enter and leave during the day.

3. If a cardholder has been cancelled an on-line wall reader or lift reader shall remove all access privileges from the card and shall deny access to anyone presenting the invalid card.
4. The current list of cancelled cards is placed onto every card when it is presented to an on-line reader (hot-spot), and the updated card shall then transfer that list to the off-line readers each time they are used, allowing for the upgraded list to be transmitted throughout the facilities by the Users as they go about accessing doors.
5. Data on card functionality shall also allow for the collection of audit trails and low battery warnings from staff & user cards.

2.02 Emergency

1. In the event of an emergency the System Manager has the ability to either “lock down” or unlocks all or some doors/locks connected via the Salto Wireless Network. These doors shall then remain locked or unlocked until the emergency is designated as over by the System Security Manager.

2.03 CCTV Invalid Card Interface

1. If an invalid card is presented to an on-line reader an entry is placed immediately in the audit trail and the control unit can trigger a CCTV camera or an alarm (local or remote). This operation can be modified at anytime by changing the dipswitch configuration in the control unit.

PART 3. EXECUTION

3.01 EXAMINATION

1. Inspect units before installation to verify physical condition and inclusion of all peripheral materials.
2. Modules shall be free of any cosmetic defects or damage.
3. Shipping box shall include the module, power supply (surface mount units) and operations manual.

3.02 PREPARATION

1. Unit shall be mounted on a properly prepared surface adequate for the size and weight of the module. The placement of the unit shall allow provision for installation and maintenance as indicated on the approved detail drawings and in accordance with the installation manual.

3.03 INSTALLATION

1. **General**: The Physical Access Control System shall be installed, configured, and tested in accordance with the manufacturer's instructions.
2. **Grounding**:

    a. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

    b. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

    c. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

    d. Bond shields and drain conductors to ground at only one point in each circuit.

    e. Signal Ground:

        i. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
        ii. Bus: Mount on wall of main equipment room with standoff insulators.

iii. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3. **Cabling:**

a. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

b. Install cables and wiring according to requirements in Division 28.

c. Access control system wiring color to be distinct and specific to the system. Contractor to coordinate cable colors with all other vendors to ensure color is not duplicated.

d. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

e. Install LAN cables using techniques, practices, and methods that are consistent with Category 5E rating of components and that ensure Category 5E performance of completed and linked signal paths, end to end.

f. Install cables without damaging conductors, shield, or jacket.

g. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, will be provided with a lock. Boxes above ceiling level in occupied areas of the building will not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public will be covered with a suitable cover plate and secured with tamperproof screws.

h. Install end-of-line resistors at the field device location and not at the controller or panel location.

4. **Cable Application**:

a. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

b. Cable application requirements are minimum requirements and will be exceeded if recommended or required by manufacturer of system hardware.

c. RS-232 Cabling: Install at a maximum distance of 50 feet.

d. RS-485 Cabling: Install at a maximum distance of 4000 feet.

5. **Configuration:** The configuration of the Physical Access Control System shall be accomplished in accordance with the overall network plan with regard to the following:
   a. Network addressing
   b. User access
   c. Network security

3.04 SUBMITTALS

1. General: Submittals shall be made in accordance with the Conditions of the Contract and Submittal Procedures Section.
2. Shop Drawings and Schematics: Shall depict the Physical Access Control System in final proposed “as built” configuration. The following shall be provided:
   i. Connection diagrams for interfacing equipment.
   ii. Network IP and or Mac addresses of field device
   iii. List of connected equipment
   iv. Locations for all major equipment components to be installed under this specification

3. Product Data: The following shall be provided:
   i. Technical data sheets for each piece of proposed equipment
   ii. A complete set of user, and maintenance manuals
4. Quality Assurance Submittals: The following shall be submitted:

i. Test Report: The final test report shall indicate that every device was tested successfully in a system test.

3.05 DELIVERY, STORAGE AND HANDLING

1. General: Delivery, storage, and handling of the Access control hardware shall be in accordance with the manufacturer’s recommendations.
2. Ordering: The manufacturer’s ordering instructions and lead-time requirements shall be followed to avoid installation delays.
3. Delivery: The Physical Access Control System shall be delivered in the manufacturer’s original, unopened, undamaged container with identification labels intact.
4. Storage and Protection: The Physical Access Control System shall be stored and protected from exposure to harmful weather conditions and at the environmental conditions recommended by the manufacturer.

3.06 FIELD/PROJECT SITE CONDITIONS

1. FIELD QUALITY CONTROL

   a. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

   b. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

   c. Perform the following field tests and inspections and prepare test reports:

      i. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.

ii. Test each circuit and component of each system. Tests will include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup will be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.

iii. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.07 WARRANTY

a. Warranty Period will be a minimum of **[one] [(1)**] year from the date of purchase.

b. All equipment and systems will be warranted by the Contractor for a period of **[two] [(2)]** years commencing with the filing date of the Notice of Completion, provided the system has been inspected and signed off by the Manufacturer and at the conclusion of satisfactory acceptance of the entire system by the Owner.

c. The warranty will cover all costs for Warranty Service, including parts.

d. The contract for service will cover the period starting with the first expected activation of each system for installation and test and will continue for an initial period of [**two**] years. A partial-year extension will be acquired to cover the period to the end of the **[two**]-year guarantee and will be handled such that a smooth transition to a Customer maintenance agreement can be achieved with no lapse in coverage.

e. Service response will be within **[2]** hours of the initial request for service; the response may be by phone or remote VPN access into system. This service should be provided during the warranty period at not added cost. This will be a **[24]** hour per day, **[7]** days per week, and inclusive of all holidays.

f. Service requests will be reported via phone call to a designated service number provided by Security Contractor, or via a service web site or e-mail account as designated by the security contractor.

3.08 START-UP SERVICES

A. Engage a factory-authorized service representative to supervise and assist with startup service. Complete installation and startup checks according to approved procedures that were developed in "Preparation" Article and with manufacturer's written instructions.

1. Enroll and prepare badges and access cards for Owner's operators, management, and security personnel.

3.09 TESTING TRAINING AND CERTIFICATION

A. The Contractor shall demonstrate the functionality of the Physical Access Control System upon completion of installation, documenting the result of all tests and providing these results to the Owner. The Physical Access Control System shall be tested in accordance with the following.

1. The Contractor shall conduct a complete inspection and test of all installed Physical Access Control System equipment. This process includes testing and verifying operation with connected equipment and network infrastructure.
2. The Contractor shall provide staff to test all devices and all operational features of the system for witness by the Owner’s representative and the Authority having jurisdiction if need be.

3. The Owner’s representative, prior to acceptance, shall witness all testing.

4. Develop separate training modules for the following:

   i. **System Administration** personnel to manage and repair the LAN and databases and to update and maintain software.
   ii. **Computer Operators** who prepare and input credentials/Tokens to operate workstation on the proposed system.(enrollment station)
   iii. **Maintenance and Security Personnel**

END OF SALTO SECTION

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 07 92 00 - Joint Sealants

B. Section 08 11 00 - Steel Door Frames

C. Section 08 14 00 – Wood Doors

D. Section 08 44 00 - Aluminum Windows

1.2 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent provisions apply.

1. ANSI Z97.1 - Safety Glazing Material Used in Buildings - Safety Performance Specifications and Methods of Test.
2. International Building Code (IBC), 2003 edition, Chapter 24.
3. Glass Association of North America (GANA) - Glazing Manual.
4. ASTM C864 - Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
5. ASTM C1036 - Specification for Flat Glass.
6. ASTM C1048 - Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
7. ASTM C1172 - Specification for Laminated Architectural Flat Glass.
8. ASTM D256 – Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
9. ASTM D635 – Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
10. ASTM D785 - Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
11. ASTM D1929 – Test Method for Determining Ignition Temperature of Plastics.
12. ASTM D2843 – Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.
13. ASTM E576 – Test Method for Frost Point of Sealed Insulating Glass
14. ASTM E2190 - Specification for Insulating Glass Unit Performance and Evaluation.
15. ASTM E1300 - Practice for Determining Load Resistance of Glass in Buildings.

16. ASTM F1233 - Test Method for Security Glazing Materials and Systems.
17. Consumer Product Safety Commission (CPSC) 16 CFR Part 1201-Safety Standard for Architectural Glazing Material.
18. International Building Code (IBC) Chapter 24.

1.3 SUBMITTALS

A. Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

B. Provide structural and physical product data characteristics, certified lab tests, size limits, special handling and installation requirements.
   1. Verify glass area to thickness per IBC.

C. Provide certifications.

D. Provide data on glazing sealants and gaskets.

E. Manufacturer, fabricator, and installer experience qualifications.

1.4 SAMPLES

A. Submit two samples minimum 12 inch by 12 inch of each different type of glazing proposed.

1.5 QUALITY ASSURANCE

A. Glass Manufacturer: Minimum 25 similar successful jobs manufacturing and supplying specified products.

B. Fabricator: Minimum 25 similar successful jobs fabricating sealed glass insulating and security units.

C. Installer: Minimum 5 similar successful jobs installing glass similar to that used on this job.

1.6 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this Section.

B. Require attendance by CONTRACTOR, Glazing Supplier, and Glazing Installer.

1.7 CERTIFICATE SUBMITTALS

A. Glass manufacturer Certificate of Compliance with specified requirements.

B. Insulating glass unit manufacturer's certificate of compliance with

specified requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. In accordance with Section 01 60 00 - Product Requirements.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Work with temperature between 35 and 55 degrees F., with no moisture present. Maintain temperature by enclosure and heating as necessary for 12 hours prior, during and 24 hours after installation.

1.10 WARRANTY

A. Provide insulating laminated and security glass manufacturer's 5-year replacement warranty covering obstruction of vision, breakage, seal failure, internal dusting or internal condensation misting of glass units.

PART 2 - PRODUCTS

2.1 GLASS MATERIALS

A. Float glass, per ASTM C1036, transparent flat, Class I, Quality q3 glazing select quality unless otherwise noted.

B. Laminated Safety Glass: Two 1/8-inch thick annealed glass lites bonded to .060 inch minimum vinyl interlayer, per ANSI Z97.1, CPSC 16 CFR 1201, ASTM C1172 and ASTM C1048.

C. Tempered Safety Glass: 1/4 inch thick fully tempered per ANSI Z97.1, CPSC 16 CFR 1201, and ASTM C1048, roll wave marks horizontal.

D. Heat Strengthened Glass: 1/4-inch thick heat strengthened per ASTM C1048, roll marks horizontal.

E. Channel Glass: Safety glass, double -glazed @ door relite frames. Same appearance both sides.

F. Manufacturer product names listed to describe appearance and performance. Substitutions in accord with Section 01 60 00 - Product Requirements.

G. Permanently label glass identifying manufacturer, third party inspection agency, fire protection rating, date; standard complied with, type and glass thickness in accordance with IBC 715 and 2403.

2.2 SEALED INSULATING GLASS

A. Fabricate double lite unit with glass to elastomer edge seal.

B. Meet ASTM E2190 Class CBA requirements. Certified by Insulating Glass Certification Council IGCC).

C. Hermetically double seal around edges: inner primary seal and outer secondary seal.

D. 1/4 inch exterior glass, 1/2 inch inter space, 1/4 inch interior glass; safety glass where indicated.

E. Total unit thickness of one-inch nominal.

F. Clean without visible discoloration, moisture or obscuration.

G. Permanently label identifying manufacturer.

2.3 VISION GLASS TYPE 1

A. Sealed insulated double unit tempered safety glass outboard lite, laminated safety glass inboard lite, total thickness one-inch nominal.

B. Exterior lite: clear Low-E surface No. 2: PPG “Solarban 60” Pilkington “Eclipse Advantage”, or approved.

C. Interior lite: clear Low-E surface No. 3 to allow maximum heat/gain; use with clear exterior lite.

D. Unit requirements:
1. Clear appearance.
2. Winter night U value 0.29.
3. Summer day U value 0.27.
4. Shading coefficient 0.44.
5. Visible light transmittance (VLT) 70 percent.

2.4 SLIDING DOOR GLASS

A. Glass: Provide flat, fully tempered glass in thickness indicated for doors. Comply with requirements of ASTM C 1048 for Kind FT (fully tempered), Condition A (uncoated surfaces), Type 1 (transparent), Class 1 (clear) glass. Provide products of thickness indicated in C 1048 and for impact strength according to 16 CFR Part 1201 for Category II materials.

B. Select thickness below (3/8 inch [10 mm] is for interior and is subject to dimension restrictions).

1. Thickness: 3/8 inch (10 mm).
2. Thickness: 1/2 inch (13 mm).
3. Edge Treatment: Provide machine ground and polished edges for exposed glass edges of doors and sidelites.

C. Fittings, General: Provide fittings fabricated from stainless steel and temper recommended by manufacturer for use intended and required for application of finish indicated. Provide manufacturer's standard fittings for configurations required.

2.5 SEALANTS

A. Silicone, per Section 07 92 00 - Joint Sealants. Verify compatible with glazing and with adjoining materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWINGS and field conditions to receive glass for defects that will adversely effect the work and for deviations beyond allowable tolerances.

B. Insure paint finish is complete over wood and steel glazing pockets and stops.

C. Beginning of installation, mean acceptance of surfaces as capable of producing an acceptable job.

3.2 PREPARATION

A. Clean the glazing channel in framing members immediately before glazing. Remove lacquer from anodized aluminum surfaces where sealants are used.

B. Verify frame dimensions to fit glazing.

3.3 INSTALLATION

A. Apply sealants, tapes, gaskets, setting blocks, edge blocks, spacer-splines, and other items necessary in accord with GANA manual, and glass manufacturer's written instructions for a resilient, weathertight installation.

B. Cut glass accurately to fit openings with proper tolerances and edge bite.

C. Provide for expansion, contraction, seismic, vibration, weep holes, and wind movement with permanent bite.

D. Inspect each piece of glass immediately before installation, and eliminate pieces, which have observable edge damage or face imperfections. Install glass with waves parallel to horizon.

E. Install in such a manner that glass will remain permanently in position without water leakage or air infiltration. Seal with silicone sealant as specified in Section 07 92 00 - Joint Sealants.

3.4 CLEAN UP

A. Clean glass and surrounding materials immediately after installation. Do not use abrasives.

B. Remove excess tape and sealant from glass and surrounding areas.

C. Remove temporary shipping labels and polish glass clean.

3.5 GLAZING LOCATION SCHEDULE

A. Interior Doors and Interior Windows: 1/4 inch clear tempered single safety glass; channel glass at relites.

B. Glass panels where nearest exposed edge is within 24 inches of a door: safety glass.

C. Special locations indicated on DRAWINGS: laminated or tempered safety glass.

D. Typical Exterior Glazing:
   1. Vision Glass – Sealed insulation unit.

E. Typical Interior Glazing:
   1. Vision Glass – Tempered Safety Glass.

F. Typical Interior Door Relite Glazing:
   1. Channel Glass – Tempered, double -glazed @ door relites. 9-inch widths in relite frames; same appearance both sides.

END OF SECTION

Finish Colors and Textures

PART 1- GENERAL

1.1 SUMMARY

A. The materials and colors listed establish the basis of design. Refer to DRAWINGS and Product Specifications for details.
B. Substitutions will be evaluated in accordance with Section 01600 – Product Requirements.

PART 2 - PRODUCTS

A. See Approved Color Selections.

PART 3 – EXECUTION

3.1 REFER TO PRODUCT SPECIFICATION

SECTION 09 06 00
APPROVED COLOR SCHEDULE

EXTERIOR

EXTERIOR COLORS	TYPE-COLOR
Exterior Glass in Aluminum Windows	PPG Glass – Clear – Solarban 60
Aluminum Window Frames	Match Ward Level 1 – Anodized Aluminum Window color

INTERIOR

LAMINATE COLORS	TYPE – COLOR
WORK/BREAKROOM 201L Cabinets – Vertical Surfaces	Formica #8842-WR Weathered Ash - Woodbrush

SOLID SURFACE COUNTERTOPS	TYPE-COLOR
WORK/BREAKROOM 201L:	Dupont Zodiaq – Mossy Green

SOLID WOOD WINDOW SILLS	TYPE-COLOR
All Window Sills	Alaskan Birch – Natural Finish

CEILING COLORS	TYPE – COLOR
Acoustical Ceilings:	Armstrong 2nd Look II - White
GWB Ceilings:	KPC Standard Off-White
Painted Structure – Exposed to View	KPC Standard Off-White

RESILIENT FLOORING COLORS	TYPE – COLOR
SDT1	Armstrong #51955 Moss Green
SDT2	Armstrong #51956 Fossil Gray

CARPET COLORS		TYPE – COLOR
CPT1:	Tandus Modular District 03500	Green Space 79002 Monolithic Installation
CPT2	Tandus Modular Change 03747	Velvet Underground 10812 Unidirectional Installation
CPT3	Tandus Modular District 03500	Cold Spring 79009 Monolithic installation

WALL BASE COLORS	TYPE – COLOR
@ CPT1	Roppe 129 Dolphin
@ CPT2	Roppe 123 Charcoal.
@ CPT3	Roppe 150 Dark Gray.
@ SDT 1+2	Roppe 123 Charcoal

INTERIOR PAINT COLORS		TYPE – COLOR
P1	KPC Standard Off-White	All non-accent walls, ceilings and painted structure
P2	Wall Accent – Reception area	SW TBD
P3	Soffit Accent – Small Conference Room	SW TBD
P4	Soffit Accent – Suite Entry Door Soffits	SW TBD
P5	Wall Accent – Work/Break 201L	SW TBD
P7	STAIR 1/STAIR 2 Railings	SW 7068 Grizzle Gray
P8	Interior Exposed Ductwork	TBD

Abbreviation: SW: Sherwin Williams BM: Benjamin Moore TBD – To Be Determined

WINDOW COVERINGS	TYPE – COLOR
Exterior Windows	Color: TBD

END OF SECTION

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SECTION 09 21 11
GYPSUM AND CEMENT BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 06 23 00 - Finish Carpentry and Architectural Woodwork

B. Section 07 21 00 – Thermal Insulation

C. Section 07 26 00 - Vapor Retarders

D. Section 07 27 00 - Air and Water Barriers

E. Section 07 92 00 - Joint Sealants

F. Section 08 11 00 - Steel Doors and Frames

G. Section 08 71 00 - Door Hardware

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict only the most stringent shall apply.

1. ASTM A568 - Specifications for General Requirements for Steel, Sheet, Carbon and High Strength Low-Alloy, Hot-Rolled Sheet and Cold-Rolled Sheet.
2. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
3. ASTM A1003 – Specification for Steel Sheet, Carbon, Metallic and Nonmetallic - Coated for Cold-Formed Framing Members.
4. ANSI/ASTM C475 - Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
5. ANSI/ASTM C645 - Specification for Nonstructural Steel Framing Members.
6. ANSI/ASTM C754 - Specification for Installation of Framing Members to Receive Screw Attached Gypsum Board.
7. ASTM C834 - Specification for Latex Sealants.
8. ASTM C840 - Specification for Application and Finishing of Gypsum Board.
9. ASTM C841 – Standard Specification for Installation of Interior Lathing and Furring.
10. ASTM C919 – Practice for Use of Sealants in Acoustical Applications.

11. ASTM C954 - Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs 0.033 inches to 0.112 inches in Thickness.
12. ASTM C955 – Specification for Load-Bearing Steel Studs, Runners and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
13. ASTM C1002 - Specification for Steel Self-Piercing Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
14. ASTM C 1047 – Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
15. ASTM C1177 - Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
16. ASTM C1178 – Specification for Glass Mat Water-Resistant Gypsum Backing Board.
17. ASTM C1325 – Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets.
18. ASTM C1396 – Standard Specification for Gypsum Board.
19. ASTM C 1629 – Classification for Abuse Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
20. ASTM C 1658 – Specifications for Glass Mat Gypsum Panels
21. ASTM D 3273 – Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
22. ASTM D5420 – Test Methods for Impact Resistance of Flat, Rigid Plastic Specimen.
23. ASTM D5034 – Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).
24. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
25. ANSI/ASTM E90 – Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
26. ANSI/ASTM E119 – Test Method for Fire Tests of Building Construction and Materials.
27. ASTM E695 – Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.
28. ANSI A108.11 – Interior Installation of Cementitious Backer Units.
29. ANSI A118.9 - Standard for Test Methods and Specifications for Cementitious Backer Units.
30. Gypsum Association (GA) 201 - Using Gypsum Board for Walls and Ceilings.
31. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.
32. GA 214 – Recommended Levels of Gypsum Board Finish.
33. GA 216 - Specifications for the Application and Finishing of Gypsum Panel Products.

34. GA 219 - Instructions for Installation of Steel Door Frames in Steel Stud Gypsum Board Fire-Rated Partitions.
35. GA 600 - Fire Resistance Design Manual.
36. Underwriters Laboratories (UL) Listing and Fire Resistance Directory.

1.3 PERFORMANCE REQUIREMENTS

A. Shaft Wall: Conform to the following:
   1. Air Pressure within Shaft or horizontal span load capacity: five pounds per square foot with maximum mid-span deflection of ½ inches.
   2. Fire Rating Requirements: 2-hour minimum unless otherwise noted in accordance with UL or Gypsum Association listed assembly.
   3. Acoustic Attenuation: 47 STC minimum in accordance with ANSI/ASTM E90, using batt insulation specified in Section 07 21 00 – Thermal Insulation.
   4. Moisture resistant glass mat faced per ASTM C1178.

1.4 SUBMITTALS

A. Indicate on shop drawings, location special details associated with fire rated assemblies, acoustic seal, control joints, deflection heads and trim.

B. Provide product data and installation instructions for metal framing, top track deflection framing, edge trim, and expansion and control joints and shaft wall.

C. Samples of proposed control joints, corner beads and wall top deflection heads.

D. Applicator experience: job descriptions, telephone number of owner or architect.

1.5 QUALITY ASSURANCE

A. Applicator: Company specializing in gypsum board systems with at least 25 jobs similar to this within the last 5 years.

1.6 REGULATORY REQUIREMENTS

A. Conform to IBC for fire rated assemblies: UL, Gypsum Association or ICC listed assemblies.

B. Conform to IBC for Steel Studs.

1.7 STORAGE AND HANDLING

A. Maintain gypsum wallboard above ground protected from weather and moisture.

B. Do not overload structure by storing concentrated stacks of gypsum wallboard.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Maintain work area, substrate and materials 55 to 85 degrees F, 70 percent maximum relative humidity for 48 hours prior to, during and 72 hours minimum after installation or until completely dry.

B. Provide adequate ventilation.

C. Provide lighting of 80 foot candles at work with explosion proof electrical fixtures. Building lights may be used.

PART 2 - PRODUCTS

2.1 GWB NONSTRUCTURAL STUDS AND TRACK - RUNNERS

A. Sheet steel channel or cee shaped at least 1-1/4 inch knurled return flange suitable for nested or interlocked lapped splicing and screw attachment of gypsum wallboard per ASTM C645 or C955.

B. Deflection Heads:
1. Provide U.L. or W.H. fire rate listed 2-piece or slotted screw top track "head of wall" assemblies with any necessary bridging, for ½-inch minimum deflection relief at top of walls: [EDIT exposed top track: mineral wool with no spray or sealant: Clark Dietrich Blaze Frame: www.clarkdietrich.com]
   a. Metal-Lite http://www.metal-lite.net
   b. Fire Trak,http://www.fire-track.com,
   c. Steel Network Inc., http://www.steelwork.com,
   d. Total Steel RediKlip http://www.totalsteel.biz/redi_klip.html
   e. CEMCO FireStik "Fastrack", http://www.cemco.com
   f. Blaze Frame, http://www.blazeframe.com

C. 3 1/2 inches minimum through the wall dimension up to 14 feet maximum length typical unless noted otherwise in the DRAWINGS.

D. Shaft Wall Studs and Tracks per Performance Requirements and stud manufacturer's approved instructions.

E. Metal thickness: metal before galvanizing:
1. 20 gage/30 mils (0.0296 inch) typical studs.

F. Provide punched openings at 1-1/2 inches diameter, not more than 24-inches on center. Studs full single piece for height required.

G. Provide ½ inch minimum weep holes 18 inch on center in bottom track used in exterior walls.

H. Finish: Hot dip galvanized G40 per ASTM A654 and ASTM A1003; G90 in exterior walls.

2.2 FURRING AND FRAMING ACCESSORIES

A. ASTM C645 and GA 216: Bridging-bracing straps, angles, anchors, plates, brackets and the like shall be at least 20 gage galvanized sheet steel, matching studs and as recommended by the stud manufacturer.

B. Furring Channels: ASTM C645, 20 gage galvanized sheet steel hat-shaped knurled face channel 7/8-inch deep for screw attachment of wallboard. Clips, adjustable brackets, and other anchorage as necessary.

C. Resilient Sound Isolation 7/8-inch Furring Channels: 20 gage rolled, knurled face galvanized sheet steel designed for resilient acoustic attachment to GWB; U.S.G. RC-1 or approved substitutions.

D. Carrying Channels: ASTM C645, 1-1/2 inch cold rolled steel, 16 gage (0.05 inch) thick minimum. Galvanized in accordance with ASTM A653.

E. Hanger Wire: Minimum 12 gage galvanized soft annealed steel.

F. Tie Wire: Minimum 16 gage galvanized soft annealed steel.

G. Provide ½-inch minimum weep holes 18-inch on center, minimum 1 inch bottom track used in exterior walls

2.3 FASTENERS

A. Self-drilling, self tapping drywall and metal screws to penetrate framing and in accordance with ASTM C954 and GA 216. Only GWB screws in GWB, no nails allowed. Use hot-dip galvanized zinc coated or stainless screws in exterior walls, showers, tub enclosures, exterior entries, exterior sheathing and similar wet use areas.
   1. Length to penetrate GWB and backing.

B. Metal Studs to Runners, Furring Channels, and Other Metal Accessories: Self-drilling, self-tapping pan head type “S” screws in accord with ASTM C 954, size per metal stud manufacturer’s written instructions for specified fire resistance but not less than No.6: 3/8 inch long.

2.4 FRAMING ANCHORS

A. Standard commercial threaded expansion anchors IBC approved and recommended for intended use by manufacturer may be used if approved

by the CONTRACTING OFFICER. Submit manufacturer's literature indicating lateral (shear) and pullout (tension) data for approval.

B. Anchor diameter 1/4 inch minimum and 400-pound minimum average pullout.

C. Each anchor shall be capable of developing at least 4 times design load in lateral (shear) and pullout (tension) loads into substrate, for condition of use.

D. Explosive driven anchors not permitted into masonry.

E. Powder driven anchors not permitted for tension without IBC approval for condition of use.

2.5 GYPSUM BOARD MATERIALS (GWB)

A. Typical Interior Gypsum Board: ASTM C1396; fire resistive Type X 5/8 inch thick, edges tapered; ends square cut. Mold resistance 10 per ASTM 3273.

2.6 SEALANT

A. Single component silicone for fire rated joints in accordance with Section 07 84 00 - Firestopping.

2.7 ACOUSTICAL AND THERMAL INSULATION

A. As specified in Section 07 21 00 - Thermal Insulation.

2.8 ACOUSTICAL SEALANT

A. Single component non-hardening, latex base non-skinning per ASTM C834, for use in conjunction with gypsum board; manufactured by U.S.G. Company, W.W. Henry Co., Pecora, or approved.

2.9 OUTSIDE CORNER BEADS

A. "L"-Shaped paper faced galvanized steel or zinc tape-on-type per ASTM C1047 or GA 216.

B. Extruded mat finish aluminum or stainless steel, round bullnose shaped matt finish concealed screw attach equal to Fry Reglet "DRMC" – in public areas as indicated and at exposed cement board.

C. Round Bullnose 3/4 inch paper faced galvanized steel or zinc tape-on-type.

2.10 EDGE TRIM

A. Paper faced galvanized steel or zinc "LC" – shaped ¾ inch minimum leg

tape-on type, without screws, per GA 216, or ASTM C1047.

2.11 CONTROL JOINTS

A. Galvanized steel or zinc ½ inch gap tape-on-type with masking strip removable after finishing per GA 216, or ASTM C1047.

2.12 JOINT COMPOUND AND JOINT TAPE

A. ASTM C475 and GA 216 compatible joint compound and adhesive, from a single manufacturer. Joint compound recommended in writing for additional mold resistance by manufacturer.
   1. Use glass fiber tape with setting type compound in high moisture areas and with any glass fiber surfaced gypsum board.
   2. Glass Fiber Tape: Alkali resistant open weave glass-mesh fabric: 4 ounce per square yard minimum weight.

B. Use latex thin-set adhesive and fiberglass tape for cement board joints. Seal cement board exposed surfaces and finish as recommended by board manufacturer.

2.13 ANCHORAGE BACKING FOR WALL MOUNTED ACCESSORIES

A. Minimum 16 gage sheet steel by 6 inches wide by length required and across 3 studs minimum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the DRAWING details and verify field conditions for defects that will adversely affect the work, and for deviations beyond allowable tolerances.

B. Other work shall be substantially complete behind wall studs and above furred ceilings prior to start of GWB work particularly mechanical, electrical, structural, fire spray and insulation.

C. Start of installation shall mean acceptance of the existing conditions as capable of producing an acceptable job.

3.2 GENERAL SYSTEMS INSTALLATION

A. Per manufacturer’s written instructions, referenced publications and IBC.

B. Do not install interior products until installation area is enclosed and heated.

3.3 METAL STUD INSTALLATION

A. Install studding in accordance with ANSI/ASTM C754, ASTM C645, and GA 201, manufacturer's instructions and the DRAWINGS.
   1. Set floor tracks in sill sealer insulation specified in Section 07 21 00 - Thermal Insulation. Trim excess and fire seal in type I and II buildings.
   2. Anchor tracks to structure at 18 inches maximum and 2 inches from each track end.
   3. Install deflection top track assembly at full height partitions in accord with deflection head manufacturer.
   4. Splice tracks with 16-inch piece at stud with two screws per flange to each piece of track.
   5. Install studs so open sides face same direction.

B. Metal Stud Spacing: 16 inches on center.
   1. Install framing around structural and other penetrations.

C. Stud Heights: Full height from floor to structure above.

D. Door Opening Framing: Install two full height studs at each side of door jamb. In accord with GA219 install stud tracks at frame head height, and between adjacent studs. Screw double studs together - with additional flat plate as necessary.

E. Backing and Blocking: Screw across three studs minimum. Install backing for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware handrails and other GWB mounted fixtures indicated.

F. Bridging required where GWB not installed each side full height: Install bridging straps at midpoints of studs or 4 feet maximum for studs over 12 feet high. Use stud track-runner screw attached to each stud or continuous strap across faces at studs.

G. Coordinate installation of backing, anchors, blocking, electrical and mechanical work placed in or behind partition framing.

3.4 WALL AND COLUMN FURRING INSTALLATION

A. Install wall furring by direct attachment to steel, masonry and concrete walls.

B. Install furring channels 16 inches on center typical. Locate joints over solid backing framing.

C. Space furring channels not more than 4 inches from floor and ceiling.

D. Coordinate acoustical and thermal insulation Specification Section 07 21 00 – Building Insulation.

E. Erect metal stud framing with insulating air space, one inch minimum at concrete and concrete masonry exterior walls, attached by adjustable furring brackets in accordance with manufacturer's instructions.

3.5 CEILING AND SOFFIT FRAMING INSTALLATION

A. Install in accordance with ANSI/ASTM C754, ASTM C645, GA 201 and IBC Chapter 25.

B. Either studs or wire hangers are acceptable for ceiling support.

C. Attach each hanger wire, stud track, and brace to structure with IBC approved anchors. Coordinate and supply embedded hangers or inserts into structure as needed.

D. Ceiling studs (studs not touching floor) and joists shall be 24 inches on center maximum.
   1. Install ceiling stud with 45 degrees brace studs to structure 6 feet maximum on center on opposite sides of ceiling assemblies.
   2. Install Brace studs 4 to 8 feet long anchored to structural ceiling above.

E. Position hanger wires for the load supported and in accord with ASTM C754 and GA 201 and four feet maximum spacing. Coordinate location to avoid other work with 6-inch minimum space.

F. Space carrying channels 4 feet maximum and within 6 inches of walls. Lap channels splices 2 feet and secure each end with double strand tie wire.

G. Provide hangers at ends of each runner and carrying channel 6-inch maximum from ends.

H. Do not slope hangers over one inch in 6 inches horizontal unless equal counter-sloping hangers are provided.

I. Provide a trapeze or equivalent device where obstructions prevent direct suspension. Minimum trapeze bar: two carrying channels wire tied together.

J. Wrap end of hanger wires 3 full turns in 3 inches at connections and loop tightly to prevent vertical movement or rotation of member.

K. Adjust hanger wires taught: do not kink or bend hanger wire to level ceiling.

L. Provide two extra hanger wires above opposite edges of gypsum ceiling

mounted air duct outlets and light fixtures for attachment by duct and light installers.

3.6 SEALANT INSTALLATION

A. Apply sealants in accord with Section 07 92 00 - Joint Sealants.

B. Install acoustical sealant continuously at gypsum board perimeter in accord with ASTM C919 at:
   1. Metal Framing: track, header, and jamb intersect.
   2. Base Layer of double layer systems.

C. Seal penetrations of gypsum fire rated assemblies by conduit, pipe, ductwork, rough-in boxes, and hardware with silicone sealant firestopping systems in accord with Section 078400 - Firestopping. Seal acoustic-sound rated assemblies with acoustical sealant.

3.7 GYPSUM BOARD INSTALLATION

A. Install GWB in accordance with ASTM C840, and GA 216 and manufacturer's instructions to meet fire resistance indicated. Extend gypsum board continuously into and behind recessed wall mounted accessories such as fire extinguishers and toilet accessories in fire resistance rated walls.
   1. Verify insulation and vapor retarder is installed and approved before installing GWB.

B. Cut GWB neatly to fit in moderate contact and neatly against adjacent GWB. Cut around penetrations for ¼ to ½-inch space between gypsum and penetration. Bevel untapered panel edges approximately 1/8 inch at a 45 degrees angle using a sharp utility knife. Peel back and remove any loose facing from the edges.

C. Install lead edge of GWB to open end of stud flanges first. Stagger joints on opposite side of wall studs by one stud minimum.

D. Use screws for fastening gypsum board: 8 inches maximum spacing over backing. Drive screws flush. Use appropriate short screws on resilient furring channels to avoid penetrating support.

E. Use corrosion resistant screws in showers, exterior entries and any similar wet use areas.

F. Install exterior gypsum sheathing horizontally, with edges separated slightly and ends occurring over framing or furring.

G. Multi Layer Applications: Gypsum backing board allowed for first layer, placed perpendicular to framing or furring members. Place second layer

perpendicular to first layer. Offset joints of second layer from joints of first layer by one stud space.

H. Use the longest practical GWB panel lengths. Keep butt end joints to a minimum.

3.8 CONTROL JOINT INSTALLATION

A. Install control joints parallel with lines of building spaces where substrate joints such as seismic joints or material changes occur and in uninterrupted gypsum board or cement board spaces: 30 feet maximum for walls and 900 square feet total area between control joints.

B. Install control joints in line with jamb edge of door openings over 10 feet wide.

3.9 GYPSUM EDGE TREATMENT

A. Treat cut edges and holes in water resistant gypsum board with manufacturer recommended sealer.

B. Place corner beads at external corners. Use longest practical length.

C. Place edge trim where gypsum board abuts dissimilar materials and where gypsum ends are exposed to view.

3.10 JOINT AND SURFACE TREATMENT

A. Embed tape at GWB joints and interior angles with joint finishing compound in accord with ASTM C840, and GA 216. Fill and smooth exposed joints, edges, and depressions to produce a smooth flush surface ready to receive finishes specified in accordance with manufacturer's instructions. No heavy texture permitted.
   1. Use setting type joint compound with fiberglass tape for fiberglass faced gypsum board.
   2. Allow sufficient drying time between coats to obtain a moisture content of 12 percent or less on GWB and joints.

B. Smoothly feather joint compound coats onto adjoining surfaces.

C. Finish square butt joints to a width at least 6 inches.

D. Levels of Surface Treatment in accord with ASTM C840 and GA214:
   1. Non-exposed areas, as above suspended ceilings: Level 2: Embed tape at joints and apply joint compound over fasteners and trim.

2. Boiler, Janitor, and Mechanical-Electrical Rooms: Level 3: Embed tape and apply two separate coats of joint compound over joints, fasteners. Joint compound shall be smooth and free of tool marks and ridges.
3. Typical Walls: Level 4: Apply two separate coats of joint compound over the taped joints, fasteners, metal corner bead and trim covered with three separate coats and as smooth as possible to minimize sanding. Sand any excess joint compound free from lap marks, tool marks, crowned joints, and ridges. Fill scratches, craters and nicks with joint compound.
4. Fiberglass faced gypsum board walls and ceilings and horizontal surfaces: Level 5: three separate coats of joint compound; apply a thin smooth skim coat of joint compound or material manufactured especially for this purpose, and applied in accord with manufacturer's recommendations to entire exposed GWB surfaces.
5. Joints behind any tile and fiber reinforced plastic panels: Level 2: Tape and fill and sand lightly to even surface.

E. Use sandpaper or abrasive-mesh cloth with grit as fine as practical.

F. Remove sanding dust with a damp rag before recoating.

3.11 GWB AND GWB STUD FRAMING TOLERANCES (NON-CUMULATIVE)

A. To Subfloor: 1/4 to 1/2 inch space. Smooth without abrupt changes. Seal continuous fire resilient silicone.

B. Space around Mechanical, Electrical, and Other Penetrations: 1/4 to 1/2 inch before sealing.

C. Bowing or Warping From Proper Plane: plus minus 1/8 inch in 10 feet.

D. Joint Alignment Before Taping: plus or minus 1/16 inch.

E. Joint Spacing Before Taping: 1/16 to 1/8 inch.

F. Gaps Between Perimeter Edge Trim Molding and Abutting Surfaces: 1/8 inch maximum with no abrupt changes.

G. Exposed Surface Texture: Smooth without texture, pock holes, or scratches over 1/64 inches within any 2 square feet.

3.12 CLEANING

A. After final taping and sanding, lightly wipe GWB surfaces with a damp rag to remove dust and dirt.

B. Leave in condition to receive primer - sealer.

3.13 SCHEDULE

A. Follow finish schedule and details on DRAWINGS.

B. Use typical GWB unless otherwise indicated. First layer of multi thicknesses may be gypsum backing board.

END OF SECTION

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SECTION 09 51 00
ACOUSTICAL CEILING SYSTEMS

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Section 09 21 11 - Gypsum and Cement Board Assemblies

B. Division 23 - Mechanical: Air diffusers and sprinklers in ceiling and ductwork over ceiling: hangers direct to structure.

C. Division 26 - Electrical: Light fixtures in ceiling: hangers direct to structure.

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict only the most stringent shall apply.
   1. Underwriter's Laboratories, Inc. (UL): Fire Resistive Index - Fire Hazard Classification.
   2. American Society for Testing Materials (ASTM) C635: - Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
   3. ASTM C636: Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
   4. Acoustical and Insulating Materials Association (AIMA) - Installation Instructions.
   5. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
   7. ASTM E1264 - Classification for Acoustical Ceiling Products.
   8. Ceilings and Interior Systems Construction Association (CISCA) Guidelines For Seismic Restraint Direct Hang Suspended Ceiling Assemblies.
   9. International Building Code (IBC) 2009 Sections 803, 800 and 2506.2.1
   10. American Society of Civil Engineers (ASCE) Standard 7-05 – Minimum Design Loads for Buildings and Other Structures.

1.3 SUBMITTALS

A. Submit Samples:
   1. Each type of acoustical tile or lay-in unit proposed: minimum size 6 by 6 inches - with representative edges and texture.

2. Each type suspension grid and wall molding proposed.

B. Submit data on fire hazard class, light, sound, lateral seismic resistance and installation specifications for suspension, panels, grid, hanger attach to structure, tile adhesive and staples, and accessories.

C. Manufacturer and installer experience qualifications.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in the manufacturing of ceiling suspension systems and acoustical panels with a minimum of 100 successful installations similar to that proposed.

B. Installer: At least 10 satisfactorily completed acoustical ceiling installations comparable to work proposed within the last 3 years.

1.5 TEMPERATURE AND HUMIDITY REQUIREMENTS

A. Maintain building and materials at 60 degrees to 85 degrees F. and 50 percent maximum relative humidity for 48 hours prior to, and during the installation. After installation maintain temperature and humidity.

B. Do not install acoustical ceilings until building is enclosed and dust-generating activities are completed.

C. Do not store or install acoustical tile or lay-in panels inside building until “wet” paint like materials have dried to acceptable emission levels.

1.6 SEQUENCING AND SCHEDULING

A. Mechanical work: Piping and ductwork above ceiling shall be complete and permanent heating and cooling systems operating to specified conditions prior to installation of ceiling components.

B. Electrical work: Installation of conduit above ceiling shall be complete before installation of ceiling components.

C. Fire protection work: Fire protection lines and equipment above ceiling shall be completed and tested before ceiling components are installed.

PART 2 - PRODUCTS

2.1 FIRE RATINGS

A. Non-combustible, fire resistance rating not required.

B. Flame spread rating per ASTM E84 or E1264: 25 maximum.

2.2 SUSPENSION GRID SYSTEM

A. Load Carrying Capacity: Sufficient to prevent deflection of ceiling more than 1/360 of span meeting requirements for Heavy Duty classification of ASTM C635.

B. Exposed Grid:
   1. 0.018 inch minimum cold rolled steel exposed “T”.
   2. 15/16-inch (9/16-option) maximum exposed width.
   3. Cadmium or electrogalvanized with flat white enamel exposed finish.

C. Wall Edge Angle: 0.018-inch minimum steel supporting angle trim with flat white enamel finish, 2-inch minimum horizontal leg or IBC approved for alternate seismic design.

D. Accessories: Runners, channels, ties, spreader bars, splines, clips, rivets, vertical struts, and other appurtenances necessary for complete suspension systems. Provide hold-down clips at lay-in panels within 20 feet of exterior doors.

2.3 ROUGH SUSPENSION

A. Hanger Anchorage into supporting construction:
   1. Standard commercial IBC approved cast-in-place, drilled, threaded, clamped or welded anchors recommended for intended use by their manufacturer may be used if approved by the CONTRACTING OFFICER.
   2. Attachment devices shall be certified capable of carrying 5 times the design load per ASTM C636. Submit manufacturer’s literature indicating lateral (shear) and pullout (tension) data for approval. Minimum 200 pounds capacity.
   3. Powder-actuated fasteners shall not be used in tension without specific IBC approval.

B. Hanger and Splay Wire: Minimum 12 gage pre-stretch-straightened galvanized soft annealed mild steel.

C. Vertical Struts: Galvanized steel equivalent to 3/4 inch diameter electrical metallic tubing, 8 foot maximum length, or 20 gage 1-1/2 inch steel stud.

D. Carrying Channels: 16 gage galvanized 1-1/2 inch rolled steel 0.475 pounds per foot minimum.

E. Minimum recycled content 25 percent.

2.4 SEALANTS

A. Single component silicone as specified under Section 07 92 00 - Joint Sealants.

2.5 ACOUSTICAL LAY-IN PANELS

A. Type 1:
   1. 24 by 48 by 3/4 inch minimum thick fiber composition angled tegular edge with 15/16 inch (or 9/16 inch) scoring to simulate 24 by 24 inch grid.
   2. Finish: Non-directional, fissured, white color, washable.
   3. Minimum Noise Reduction Coefficient (NRC): 0.55
   4. Ceiling attenuation class (CAC): 30 to 35
   5. Light reflectance: 0.80 to 0.85.
   6. Humidity and mold resistant finish on face and back.
   7. Acceptable Manufacturer:
      a. Armstrong – “Fine Fissured” Second Look II.
      b. No Substitutions; must match existing products on Campus.
   8. Minimum recycled content 25 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWING details and verify field conditions for defects that will adversely affect the work, and for deviations beyond allowable tolerances.

B. Work shall be substantially complete above acoustical ceiling prior to start of ceiling work particularly mechanical, electrical and structural unless approved by ceiling installer.

C. Start of installation shall mean acceptance of the existing conditions as capable of producing an acceptable job.

3.2 SUSPENSION INSTALLATION

A. Per manufacturer’s written instructions, referenced standards, in accord with ASTM C636, IBC 2506.2.1 and ASCE 7 and these Specifications.
   1. Provide seismic separation joint or full height partition for ceilings exceeding 2,500 square feet.

B. Attach each hanger to structure through an approved anchor. Coordinate and supply hangers or inserts into structure as needed.

C. Position grid hanger wires for 4 feet maximum spacing. Attach hanger to main runners within 2 inches of cross runner. Space wire at least 6 inches from ducts, pipes and conduits. Provide grid hangers 8 inches maximum from walls.

D. Lateral Force Bracing: Position four 45 degree splayed hanger wires and vertical strut braces fastened to structure above per IBC 2506.2.1 for lateral bracing at main runner within 2 inches of cross runner intersection. Space 6 inches from ducts, pipes and conduits.
   1. Ceilings of less than 1000 square feet area surrounded by walls which connect directly to structure above, do not require lateral bracing.
   2. Place bracing at not more than 12 feet on center and not more than 6 feet from surrounding walls. Bracing strut does not replace requirement for hanger wire.
   3. Attach splayed wires to cross runner structure and to main grid runner within two inches of cross runner.

E. Perimeter: Provide hangers at ends of each grid runner at walls and provide spacer bar strut crosstie or wire tie above acoustical units to prevent spreading at ends of runners.
   1. Not required if perimeter angle is within 12 inches.
   2. Not required with IBC approved alternate seismic design.

F. Do not slope hangers unless equal counter- sloping hangers are provided.

G. Provide a trapeze or equivalent device where obstructions prevent direct suspension. Minimum trapeze bar: two carrying channels wire tied together 12 inch on center. Space carrying channels 4-foot maximum.

H. Wrap ends of hanger wires three tight turns within 3 inches at connections and loop tightly to prevent vertical movement or rotation of member.

I. Do not kink or bend hanger wire to level ceiling. Position suspension wires plumb and tight.

J. Coordinate and provide extra hanger wires anchored to structure at each corner of each ceiling mounted air duct and light fixture.

K. Securely fasten components together in accord with manufacturer instructions and to prevent rattling noisily against each other.

3.3 WALL EDGE ANGLE INSTALLATION

A. Install at intersections of suspended ceiling and vertical surfaces. Form neat tight joints.

B. One end of the ceiling grid shall be attached to the wall closure angle. The other end in each horizontal direction shall provide ¾-inch clearance between wall and runners to allow grid to slide.

3.4 GRID LAYOUT

A. Install grid perpendicular and parallel to major walls and per reflected ceiling drawings.

B. Center in each major space to avoid cutting border units smaller than 1/4 size.

C. Locate seismic separation joints for approximately equal sizes.

3.5 ACOUSTICAL PANEL INSTALLATION

A. Install spring hold down clips if recommended by manufacturer for entire ceiling.
   1. Install to retain panels in grid as recommended by manufacturer within twenty feet of exterior doors.

B. Penetrations: Scribe cut and provide oversize trim to allow for 1 inch ceiling movement in all horizontal directions.

C. Rout edge of field cut panels to match factory edge and paint exposed edges to match exposed surface.

D. Any sprinkler penetrations: provide oversize trim ring to allow free movement of at least 1 inch in all horizontal directions.

E. Seal cut or drilled edges of panels with paint to match factory surface.

3.6 TOLERANCES

A. Completed Ceiling System: Level within 1/4 inch in 10 feet.

B. Gaps Between Perimeter Molding and Wall: 1/8 inch maximum.

C. Exposed Grid: Square (90 degrees) within 2 degrees. Adjacent pieces: flush hairline joints.

3.7 CLEANUP

A. Touch-up minor scratches and abrasions on painted surfaces allowed with matching paint. Replace defects over 2 percent of exposed surfaces.

B. Acoustical units shall be clean and undamaged.

END OF SECTION

SECTION 09 65 00
RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 06 23 00 - Finish Carpentry and Architectural Woodwork

B. Section 09 06 00 – Finish Colors and Textures

C. Section 09 68 00 - Carpet

1.2 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict only the most stringent shall apply. No Asbestos Based Products allowed.

1. Federal Specification (FS) FF SS-T-312 – Tile, Floor, Asphalt, Rubber, Vinyl-Composition.
2. FS-L-F-475 - Floor Covering, Vinyl, Surface, (Tile and Roll), with Backing.
3. FS SS-W-40 - Wall Base: Rubber and Vinyl Plastic.
4. ASTM D471-Test Method for Rubber Property—Effect of Liquids.
5. ASTM D1894 – Test Method for Static and Kinetic Coefficients of Plastic Film and Sheeting.
6. American Society for Testing and Materials (ASTM) D2047 - Test Method for Static Coefficient of Polish-Coated Floor Surfaces as Measured by the James Machine.
7. ASTM D 2240-Test Method for Rubber Property Durometer Hardners.
8. ASTM D3389 – Test Method for Coated Fabrics Abrasion Resistance.
9. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
10. ASTM E648 - Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
11. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
12. ASTM F150 – Test Method for Electrical Resistance of Conductive Resilient Flooring.
13. ASTM F710 – Practice for Preparing Concrete Floors to Receive Resilient Flooring.
14. ASTM F 925 – Test Method for Resistance to Chemicals of Resilient Flooring.
15. ASTM F970 – Test Method for Static Load Limit.
16. ASTM F1066 – Specification for Vinyl Composition Floor Tile.

17. ASTM F1303 - Specification for Sheet Vinyl Floor Covering with Backing.
18. ASTM F1344 – Specification for Rubber Floor Tile.
19. ASTM F1516 – Practice for Sealing Seams of Resilient Flooring Products by the Heat Weld Method.
20. ASTM F1700 – Specification for Solid Vinyl Floor Tile.
21. ASTM F1861 – Specification for Resilient Wall Base.
22. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
23. ASTM F1913 – Specification for vinyl sheet floor covering without backing.
24. ASTM F2169 – Specification for Resilient Stair Treads.
25. U.S. Department of Commerce (DOC): FF-1-70-Fire Spread Flammability Pill Test.
26. ASTM F2170 – Test Method for Determining Relative Humidity in Concrete Floor Slabs using In-Situ Probes.

1.3 ACCEPTABLE MANUFACTURERS

A. Manufacturer names, numbers and features are listed to establish a standard of quality. Products may be provided from manufacturers with equivalent features and colors subject to meeting specified criteria.

1.4 SUBMITTALS

A. Manufacturers Literature:
   1. Material Composition.
   2. Installation Instructions and Specifications to be used on this job, including floor preparation, floor manufacturer approved adhesives and seam locations, edge trim and expansion joint trim.

B. Samples:
   1. 6 by 6 inch of full range of manufacturers standard color - texture available for selection.

C. Written verification of manufacturer and installer qualifications with job experience names, addresses and telephone numbers.

D. Maintenance manuals: flooring manufacturer’s instructions for cleaning and maintenance.

E. Shop drawings, showing the locations of seams and edge trim strips and different color or flooring type on a floor plan.

F. Warranty.

G. Certification: Manufacturers Certification on manufacturer's letterhead, signed by the CONTRACTOR that the flooring:
   1. Meets these specifications and conforms to submitted literature.
   2. Conforms to specified fire hazard properties.
   3. Is recommended for heavy public traffic in corridors and classrooms

1.5 MANUFACTURER QUALIFICATIONS

A. Manufacturer shall have been manufacturing commercial grade flooring for at least 25 similar successful jobs, and manufactured the flooring proposed for this job for the last 2 years.

B. List 5 jobs with similar traffic use in which the proposed flooring has been installed for at least 2 years. Include Owner Representatives Names, Address, and Phone Number for reference.

1.6 INSTALLER QUALIFICATIONS

A. Installer shall have successfully completed at least 5 jobs of similar size and complexity in the past 5 years.

1.7 PRE-INSTALLATION CONFERENCE

A. Arrange a Pre-Installation Conference held at the job site on the first day of installation.
   1. Attendance required for:
      a. Flooring Installer Superintendent
      b. OWNER Representative

1.8 INSTALLATION QUALITY CONTROL

A. First 150 square feet of flooring installed and approved by the OWNER shall be the standard for the rest of the installation, including seams, bases, transition, floor preparation and adhesives.

1.9 INDOOR AIR QUALITY

A. The Owner is concerned about indoor air quality and chemical emissions.

B. Verify building ventilation system is in proper working order. Operate building permanent ventilation system at maximum outdoor air flow before applying adhesives, during installation and minimum 72 hours after installation.

1.10 TEMPERATURE AND HUMIDITY REQUIREMENTS

A. Maintain building and materials including subfloor at 65 to 75 degrees Fahrenheit and 20 to 50 percent relative humidity for 72 hours prior to,

during and maintain 60 degrees Fahrenheit after installation..

1.11 EXTRA MATERIALS

A. Not less than 8 square feet of extra flooring material in full tiles for tile of each type and color pattern used in the work for subsequent repair and maintenance by the OWNER.

B. Label each piece indicating manufacturer, stock number and location in completed work. Deliver to OWNER at job site.

PART 2 - PRODUCTS

2.1 HAZARD CLASSIFICATION

A. Flame Spread: 75 maximum and 25 maximum within enclosed stairs per ASTM E84 Tunnel Test, or ASTM E 648 Class I. Smoke: 450 maximum per ASTM E 662.

B. No Asbestos based materials allowed.

2.2 STATIC DISSIPATIVE TILE

A. A solid homogeneous conductive smooth 1/8 inch thick per ASTM F 1700 vinyl tile.

B. Electrical resistance average 1,000,000 ohms per ASTM F150 recommended by manufacturer for computer processing facilities. Armstrong “Excelon SDT”, Roppe “ESD” Forbo “COLOREX” or approved.

C. Resists permanent indent from heavy equipment up to 2000 psi.

D. Special heat welded seams, adhesive and copper grounding strip system as recommended by tile manufacturer.

2.3 BASE

A. Thermoset (TS) vulcanized rubber top-set toe cove in accord with ASTM F1861.

B. 1/8-inch minimum thickness by height indicated on DRAWINGS or 4-inch minimum height. 4 feet minimum lengths.

C. 10 percent natural rubber, PVC free.

D. Provide minimum of 6 different standard through colors black, gray, blue, tan and brown for selection. Two colors will be used.

2.4 ADHESIVES, SEAM SEALERS AND ACCESSORIES

A. Waterproof type adhesives, seam sealers, heat weld rods, primers, cove strips, cap strips, and sub floor fillers: Type and brands as recommended in writing by flooring manufacturer for the conditions of installation.

B. Certify solvent free, low chemical emission and low Volatile Organic Compound (V.O.C.).

2.5 EDGE TRIM

A. Extruded mill finish aluminum, 2-1/2 inch by 3/8-inch one-piece PEMKO 174 or 236 to fit over flooring.
   1. Counter sunk drilled expansion screw fasteners 12 inch on center to match.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and the DRAWING details to receive flooring for defects that will adversely affect the work and for deviations beyond allowable tolerances.
   1.

B. Verify building permanent ventilation system is operating.

C. Start of work shall mean acceptance of interfacing surfaces as capable of producing acceptable work.

3.2 REMOVAL AND REPLACEMENT OF LOOSE EQUIPMENT AND FURNITURE

A. OWNER will remove, relocate and replace existing furniture to allow flooring installation continuous underneath.

3.3 PREPARATION OF SUBFLOOR SURFACES

A. Prepare subfloor in accord with flooring manufacturer's recommendations. Clean subfloor to remove existing flooring, dirt, loose particles, oil, grease and other foreign material detrimental to the adhesion and level of new finish flooring. Use approved State and Federal asbestos procedures.

B. Fill holes and cracks over ¼ inch with filler approved by finish flooring manufacturer. Allow filler to dry, and prime as recommended by filler manufacturer before installing flooring.

C. Smooth substrate to acceptable flatness by grinding or filling uneven joints, and rough areas up to 5/16 inch plus or minus to featheredge.

D. Provide for 15 percent of sub-floor grinding and filling flat to 5/16 inch as measured with a 10 foot straight edge.

E. Vacuum or damp mop substrate clean immediately prior to flooring installation.

3.4 INSTALLATION

A. Install in accord with manufacturer's instructions, approved submittals, using flooring manufacturer approved application materials including primers, fillers, underlayments, adhesives and seam fusion solvents.

B. Flooring: Smooth and level without blisters or waves and with tight, abutting, adhered joints:
   1. Remove any adhesive, which dries or films over before flooring placement and replace with fresh, workable adhesive.

C. Pattern-sheet layout: start at center of floor space so that perimeter pieces are at least 1/2 width, except in irregularly shaped areas.
   1. Lay tile with grain direction alternating in adjacent tiles.
   2. Fit flooring neatly around recesses, penetrations, and permanent equipment, under edge strips, thresholds, and bases.

3.5 EDGE TRIM STRIP INSTALLATION:

A. Install over flooring edges at junctions with different type flooring materials and other exposed edges where flooring does not abutt a vertical surface.
   1. Place directly under doors where joint occurs in doorway.
   2. Not required where door threshold is installed over edge of flooring.
   3. Anchor with screws, expansion anchor type for concrete, 12 inches maximum, adhesive not acceptable.

3.6 CLEAN UP

A. Remove surplus materials, adhesive, and installation compounds from flooring and adjacent materials caused by resilient flooring installation.

B. Leave completed flooring clean and buffed, ready for use.

3.7 PROTECTION

A. Prevent rolling traffic for at least 48 hours after installation.

B. Provide plywood protection when moving heavy fixtures over flooring.

3.8 FINISHED TOLERANCES (NON-CUMULATIVE)

A. Abutting Joints: 1/64-inch maximum space.

B. Seams and Joints: Flush with completed surface.

C. Flat even Surface: 1/8 to ¼ inch gap measured anywhere with a 10-foot straightedge.

END OF SECTION

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SECTION 09 68 00
CARPET

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict the most stringent shall apply.
   1. American Society for Testing and Materials (ASTM): ASTM D418 - Methods of Testing Pile Yarn Floor Covering Construction.
   2. ASTM D1335 – Test Method for Tuft Bind of Pile Yarn Floor Coverings.
   3. ASTM D2646 - Test Method for Backing Fabrics.
   4. ASTM D5252 – Standard Practice for the Operation of the Hexapod Tumbler Drum Tester.
   5. ASTM D2859 – Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
   6. ASTM E648 - Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
   7. ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   8. ASTM F710 – Preparing Concrete Floors to Receive Resilient Flooring.
   9. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   10. National Fire Protection Association (NFPA): NFPA 258/ASTM E662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   11. U.S. Department of Commerce (DOC): DOC-FF-1 Fire Spread Flammability Pile Test.
   12. American Association of Textile Chemists and Colorists (AATCC): AATCC 134-75 - Electrostatic Propensity of Carpet.
   13. Carpet and Rug Institute (CRI) CRI – 104 – 2000 - Standard for Installation of Commercial Carpet.
   14. International Building Code (IBC): 804 – Interior Floor Finish Requirements.

1.2 SUBMITTALS

A. Manufacturers Literature:
   1. Materials and Construction.

2. Installation Instructions and Specifications to be used on this job, including floor preparation, carpet manufacturer approved adhesives and seam locations, edge trim and expansion joint trim.

B. Samples:
   1. 6 by 6 inch of full range of manufacturers standard color - texture available for selection.

C. Written verification of manufacturer and installer qualifications with job experience names, addresses and telephone numbers.

D. Maintenance manuals: Carpet and carpet fiber manufacturer's instructions for cleaning and maintenance.

E. Shop drawings, showing the locations of seams and edge trim strips and different color or carpet type on a floor plan of the carpeted area.

F. Warranty.

G. Certification: Manufacturers Certification on manufacturer's letterhead, signed by the CONTRACTOR that the carpet:
   1. Meets these specifications and conforms to submitted literature.
   2. Conforms to specified fire hazard properties.
   3. Carpet and adhesive conforms to Carpet and Rug Institute indoor air quality low chemical emission program and qualifies for the low Volatile Organic Compound (V.O.C.) "Green Label."
   4. Is recommended for heavy public traffic in corridors and [classrooms, offices and patient] rooms.
   5. Appearance Retention Rating (ARR).

1.3 MANUFACTURER QUALIFICATIONS

A. Manufacturer shall have been manufacturing commercial grade carpet for at least 25 similar successful jobs, and manufactured the carpet proposed for this job for the last 2 years.

1.4 PRE-INSTALLATION CONFERENCE

A. Arrange a Pre-Installation Conference held at the job site on the first day of carpet installation.
   1. Attendance required for:
      a. Carpet Installer Superintendent
      b. Carpet Manufacturer's Technical Representative
      c. OWNER Representative

1.5 INSTALLATION QUALITY CONTROL

A. Carpet Manufacturer's Technical Representative shall be on site to oversee and approve the initial carpet preparation and installation.

B. Carpet first 150 square feet of carpet installed and approved by the OWNER shall be the standard for the rest of the installation, including seams, bases, transition, floor preparation and adhesives.

1.6 DELIVERY, STORAGE AND HANDLING

A. Do not store carpet inside project building until "wet" materials such as paint, sealants, and adhesives have dried to acceptable emission levels.

B. Store materials in a clean, dry area and in accord with CRI.

1.7 INDOOR AIR QUALITY

A. The OWNER is concerned about indoor air quality and chemical emissions.

B. Verify building ventilation system is in proper working order. Operate building permanent ventilation system at maximum outdoor air flow before bringing carpet into building, during installation and minimum 72 hours after installation.

1.8 TEMPERATURE AND HUMIDITY REQUIREMENTS

A. Maintain building, floor, and materials at 60 to 85 degrees F. for 72 hours prior to, during and after installation. Maintain relative humidity between 20 to 65 percent.

1.9 WARRANTY

A. Provide a fully executed minimum 10 year non-prorated warranty. Provide on the carpet manufacturer's letterhead, co-signed by the installer that the carpet will conform to the following:
   1. Wear: the surface yarn in any area will not be abrasively worn or loose resiliency by more than 10 percent during the warranty period if the carpet is properly maintained.
   2. Static Protection: the carpet will give protection against static discharges in excess of 3.0 kilovolts during the warranty period.
   3. [Broadloom] Edge Ravel: the carpet will not edge ravel along seams or zipper during the warranty period.
   4. Backing adhesion: no delamination.
   5. Tuft bind: 20 pounds average per ASTM D1335.
   6. Colorfastness to Crocking: Rating of 4 minimum, wet and dry, using AATCC Gray Scale per AATCC-165.

7. Colorfastness to Light: Rating of 4 minimum, after 160 AATCC fading units using AATCC Gray Scale per AATCC-16, option E.
8. Stain Resistance: Carpet shall meet GSA requirements for permanent stain resistant carpet per AATCC 175 modified by exposing sample to 100 revolutions of the Taber Abrader then stain tested in the abraded area. Test Rate of 8.0 or better on the AATCC Red 40 Stain Scale required.
9. Exclusions for abnormal use and/or soiling will be allowed, however, any exclusions must be prefaced with a statement that the installed carpet is recommended for the intended use, i.e. corridors, offices and waiting rooms.

B. Carpeting replaced under this warranty shall include removal, labor and materials and be done at no cost the OWNER.

1.10 EXTRA MATERIALS

A. Provide 2 percent of each color - pattern installed [in full roll wide carpet], full tiles, and trim. Deliver to project location for future replacement.

B. Each piece of extra material shall be clearly labeled to identify exact style, color, manufacturer, and dimensions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers names, numbers and features are listed to establish a standard of quality. Carpet may be provided from any of the acceptable manufacturers with equivalent features and colors. A maximum of two manufacturer's color-textures will be selected.

B. Acceptable manufacturers, subject to meeting specified criteria:
1. Collins and Aikman: 800-248-2878.

C. Refer to Section 09 06 00 – Finish Colors and Textures for colors and textures that match the existing carpet products on the Campus.

2.2 CARPET TILE

A. Modular carpet tile recommended for school and office use. Basis of Design: C+A Tandus ER3 Modular Flooring. One of the manufacturer’s standard color – textures will be used.

2.3 ANTI STATIC CHARACTERISTICS

A. Carpet fibers shall have built in protection against static discharges in excess of 3.0 kilovolts (below normal human sensitivity) at 70 degree F. and 20 percent relative humidity per AATCC 134.

2.4 APPEARANCE RETENTION RATING

A. Based on a 12,000 cycle hexapod exposure test per ASTM D5252.
   1. Appearance Retention Rating (ARR) 2.5 or greater for moderate traffic use (sleeping room).
   2. ARR 3.0 or greater for heavy traffic (private offices).
   3. ARR 3.5 required for severe traffic use (conference rooms, corridors, classrooms).

2.5 EDGE TRIM

A. Base Cap:
   1. "J" shaped vinyl/rubber coved carpet base cap black color, sized as recommended to fit carpet used.
   2. Mercer Products, Roppe Corporation, VCI Plastics, or approved.

B. Edge Trim:
   1. Provide at:
      a. Carpet-to-carpet seams in doorways.
      b. Where carpet meets different type flooring.
   2. Extruded mill finish aluminum, 1-3/4 inch by 7/16 inch high to fit over carpet.
   3. Pemko 236 or approved.
   4. Countersunk head screw attach at 12 inches on center drill-in expansion type for concrete.

C. Expansion Joint Trim:
   1. Extruded clear aluminum.
   2. Pemko 236, 252 or approved to fit over carpet.
   3. 10 feet – 0 inch minimum lengths.
   4. Countersunk head screw attach at 12 inches on center.

D. Edge Trim
   1. Provide at:
      a. Carpet end without floor finish.
      b. Where carpet meets different type flooring.
   2. Extruded mill finish aluminum, 2-1/2 by 3/8 inch, tapered nose Pemko 174 or 236 or approved to fit over carpet.
   3. 10 feet – 0 inch minimum lengths.
   4. Countersunk head screw attach 12 inches on center.

E. Screws: number 10 minimum for ¾ inch minimum embedment - with drill-in expansion type for concrete.

2.6 PRIMERS, ADHESIVES, SEAM SEALERS AND FILLERS

A. Moisture resistant, waterborne non gypsum, non-flammable mildew resistant as recommended in writing by the carpet manufacturer for conditions of use, direct adhering to existing concrete or wood subfloors with low chemical emission (V.O.C.) emission conforming to Carpet & Rug Institute Green label guidelines.

B. Provide primers as recommended by adhesive and filler manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive carpeting for defects that will adversely affect the Work, and for deviations beyond allowable tolerances.
   1. Drawing dimensions are approximate: verify exact dimensions at installation site.

B. Verify subfloor is adequately dry and cured in accord with carpet manufacturers recommendations: concrete: cured 90 days minimum with 50 to 85 degree F temperature, free of oil and curing agents.

C. Moisture tests: for concrete floors on ground perform a minimum of three calcium chloride tests per ASTM F1869 or drilled Probe Tests per ASTM F2170 for verification of concrete dryness: 3 pounds moisture maximum per 1000 square foot in 24 hours. ASTM test probes: CTL Group:(800-561-3068), or equal

D. Alkalinity tests: for concrete floors perform a minimum of three alkalinity tests per ASTM F710 for verification of pH levels: 5 to 9.

E. Verify building permanent ventilation system is operating at full capacity.

F. Start of work shall mean approval of the interfacing surfaces as capable of producing an acceptable job.

3.2 REMOVAL AND REPLACEMENT OF LOOSE EQUIPMENT AND FURNITURE

A. OWNER will remove, relocate and replace existing furniture to allow carpet installation continuous underneath.

3.3 PREPARATION OF SUBFLOOR SURFACES

A. Clean subfloor to remove existing flooring, dirt, loose particles, oil, grease, curing compounds, and other foreign material detrimental to the adhesion and level laying of new carpet. Prepare subfloor in accord with flooring manfacturer recommendations and ASTM F710. Use State and Federal approved asbestos procedures.

B. Fill holes and cracks over ¼ to ½ inch wide with filler approved by carpet adhesive manufacturer. Wider crack repair will be negotiated. Allow filler to dry and prime as recommended by filler manufacturer before installing carpet.

C. Smooth substrate to acceptable flatness by grinding or filling uneven joints and rough areas up to 5/16 inch plus or minus flat to feather edge as measured with a 10-foot straight edge.

D. EDIT [Provide for 15 percent of the subgrade to require grinding and filling to maximum 5/16 inch gap as measured with a 10-foot straightedge.]

E. Vacuum or damp mop substrate clean immediately prior to carpet installation.

F. Prime substrate as recommended by carpet adhesive manufacturer.

3.4 INSTALLATION

A. Remove carpet from packaging and open to allow to relax in the installation area 24 hours per CRI.

B. Lay any patterns parallel to major space edges and in accordance with approved seam drawings. Make pile lay in same direction in every width and through unobstructed openings.

C. Extend carpet under removable flanges and equipment. Cut and fit neatly around permanent fixtures, outlets and projections.

D. Remove any adhesive that dries or films over before use.

E. Run carpet continuously over stairs, cutting out for steel strips used for metal nosing.

F. Neatly trim and remove any loose threads or tufts.

G. Completed installation shall be smooth, continuously adhered and free from wrinkles, buckles, frayed areas, visible seams or distortion.

3.5 CARPET EDGE TRIM INSTALLATION

A. Install trim over carpet edges at junctions of different type carpet or different flooring materials and where carpet edge does not abutt a vertical surface.

B. Anchor trim with expansion anchor type screws at concrete and screws into wood at 12 inches maximum. Adhesive is not acceptable.

C. Place trim over carpet joints under closed-door position where carpet meets different flooring materials at a door.

3.6 BASE INSTALLATION

A. Specified in Section 09 65 00 – Resilient Flooring.

B. Install 6-inch high carpet base of carpet matching adjacent carpet at all permanent vertical surfaces adjacent to new carpet: walls, columns and casework.

C. Adhere tightly around vertical surfaces with adhesive and finish with plastic base cap.

3.7 CLEAN UP

A. Dispose of surplus materials except cuttings over 12 inches by 6 feet to be delivered to OWNER. This is in addition to the extra material required.

B. Leave carpet and adjacent surfaces clean and free from adhesives or soil spots.

C. Vacuum carpet with a commercial, upright beater type vacuum cleaner.

D. Replace any furniture relocated to original locations.

3.8 PROTECTION

A. Prohibit traffic over carpet for 48 hours after installation, use plywood sheets if necessary to protect.

B. Do not install sheet plastic over carpet for protection, if needed use non-staining Kraft protection paper.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 01 50 00 – Temporary Facilities and Controls

B. Section 01 77 00 – Closeout Procedures

C. Section 05 52 00 – Handrails and Guardrails

D. Section 06 23 00 – Finish Carpentry and Architectural Woodwork

E. Section 06 41 16 - Laminate Faced Cabinets

F. Section 07 62 00 – Flashing and Trim

G. Section 07 92 00 – Joint Sealants

H. Section 08 11 00 - Steel Door and Window Frames

I. Section 08 14 00 – Wood Doors

J. Section 09 21 11 - Gypsum and Cement Board Assemblies

K. Mechanical– Air Distribution: Grilles

L. Electrical General Provisions: Electrical Identification

1.2 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. Publications may be referenced in the text by basic designation only. In case of conflict the most stringent apply.
   1. ASTM D16 – Standard Terminology for Paint Related Coatings, Materials, and Applications.
   2. ASTM D610 – Practice for Evaluating Degree of Rusting on Painted Steel Surfaces.
   3. ASTM D714 – Test Method for Evaluating Degree of Blistering of Paints.
   4. ASTM D 2485 – Test Methods of Evaluating Coatings for High Temperature Service.
   5. ASTM D2486 – Test Method for Scrub Resistance of Wall Paints
   6. ASTM D3359 – Standard Test Methods for Measuring Adhesion by Tape Test.

7. ASTM D4442 - Test Method for Direct Moisture Content Measurement of Wood and Wood-Base Materials
8. ASTM D4541 – Test Method for Pull-Off Strength of Coatings Using Portable Adhesion-Testers.
9. ASTM D5894 – Practice for Cyclic Salt Fog/UV Exposure of painted Metal.
10. ASTM D6677 – Standard Test Method for Evaluating Adhesion by Knife.
11. Society for Protective Coatings/Steel Structures Painting Council (SSPC) - Standards and Specifications.
12. Architectural Woodwork Institute (AWI) Quality Standard, Guide Specifications & Quality Certification Program.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.4 SUBMITTALS

A. Provide product data on all coating and finishing products. Indicating application instructions including: surface preparation, undercoating, reducing, and certification that product is “Best Line - Premium Grade”.

B. Submit a full line and spectrum of decorator deep tone colors, pastel colors, and stains from an acceptable paint manufacturer for selection of samples.

C. Submit samples 1 by 2 inch minimum size illustrating range of colors and textures available for each surface-finishing product.

D. Submit samples of selected colors representative of actual work as follows:
   1. Minimum size: 3 by 3-inches.
   2. Stain Colors: prepare on wood complete with transparent topcoat if scheduled.
   3. Approved samples shall become final criteria for evaluating color and appearance of completed work.
   4. One set of approved samples shall be kept on the job.
   5. Identify each sample as to finish, formula, color name, and number.

E. Submit manufacturer and applicator experience data with project owner phone numbers.

F. Submit V.O.C. compliance certificate.

1.5 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing paint and coating finish products with 25 jobs similar in scope to work proposed.

B. Applicator: Specializing in commercial painting and coating application with at least 10 successful jobs similar to that proposed.

C. Verify coating thickness per manufacturers' instructions using an approved dry film coating testing instrument.
   1. Make 5 separate spot measurements where directed with 3 gage readings made for each location.
   2. The average of 5 spot measurements shall not be less than the specified thickness.

D. Paint applicator shall certify the following:
   1. Immediately before painting, surfaces conformed to the specified preparation; they were in the specified condition; and were clean, dry, and free of dust, rust, and mill scale to the degree required by this Specification.
   2. Surface preparation and coating use, mixing, application, and curing were done in accordance with the current printed instructions and instructions of the coating manufacturer, and these Specifications.
   3. The products specified were used or a listing of the names of the products used and their manufacturer was submitted and approved.
   4. The products were used within the shelf-life dates, stating the shelf-life dates of each container of each product used.
   5. The manufacturer's recommended dry film thickness of coatings are on the work.
   6. Compatible paints were used where coatings are applied over previously applied coatings.

1.6 INDOOR AIR QUALITY

A. Before painting inside building coordinate with User to operate building permanent ventilation system at maximum outdoor airflow before mixing and applying paint, and for minimum 72 hours after application.

1.7 REGULATORY REQUIREMENTS

A. Conform to International Building Code (IBC) for flame, fuel, smoke-rating requirements for completed finishes.

1.8 MOCKUP

A. Before proceeding with Painting, finish one complete space or area of each color and substrate required: minimum 6x6 foot. Show selected colors, finish textures, materials, and workmanship.

B. Accepted mockup spaces or area shall serve as a standard for remainder of work.

C. Locate mockup where directed.

D. Accepted mock up area may remain as part of the Work.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 016000 – Product Requirements.

B. Store and protect products as recommended by paint manufacturer.

C. Deliver products to site in sealed and labeled containers.

D. Container labeling shall include manufacturer's name, type of paint, brand name, manufacture data, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

E. Store paint materials at ambient temperature of 45 degrees F to 90 degrees F in well ventilated area, unless required otherwise by manufacturer's instructions. Only materials to be consumed within a 24-hour work period allowed at work site.

F. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.10 TEMPERATURE AND HUMIDITY REQUIREMENTS

A. Provide continuous ventilation and heating equipment to maintain paint products and substrate dry and at ambient temperatures between 50 and 85 degrees F. for 24 hours before, during and 48 hours after application of finishes, unless permitted otherwise by coating manufacturer's recommendations.
   1. Provide temperatures by temporary scaffold enclosures and heating as necessary.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 65 percent, unless permitted otherwise by coating manufacturer's recommendations.

C. Provide lighting of 80 feet candles at work. Building lights may be used.

1.11 EXTRA MATERIALS

A. Provide a one-gallon container of each color used to OWNER for repair touch up.

B. Label each container with color, texture and building locations, in addition to the manufacturer's label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Companies meeting the “Quality Assurance” criteria and these specifications.

2.2 MATERIALS – AIR QUALITY

A. Conform to governing regulations including Federal and State requirements for pollution, safety and health. Maximum chemical pollutant emission volatile organic compounds (V.O.C.) for paints per USGBC LEED requirements.

2.3 PAINT MATERIALS

A. Provide compatible products in accordance with approved paint manufacturer including paint, varnish, stain, enamel, lacquer, fillers and related products for prime, intermediate and finish coats.

B. Accessory material not specifically indicated, but required, such as shellac, reducers, undercoats, primers, putty and the like, shall be of quality not less than required by applicable Specification Standards and recommended by the finish coat manufacturer in writing for compatibility and conditions of use.

C. Paints containing lead shall not be used.

D. All products “Best Line - PREMIUM GRADE” for professional trade sales recommended by paint manufacturer for the conditions of use.

E. Mixing
   1. Furnish ready-mixed products except as otherwise specified.
   2. Follow manufacturer’s directions for:
      a. Field-mixing of pastes and powders.
      b. Field-catalyzing components.
   3. Coatings shall have good flowing application properties, capable of drying, or curing free of streaks or sags and yielding finish specified.

2.4 DEEP TONE COLORS

A. Deep tones will be required for 20 percent of the work.

B. A maximum of 15 different shades or tints of color will be selected for use in the job.

2.5 FINISHES

A. Refer to schedule at end of specification for surface finishes.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate time and areas of work with OWNER. Allow for building occupancy during work.

3.2 EXAMINATION

A. Verify that surface and substrate conditions are ready to receive work as specified and as recommended by the paint manufacturer.

B. Examine surfaces scheduled to be coated prior to starting work. Report any conditions that may adversely affect proper application.

C. Examine DRAWINGS, SPECIFICATIONS, and field conditions to determine extent of exposed piping, ducts, conduit, electrical controls, cabinets and equipment and allow for painting as required.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Concrete Plaster and Concrete Masonry: 12 percent and minimum 45 days at 55 to 85 degrees F. curing.
   3. Concrete Floors: minimum dry condition 60 days. Conform to coating manufacturer moisture requirements.
   4. Interior Located Wood: 7 percent, measured in accordance with ASTM D4442.
   5. Exterior Located Wood: 12 percent, measured in accordance with ASTM D4442.

E. Beginning of application means acceptance of existing surfaces.

3.3 PROTECTION

A. Protect elements surrounding the work of this section from damage or disfiguration.

B. Mask and shut down heat and ventilation intakes when painting adjacent exterior surfaces.

C. Repair damage to other surfaces caused by work of this Section.

D. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

E. Protection of work when stopping for the day:
   1. Erect barriers and post warning signs. Confirm that no dust generating activities will follow shutting down for the day.

3.4 ITEMS NOT TO BE PAINTED

A. The following items shall be masked and not painted unless specifically scheduled:
   1. Items with factory finish paint, such as light fixtures, toilet partitions, factory finished wall and soffit panels, vinyl wall coverings, and acoustical ceilings.
   2. Concealed areas such as pipe chases and areas above finish ceilings.
   3. Finished surfaces such as hardware trim, anodized aluminum, glass, stainless steel, bronze and the like.
   4. Moving equipment wearing surfaces.
   5. Equipment data plates, manufacturer's permanent maintenance labels and fire door and jamb labels.

3.5 PREPARATION

A. General: Clean and prepare substrate for finish as specified and as recommended by coating manufacturer for conditions of use.

B. Coordinate with OWNER for areas which cannot use water or blast cleaning.

C. Remove or coordinate and have removed electrical plates, hardware, glazing stops, light fixture trim, and fittings prior to preparing surfaces and finishing. Replace removed items after painting.

D. Clean surfaces and correct minor defects.
   1. Remove oil-grease and mildew with solvent first (do not use paint thinner or turpentine as they leave residue).
   2. Remove dirt, dust, loose material, rust-scale, oil-grease, mildew, release agents, non-adhering paint by grit blast, pressure water blast, sand papering, grinding, scraping or wire brushing.
   3. Sand paper thick and sharp edges of shop and existing paint and runs to smooth featheredge.
   4. Lightly abrade surfaces dull to insure adhesion.
   5. Fill or sand out cracks, holes, pits and scratches, smooth to match adjacent finish.
   6. Remove sanding dust prior to painting.

E. Seal stain marks, which may bleed through subsequent, finishes.

F. Existing coating to be re-painted or finished: remove loose, blistered, scratched, weathered-corroded shop finish, scaled or crazed finish to base material surface or feather edges smooth. Where new work joins existing work, prepare existing surfaces extending to the nearest break in the plane intersecting wall, ceiling or pilaster.

G. Impervious Surfaces: Remove mildew by scrubbing with solution of T.S.P. Rinse with clean water and allow surface to dry.

H. Aluminum Surfaces Scheduled for Coating: Remove surface contamination by solvent cleaning. Remove oxidation with acid etch followed by solvent washing. Apply primer immediately following cleaning.

I. Insulated Coverings: Remove dirt, grease, and oil from cloth jacketing.

J. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high-pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

K. Gypsum Board: Surfaces shall be clean, crack-free, joints finished, textured where specified prior to painting.
   1. If surface defects appear after prime coating, repair defects.

L. Existing Gypsum Board Surfaces: Clean, then latex fill and smooth defects up to 2-inch holes flush with adjacent surface and match existing texture. Sand to feather edge. Spot prime defects after repair.

M. Galvanized Surfaces: Remove surfaces contamination and oils per SPC SP1 solvent cleaning and thoroughly rinse. Clean to remove sheen per SPC SP2, hand tool cleaning, or SP7 brush-off blast cleaning. After cleaning, and prior to painting, remove dust and similar containment's by air blast or vacuum. Apply primer immediately after cleaning.

N. Uncoated Steel and Iron Surfaces: remove grease, scale, dirt and rust per SPC SP1Solvent Cleaning. Clean per SPC SP3 power tool cleaning, or SP2 hand cleaning, or SP7 brush-off blast cleaning.

O. Shop Primed Steel Surfaces: Solvent clean per SPC SP1 followed by sanding, scraping and wire brushing per SPC SP2 hand cleaning or SP7 brush-off blast cleaning to remove loose, scratched or weathered-corroded shop finish primer weld burns and rust. Feather edges to make inconspicuous. After cleaning and prior to painting remove dust and similar containment's by air blast or vacuum.

P. Interior Wood Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

Q. Wood to Receive Stain or Transparent Finish: Remove dust, grit, and foreign matter. Apply stain to ends and edges prior to installation.

R. Doors Scheduled for Painting: Paint top and bottom edges with paint after door fitting.

S. Wood Doors Scheduled for Transparent Finish: Seal top and bottom edges with clear varnish or lacquer after door fitting.

3.6 EXISTING PREVIOUSLY COATED SURFACES

A. After preparation as specified check for paint compatibility by applying a 2 to 3 square foot test patch of the proposed coating systems over existing sound coating. Allow to dry 7 days and test adhesion per ASTM D6677, ASTM D4541 or ASTM D3359. If adhesion fails different coating, or complete removal of existing coating, is required.

3.7 APPLICATION

A. Apply coatings to all visible exposed surfaces scheduled in accordance with approved coating manufacturer's instructions and approved submittals for the conditions of use.

B. Do not apply finishes to surfaces that are not clean, dull, and dry.

C. Apply each coat to uniform finish.

D. Sand or abrade lightly and clean between coats to achieve adhesion if recommended by coating manufacturer.

E. Allow applied coat to dry before next coat is applied.

F. Where clear finishes are required tint fillers to match wood. Work fillers and stains into the grain before set. Wipe excess from surface.

G. Change colors or finishes at corners and joints.

H. Apply materials so that the following results are obtained.
   1. Smooth uniform appearance, underlying paint edges feathered, free of brush marks, uneven orange peel, sags, runs or foreign matter.
   2. Complete coverage without skips or streaks and without heavy build-up in details.
   3. Close match with approved color.
   4. Sharp edges at adjoining materials or at color changes.
   5. Work stain finishes thoroughly into wood by brushing or rolling.

I. Inspection of Coats: Do not apply additional coats until each completed coat has been inspected by the ARCHITECT/CONTRACTING OFFICER.

1. Only inspected and approved coats of paint shall be considered in determining number of coats applied.
2. Refinish entire surface if coat is not acceptable.

3.8 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed items.

B. Remove unfinished louvers, grilles, covers, steel glazing stops, access panels, and other loose components and paint separately.

C. Clean, prime and paint exposed mechanical and electrical work including: pipes, pipe insulation, conduit, boxes, ducts, hangers, brackets, collars and supports.

D. Protect and retain legibility of data plates and identification markings on mechanical and electrical equipment by masking.

E. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles and convector and baseboard cabinets to match face panels.

F. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.9 CLEANING

A. As Work proceeds, promptly remove excess paint products where spilled, splashed or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Remove waste, cloths, and material, which may constitute fire or V.O.C. hazard daily from site.

D. Leave surfaces not required to be finished under this section undamaged and clean and free of paint products from work of this Section.

3.10 COATING SCHEDULE

A. General:
1. For the purposes of this schedule each coat shall be at least dry to the touch before proceeding with the following coat.
2. Coating materials shall be recommended by manufacturer for condition of use and compatible with undercoats.

3. Minimum number of coats is scheduled. Apply additional finish coats as necessary to provide uniform appearing coverage.
4. Refer also to DRAWINGS and Finish Schedule.
5. Sherwin Williams products are referenced. Other manufacturers having similar specifications meeting Quality Assurance specifications may be used.

B. Exterior Coating Schedule:
   1. Steel – Unprimed Bare Steel and Aluminum powder coated. Coating recommended by Powder manufacturer for exterior substrate. Architectural Manufacturer's Association (AAMA)) 2604-02:
      a. Salt spray resistance: 3000 hours:1-2mm creep, blisters size no. 8.
      b. Color retention: Delta EL5.
      c. Chalk resistance: No. 8 maximum.
      d. Gloss resistance: 30 percent maximum.
      e. Two coats acrylic enamel zero Voc DTM rust inhibitive: Sherwin Williams, "O VOC Acrylic".
      f. [Contractor OPTION]: One coat top coat compatible rust inhibiting alkyd resin primer, Sherwin Williams "Kromik". Two coats acrylic corrosion resistant enamel semi-gloss sheen, Sherwin Willams "DTM B66".
   2. Steel-Shop Primed: reprime completely unless shop primer is acceptable for producing finish coat without priming.
      a. One coat top coat compatible rust resisting alkyd resin primer, Sherwin Williams "B50". Two coats acrylic corrosion resistant enamel, semi-gloss, Sherwin Williams "DTM B66".
   3. Steel-Galvanized:
      a. First coat: two component epoxy primer 5 mil to 10 mil thick, Sherwin Williams "Galvite B50", or approved.
      b. Second coat: two part semi-gloss polyurethane 6 to 7 dry mil thick, Sherwin Williams "Fast Clad", or approved.
      c. [Contractor OPTION]: One top coat compatible rust inhibiting acrylic emulsion primer. Two coats acrylic corrosion resistant enamel, satin sheen Sherwin Williams "Duration"
   4. Aluminum:
      a. One coat zinc wash primer.
      b. Two coats aliphatic urethane enamel, semi-gloss sheen.
      c. [Contractor OPTION]: One coat top coat compatible rust inhibiting acrylic emulsion primer. Two coats acrylic corrosion resistant enamel, satin sheen Sherwin Williams "Duration".
   5. Steel Galvanized: Repair abrasions and field welds:
      a. Two coats zinc rich primer per SSPC Paint 20: 2RC "Galvilite" or approved.

C. Interior Coating Schedule
   1. Structure ceiling joists, beams and deck:
      a. First Coat: waterborne acrylic dry fall 3 to 4.5 dry mils thick, white

color egg-shell, Sherwin Williams “B42 W0002”, or approved. Any factory painted decking shall be dulled by wire brushing or brush off blasting and welds and abrasions spot-primed.

b. Finish Second Coat: same as first coat.

2. Exposed Wood MDF and MDO- Painted
   a. One coat latex primer sealer top coat compatible: Sherwin Williams, B51, ProBlock”.
   b. 2 coats water-based 2 component catalized epoxy satin sheen Sherwin Williams “Pro Industrial K45” Series enamel, or approved equal.
3. Wood - Transparent equal to AWI Lacquer Systems Custom Grade:
   a. One coat stain.
   b. Filler coat (open grain wood only).
   c. One coat sealer.
   d. 2 top coats lacquer or catalyzed lacquer medium satin sheen. (Match adjacent shop finished wood).
4. Steel and Aluminum – Bare Unprimed and galvanized - dry use
   a. One coat top coat compatible rust-inhibiting acrylic latex primer: Sherwin Williams “ProCryl” B66.
   b. 2 coats acrylic latex enamel, satin sheen: Sherwin Williams “B70”.
5. Steel Doors and Frames – Shop Primed: re-prime completely unless shop primer is acceptable for finish coat without priming. Previously painted steel in sound condition without loose or cracked paint does not require primer.
   a. One coat top coat compatible rust-resisting industrial acrylic latex primer: Sherwin Williams “ProCryl” B66”.
   b. 2 coats Sherwin Williams “DTM” semi-gloss B66 series.
6. Plaster, Gypsum Board
   a. First coat latex sealer primer surface: Sherwin Williams “Progreen 200”, or approved.”
   b. 2 coats washable acrylic latex enamel, low eggshell sheen on walls, flat on ceilings, Sherwin Williams “Progreen 200”, B20W651, or approved.”, or 2 coats washable acrylic latex enamel semi-gloss sheen on trim: Sherwin Williams “B31”.
7. Insulated Coverings - Cloth
   a. One coat alkyd primer sealer.
   b. 2 coats acrylic latex enamel, satin sheen.

3.11 COLOR SCHEDULE

A. Unless otherwise specified, refer to the Finish Schedules and Drawings. Match adjacent surface color for the following:
   1. Access doors, registers, radiation unit covers, exposed piping, electrical conduit, and mechanical/electrical panels.
   2. Exterior wall and roof mounted pipes, ducts, conduits, flues and flashing.

B. Exterior and interior windows and doors, their framing and trim: different color from adjacent walls.

C. Paint surfaces visible behind vents, louvers, grilles and reveals in public areas: flat black.

D. Ceilings shall be painted a different color than walls.

E. Doors generally all the same color with a different color than frames.

END OF SECTION

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SECTION 10 11 10
MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Special mounting embedments, blockouts, or other items to be incorporated into the adjacent structure as necessary.

1.2 SUBMITTALS

A. Manufacturer's product literature describing finish and color selections, dimensions, materials, fasteners, anchorage installation instructions and typical details maintenance and location in completed work.

1.3 SAMPLES

A. Submit two samples 6 by 6 inch in size illustrating finish, color and texture of chalkboard, markerboard and tackboard.

PART 2 - PRODUCTS

2.1 MARKERBOARDS AND TACKBOARDS

A. Frames: Extruded aluminum 4 feet high full surround with screw clip hangers. Markerboards with full length upper aluminum framed maptack strip and full length lower marker tray. Face joints shall be flush. Manufacturers standard natural aluminum color finish.
   1. Provide for each board: metal clip anchors top and bottom for each 2 lineal feet of board, 1 flag holder (per room).
   2. Where indicated on DRAWINGS, provide aluminum track and horizontal sliding panels with nylon top and bottom rollers.
   3. Where indicated on DRAWINGS, provide vertical sliding panels with counter balanced steel/cable suspended where indicated on DRAWINGS.
   4. Where indicated on DRAWINGS, provide modular backs that can be mounted at various heights on aluminum wall tracks. Tracks slotted to receive modular board attachment

B. Tackboard: 1/4 inch thick cork covered by textured nylon "Hook-Fab" fabric, which accepts pins and hook tape, over 7/16 inch minimum thick particle board in single pieces up to 4 feet long, Class A fire rating per ASTM E84; color: manufacturer's standard color as selected; overall lengths as indicated.

C. Markerboard: 24 gage, non-porous erasable porcelain enamel coated

steel magnetic face over 7/16 inch minimum thick particle board or medium density fiberboard (MDF) with sheet aluminum backing in single pieces up to 8 feet long. Color: semi-gloss white. Overall lengths as indicated on DRAWINGS. Any joints butted with steel splines.

D. Acceptable Manufacturers: subject to specified criteria:
   1. Claridge Products and Equipment Inc., (870) 743-2200.
   2. Lemco (801) 262-2596.
   3. Greensteel/IDT (800) 245-6835
   4. Nelson Adams (909) 340-2800.
   5. Poly Vision Steelcase Corp (800) 679-6226

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and Drawing details to receive the work for defects that will adversely affect the work and for deviations beyond allowable tolerances.

B. Start of work shall mean acceptance of interfacing surfaces as capable of producing an acceptable job.

3.2 INSTALLATION

A. General: Installation of specialties shall be as recommended by the manufacturer for the conditions of use: complete and ready to use, with all necessary attachments, adapters, and accessories and in accord with approved submittals.
   1. Coordinate with interfacing and related trades as necessary.
   2. Mount specialties rigidly and permanently into solid backing unless specifically indicated otherwise by manufacturer.

3.3 CLEAN UP

A. Leave boards and adjacent areas clean, free from stains and surplus materials resulting from installation.

3.4 SCHEDULE

A. Install boards scheduled at building locations directed.
   1. Two: 4 feet high by 8 feet long markerboards.
   2. Two: 4 feet high by 4 feet long markerboards.
   3. Four: 4 feet high by 4 feet long tackboards.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this Specification. The publications may be referred to in the text by basic designation only. In case of conflict only the most stringent apply:
   1. Americans with Disabilities Act (ADA) - Accessibility Guidelines For Buildings and Facilities (ADAAG.)
      a. IBC 1110.
      b. ANSI A117.1 Chapter 7.

1.2 PERFORMANCE REQUIREMENTS

A. DRAWINGS are in part diagrammatic to allow for manufacturer standard details.

B. Size connections, piers, and pipes between sign body and building structure to withstand gravity and seismic loads in accord with International Building Code (IBC) with importance factor of 1.0.

1.3 SUBMITTALS

A. Manufacturer's product literature illustrating letter styles, finish and color selections, dimensions, materials, and attachment.

B. Shop drawings indicating sign lettering, message and location.

C. Sample sign of each type; if approved, samples maybe used in work.

D. Method of Suspension connection to structure certified by signature and seal of a professional civil (structural) engineer registered in the State of Alaska that signs meet Performance Requirements.
   1. Contractor shall submit structural seismic support calculations and shop drawings to Municipality of Anchorage (MOA) Building Department as an IBC deferred Submittal for a Building Permit.

PART 2 - PRODUCTS

2.1 LETTER AND NUMBER PROPORTION

A. Character Width: Upper case “O” 55 percent minimum and 110 percent maximum of uppercase “I” height.

B. Spacing: 1/8 inch minimum.

C. Separation from edge of sign: 3/8 inch minimum.

2.2 FINISH AND CONTRAST

A. Characters and background: eggshell, matte, or other non-glare finish.

B. Refer to Part 3 for sample signs currently installed at the KPC Campus

2.3 SYMBOLS OF ACCESSIBILITY

A. Pictogram symbols of accessibility, telephone, and assistive listening shall be in accord with ANSI A117.1.7.

2.4 LAYOUTS AND MESSAGES

A. As indicated on SCHEDULE and DRAWINGS. Verify with shop drawing approval before fabricating and installing.

2.5 ACCESSIBLE TOILET AND EXIT SIGNS

A. Letters, numbers and messages 1/32 inch raised tactile upper case, sans serif type accompanied by Grade 2 Braille below the text in accord with ADAAG.

B. Size:
   1. Character: 5/8 inch high minimum 2 inches high maximum, in accord with ANSI A117.1.7 2003.
   2. Pictogram: 6 inches minimum high.

2.6 SIGN FABRICATION

A. Straight parallel edges: ¼-inch in 10 feet. Smooth flush tight joints: 1/32 plus or minus without sharp edges. Countersunk head screws where exposed.

B. Room Signs
   1. 1/8-inch minimum thick sheet metal with enamel paint finish or plastic integral color back plate without sharp edges or warp. Radius corners 1/4 inch minimum.
   2. Flat against wall without raised borders for wall mount signs. Screw attach with vandal resistant screws.
   3. Construct ADA raised tactile message signs with one of the following methods. The same technique and materials shall be used throughout.
      a. Precisely cut plastic characters and images chemically fused to a plastic backplate.

b. Photo chemically etched metal.
c. Reversed engraved plastic to provide raised characters resulting in integral back.
d. Glued-on raised letters not acceptable.

2.7 ANCHORAGE ACCESSORIES

A. Provide necessary vandal resistant screws, double back adhesive tape, adhesive, anchor bolts, clamps, cover plates, trim and hangers suitable for substrate.

B. Exposed hardware shall match adjacent color of sign frame. Exposed fasteners shall be stainless steel or aluminum vandal resistant “Torx” with button or countersink heads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and Drawing details to receive work for defects that will adversely affect the work and for deviations beyond allowable tolerances.

B. Start of work shall mean acceptance of interfacing surfaces as capable of producing an acceptable job.

3.2 INSTALLATION

A. General: Installation of signs shall be as recommended by the manufacturer, approved submittals and as indicated on DRAWINGS.

B. Install signs flat, without distorting waves or buckles using concealed fasteners were possible. Exposed fasteners shall be countersunk, matching adjacent finishes.

C. Anchor suspended signs to overhead structure or structure columns in accord with approved engineer design.

3.3 WALL SIGN INSTALLATION

A. Install on wall adjacent to latch side of door, where there is no wall space at the latch side of the door, including double leaf doors, place sign on nearest adjacent wall. Mount so that a person may approach within 18 inches of sign without encountering protruding objects, or standing within swing of a door.

B. Install between 48 and 60 inches above finish floor to baseline of lowest character.

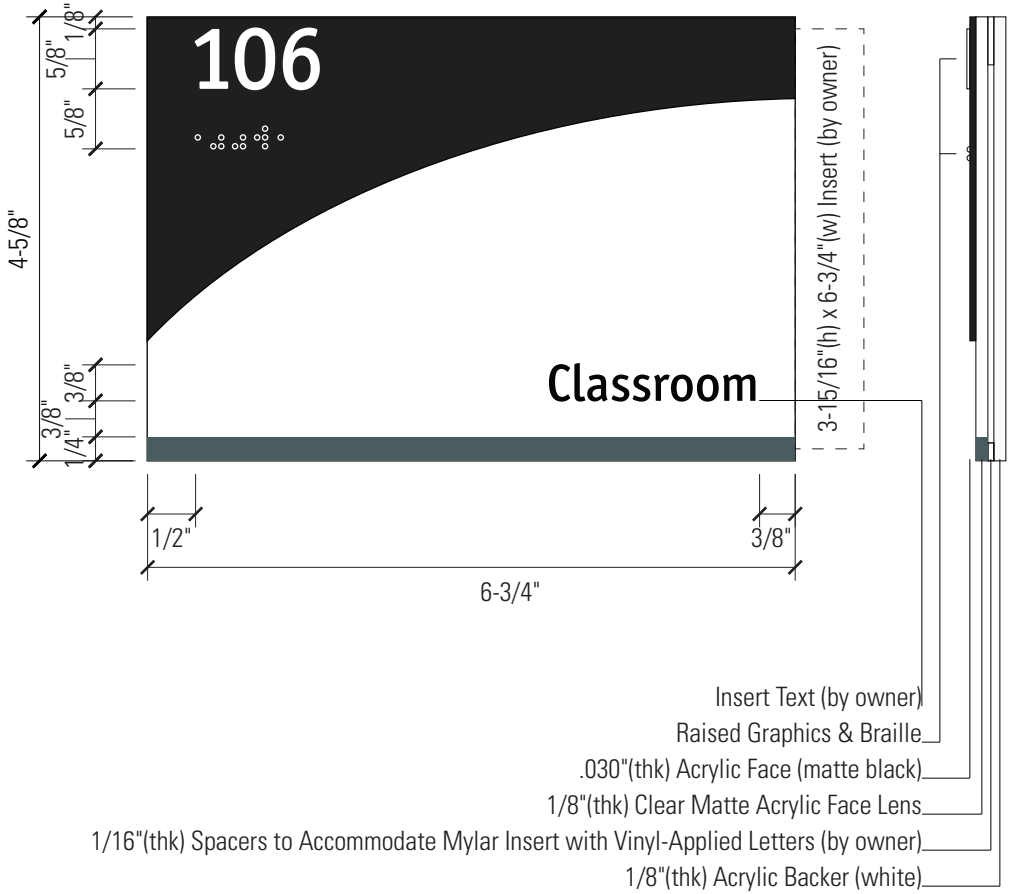
3.4 SCHEDULE OF SIGNS

A. Install signs scheduled and indicated on the DRAWINGS at building locations directed. Verify messages and numbers with OWNER before fabrication.

B. Provide room wall signs of quantity in Room Finish Schedule. Allow space for at least 25-letter room name and 3-digit room number.

C. Room Signs with ADAAG Pictograms: in addition to typical room sign requirements.
   1. At each accessible toilet Room: i.e. “Men's Toilet” and “Women's Toilet".
   2. At each Office and Room in the Ward Level 2 Office Suite.

END OF SECTION



Specifications

Construction: ADA-Type Window Sign Plaque with Raised Copy and Corresponding Braille
Materials: See Call-Outs
Size: 4-5/8"(h) x 6-3/4"(w)
Face Color: Matte Black
Backer Color: White
ADA Copy Color: White
Accent Bar: Subsurface SW 6223 Stillwater
Typestyle: Officina Sans Medium
Braille: Grade II
Mounting: 3M #4910 VHB Tape

Specifications

Construction: ADA-Type Plaque with Raised Copy and Corresponding Braille
Materials: See Call-Outs
Size: 11"(h) x 7-3/4"(w)
Face Color: Matte Black
Backer Color: Metallic Silver (PMS 877c)
ADA Copy Color: White
Typestyle: Officina Sans Medium
Braille: Grade II
Mounting: 3M #4910 VHB Tape

SECTION 10 44 10
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 PRODUCTS FURNISHED BUT NOT INSTALLED IN THIS SECTION

A. Mounting embedments, anchorage, block outs, or other items to be incorporated into the adjacent structure.

B. Provide minimum 16 gage by 6-inch sheet steel mounting across 3 studs behind gypsum board.

1.2 RELATED SECTIONS

A. Section 09 21 11 - Gypsum and Cement Board Assemblies

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this Specification. Publications may be referenced in the text by basic designation only. In case of conflict only the most stringent shall govern:
   1. Underwriters Laboratories Inc. (U.L.) listing and " Building Materials Directory".
   2. National Fire Protection Association (NFPA) 10 - Standard Portable Fire Extinguishers.
   3. NFPA 14 – Installation of Standpipe, Private Hydrants and Hose Systems.
   4. International Fire Code (IFC) 906
   5. International Building Code (IBC) 11: ANSI A117.1

1.4 SUBMITTALS

A. Submit dimensions, operational features, materials, finishes, fasteners, anchorage installation instructions, typical details and location in completed work.

B. Submit operations and maintenance data including refilling and recertification.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Protect extinguishers from freezing.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. U.L. Labeled dry chemical 2A-10BC (11 pound overall weight) [3A-40BC] (12 pound) rechargeable type.
   1. Pressure gage
   2. Stainless steel or aluminum nozzle and trigger control.

B. Extinguishers shall be fully charged.

2.2 WALL SIGN

A. Wall mount angle shaped two-faced .060 inch plastic “glo-brite” white and red color with “Fire Extinguisher” message 12-inch high x 6-inch wide: www.emedco.com

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine DRAWING details and verify field conditions for defects that will adversely affect the completed work and for deviations beyond allowable tolerances.

B. Verify rough openings for cabinet are correctly sized and located.

C. Beginning installation shall mean acceptance of the interfacing surfaces as capable of producing an acceptable job.

3.2 INSTALLATION

A. General: Installation shall be as recommended by the manufacturer and approved submittal for the conditions of use: complete and ready to use, with all necessary attachments, adaptors, and accessories.
   1. Coordinate with interfacing and related trades as necessary. Gypsum board shall run continuously behind cabinet wall recess for wall fire and sound resistance.
   2. Mount rigidly and permanently into solid backing.
   3. Seal continuously between cabinet and adjacent wall with Sealant per Section 07 92 00 – Joint Sealants.

B. Anchorage: Standard commercial threaded, or expansion anchors recommended for intended use by their manufacturer's literature indicating lateral (shear) and pullout (tension) data for approval.
   1. Minimum anchor diameter: 0.25 inch.

2. Each anchor shall be capable of developing at least 200 pound lateral load and 200 pound pullout load.

C. Semi-recessed cabinets: Mount operating handle of extinguisher maximum 48 inches above floor as approved by local fire authority and ADAAG.
   1. Surface mount cabinets and extinguishers not in cabinets: 27 inches to bottom from floor

D. Mount extinguishers not in cabinets onto hook into solid backing in wall.

3.3 CLEAN UP

A. Leave extinguisher, cabinet, and adjacent areas clean and free from stains or surplus materials resulting from installation.

3.4 SCHEDULE

A. Typical Installation: Extinguisher in cabinet at locations indicated and a minimum of the following:
   1. Provide one extinguisher for every 1500 square feet, 75 lineal feet of travel distance per IFC 906, and a minimum of one extinguisher at every exit and exterior door on each floor.

END OF SECTION

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SECTION 12 21 13
WINDOW BLINDS

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 09 21 11 - Gypsum and Cement Board Assemblies

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Backing to be built into the surrounding construction for secure anchorage.

B. Coordinate and provide placement location of solid backing at blind mounting locations.

1.3 SYSTEM DESCRIPTION

A. “Top-Down/Bottom-Up” manually operated pleated fabric shades installed at window openings listed in Part 3 – Schedule; manual control of raising and lowering by cord.

1.4 SUBMITTALS

A. Manufacturer’s description data, maintenance recommendations, list of room location openings with dimensions

B. Submit color samples for fabric illustrating complete range of manufacturer’s standard colors for selection.

1.5 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing window blinds with at least 50 successful jobs of similar size complete.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to specified criteria:
   1. Levelor Lorentzen Inc.
   2. Marathon Carey-McFall Company.
   3. Hunter Douglas, Inc.
   4. Or Equal manufacturers.

2.2 MATERIALS

A. Top-Down-Bottom-up Shades: One inch wide pleated fabric shades; high-performance hardware system with cordlock.

B. Head/Sill Rail Housing: Prefinished, formed metal box internally fitted with hardware, pulleys and bearings for dual operations. Finish color same as blind slats.

C. Cord: Braided nylon or polypropylene, continuous loop.

D. Anchorage and Accessory Hardware: Type recommended by blind manufacturer for screw attachment.

E. Finish and Color: Manufacturer's standard finish and colors. One color shall be used throughout.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Do not commence fabrication until field measurements are confirmed.

C. Ensure structural supports are correctly placed.

D. Beginning of installation means installer accepts existing surfaces as capable of producing an acceptable job.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions for condition of use to cover glass surfaces.

B. Mount inside glazed opening. Secure in place with screws penetrating window frames or 3/4-inch into solid backing.
   1. Provide two inch minimum space between blinds and glass surface.

C. Adjust blinds for smooth, full height operation.

3.3 TOLERANCES

A. Maximum gap around window opening: ¼-inch

B. Maximum Variation of Gap at Window Opening Perimeter: 1/8-inch.

C. Maximum Offset From Level: 1/8 inch.

3.4 SCHEDULE

A. All exterior windows.

END OF SECTION

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

B. Related Sections:
   1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. National Fire Protection Association:
   1. NFPA 99 - Standard for Health Care Facilities.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

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

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Craftmark Identification Systems.
   2. Safety Sign Co.
   3. Seton Identification Products.
   4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:
   1. Manufacturers:
      a. Craftmark Identification Systems.
      b. Safety Sign Co.
      c. Seton Identification Products.
      d. Substitutions: Division 01 - Product Requirements.
   2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:
   1. Manufacturers:
      a. Craftmark Identification Systems.
      b. Safety Sign Co.
      c. Seton Identification Products.

d. Substitutions: Division 01 - Product Requirements.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors and lettering size are conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.

c. Seton Identification Products.
d. Substitutions: Division 01 - Product Requirements.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
3. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:
   1. Plumbing valves: Green.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Division 09.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters and pumps with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers or stenciled painting. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE

A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

1.2 WORK INCLUDED

A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.

B. Division 01 of the specifications is to be specifically included as well as all related drawings.

1.3 RELATED WORK

A. Related Work Specified Elsewhere:
   1. Electrical Specifications: Division 26
   2. Motors and Connections: Division 26
   3. Starters and Disconnects: Division 26

B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric-pneumatic and pneumatic electric switches, electrical components, wiring and any other miscellaneous Division 23 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.

C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

1.4 REFERENCED CODES - LATEST ADOPTED EDITION

A. NFPA 13 Installation of Sprinkler Systems

B. NFPA 70 National Electrical Code (NEC)

C. IMC International Mechanical Code

D. UPC Uniform Plumbing Code

E. IFC International Fire Code

F. IFGC International Fuel Gas Code

G. IBC International Building Code

1.5 SUMMARY

A. Section Includes:
   1. Vibration and seismic controls for plumbing piping and equipment.
   2. Pipe and valve markers for plumbing systems.
   3. Nameplates for plumbing equipment.
   4. Sleeves for interior floor and wall pipe penetrations.

1.6 SUBMITTALS

A. See General Conditions and the General Requirements in Division 01 regarding submittals.

B. Submit by specification section complete and all at one time; partial submittals will not be considered. Submittals shall be in booklet form. The data shall be arranged and indexed under basic categories. A typewritten index shall be included with dividers and identifying tabs between sections and references to sections of specifications.

C. Catalog sheets shall be complete and the item or model to be used shall be *clearly marked*, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.

D. *Only submit* on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

1.7 PROJECT RECORD DRAWINGS

A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building.

B. Show the location of all valves and their appropriate tag identification.

C. At completion of project, deliver these drawings to the owner and obtain a written receipt.

1.8 HANDLING

A. See General Conditions and the General Requirements in Division 01 regarding material handling.

B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

1.9 SUBSTITUTIONS

A. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The owner shall be the final authority regarding acceptability of substitutes.

1.10 DIMENSIONS

A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.

B. Any differences, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

1.11 MANUFACTURER'S DIRECTIONS

A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise in the plans. Advise the owner of any such conflicts before installation.

1.12 PERMITS, FEES, ETC

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.13 TESTING

A. The Contractor under each section shall, at his own expenses, perform the various tests as specified and required by the owner and as required by

applicable code, the State, and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests

1.14 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.

B. Where a material is described in detail, listed by catalog number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.

C. The use of the word "shall" conveys a mandatory condition to the contract.

D. "This section" refers to the section in which the statement occurs.

E. "The project" includes all work in progress during the construction period.

F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

1.15 SCHEDULE OF WORK

A. The work must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The owner will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process his work so as to ensure the proper execution of it.

1.16 COOPERATION AND CLEANING UP

A. The contractor for the work under each section of the specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the owner, clear any designated areas or area of materials and debris. On completion of any

portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

1.17 GUARANTEE

A. Unless a longer guarantee is hereinafter called for, all work, materials and equipment items shall be guaranteed for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect, shall be repaired and/or replaced to the complete satisfaction of the Architect. Guarantee shall be in accordance with Division 01.

1.18 COMPLETION REQUIREMENTS

A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
   1. Accurate project record drawings, shown in red ink on blueline prints, showing all changes from the original plans made during installation of the work.
   2. All manufacturers' guarantees.
   3. Warranties.
   4. Operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.

B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

2.2 RESTRICTED MATERIALS

A. No materials containing asbestos in any form shall be allowed. Where materials or equipment provided by this Contractor are found to contain asbestos, such items shall be removed and replaced with non-asbestos items. Entire cost of asbestos removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those asbestos containing items installed by the Contractor.

B. No solder or flux containing lead shall be used on this project.

2.3 ELECTRICAL MOTORS

A. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than + 10% of rated voltage. Motors for pumps and fans shall be selected to be non-overloading.

B. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.

C. Size motors for 1.15 service factor and not to exceed 40º C temperature rise above ambient.

D. Fractional horsepower motors to have self-resetting thermal overload switch.

E. Provide Premium Efficiency, motors for all three phase motors one horsepower and larger. Standard efficiency motors will not be acceptable.

2.4 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated plastic with engraved letters.

B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.5 SLEEVES

A. Refer to Section 22 05 29 for sleeve requirements.

2.6 FORMED STEEL CHANNEL

A. Refer to Section 22 05 29 for formed steel channel requirements.

PART 3 - EXECUTION

3.1 DRAWINGS

A. The mechanical drawings are generally diagrammatic. Complete details of the building, which affect the mechanical installation, may not be shown. For additional details, see Architectural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

3.2 INSTALLATION

A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the NFPA, IMC, IFC, UPC, IFGC and IBC Standards; all local and state amendments to all codes and standards.

B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.

C. Compliance with codes and ordinances shall be at the Contractor's expense.

3.3 MEASUREMENTS

A. Verify all measurements on the job site.

B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.

C. Check all piping, ducts, etc. to clear openings.

D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with ADA Guidelines.

3.4 OPERATING INSTRUCTIONS

A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Mechanical Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.

B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of four hours of onsite instruction to the owner designated personnel.

3.5 OPERATION AND MAINTENANCE MANUALS

A. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor. Submit prior to substantial completion.

B. The operation and maintenance manuals shall be bound in a loose leaf three ring binder with reinforced holes in the sheets so as to prevent lost pages. The manual shall contain, but not limited to, the following types of information:
   1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
   2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
   3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
   4. Identification numbers of all parts and nearest sources for obtaining parts and services.
   5. A copy of valve schedule and reduced scale drawings showing valve locations.
   6. Written summary of instructions to Owner.

C. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

3.6 CUTTING, FITTING, PATCHING AND FINISH

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for piping.

C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.7 PAINTING

A. Perform all of the following painting in accordance with provisions of Division 9 with colors as selected by the Architect. Provide the following items as a part of mechanical work:
   1. Factory applied prime and finish coats on mechanical equipment.
   2. Factory applied prime coat on access doors.
   3. Pipe identification where specified.

B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

3.8 INSTALLATION OF EQUIPMENT

A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.

B. Maintain manufacturer’s recommended minimum clearances for access and maintenance.

C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.

D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.

E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all apparatus furnished under this Contract.

F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, water hammer arrestors, trap primers, and controls, etc.

3.9 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

A. Install plastic nameplates with adhesive.

B. Install plastic tags with corrosion resistant metal chain.

END OF SECTION

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SECTION 22 05 03
PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Domestic water piping within 5 feet of building.
   2. Storm water piping within 5 feet of building.
   3. Equipment drains and over flows.
   4. Unions and flanges.

1.2 RELATED SECTIONS

A. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.

B. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.

C. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.

D. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.

E. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.

F. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Gray Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B31.9 - Building Services Piping.
   6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
3. ASTM B32 - Standard Specification for Solder Metal.
4. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
5. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
6. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
8. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
9. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
11. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
12. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
13. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
14. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
15. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
16. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

D. American Water Works Association:
1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

E. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

C. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.6 QUALIFICATIONS

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

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe: AWWA C151.
   1. Fittings: AWWA C110, ductile iron, standard thickness.
   2. Joints: AWWA C111, rubber gasket with rods.

B. Copper Tubing: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

B. PEX Tubing: Tubing shall be cross-linked high-density polyethylene. Tubing shall be produced using silane method of cross-linking and shall meet the dimension and performance specifications of ASTM F876/F877 and CSA B137.5. Tubing shall also comply with ANSI/NSF 61 as suitable for use with potable water. Temperature and pressure ratings shall be 160 psi at 73 degrees F, 100 psi at 180 degrees F, and 80 psi at 200 degrees F.
   1. PEX tubing is approved for use for piping in concealed locations only.

2.3 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74, service weight, bell and spigot ends.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight, bell and spigot ends.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, neoprene gasket system or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, Neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.
   1. Fittings: ABS.
   2. Joints: ASTM D2235, solvent weld.

D. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
   1. Fittings: PVC, ASTM D2665 or ASTM D3034.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.5 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized.
   1. Fittings: ASME B16.3, malleable iron or ASME B16.4, cast iron.
   2. Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

B. Copper Tubing: ASTM B88, Type L drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

C. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, polyvinyl chloride (PVC) material.
   1. Fittings: ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

D. ABS Pipe: ASTM D2680 or ASTM D2751, Acrylonitrile-Butadiene-Styrene (ABS) material.
   1. Fittings: ABS, ASTM D2751.
   2. Joints: ASTM D2235, solvent weld.

2.6 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
   4. PVC Piping: PVC.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. PVC Piping: PVC flanges.
   4. CPVC Piping: CPVC flanges.
   5. Gaskets: 1/16 inch thick preformed neoprene gaskets.

C. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464, Schedule 80, threaded, PVC pipe.

D. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01- Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Establish elevations of buried piping with not less than five ft of cover.

C. Establish minimum separation from sanitary sewer piping in accordance with code.

D. Excavate pipe trench in accordance with Division 31.

E. Install pipe to maintain head room, to conserve building space, and not to interfere with use of space.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install shutoff and drain valves at locations indicated on Drawings in accordance with Section 22 05 23.

J. Install plastic ribbon tape continuous over top of pipe buried 6 inches below finish grade, above pipe line; coordinate with Division 31.

K. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 22 05 29.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 21 05 16.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum, and 1/8 inch per foot if 4" or over, minimum. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 22 05 23.

N. Install piping specialties in accordance with Section 23 21 16.

O. Insulate piping. Refer to Section 22 07 00.

P. Install pipe identification in accordance with Section 22 05 53.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

A. Install domestic water piping system in accordance with ASME B31.9.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install bell and spigot pipe with bell end upstream.

C. Support cast iron drainage piping at every joint.

3.7 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

A. Install storm drainage piping systems piping in accordance with ASME B31.9.

B. Install bell and spigot pipe with bell end upstream.

C. Support cast iron drainage piping at every joint.

3.8 INSTALLATION - COMPRESSED AIR PIPING SYSTEMS

A. Install compressed air piping systems piping in accordance with ASME B31.9.

B. Install drip connections with valves at low points of piping system.

C. Install take-off to outlets from top of main, with shut off valve after take-off. Slope take-off piping to outlets.

D. Install compressed air couplings, female quick connectors, and pressure gages where outlets are indicated as indicated on Drawings.

E. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.

F. Cut pipe and tubing accurately and install without springing or forcing.

G. Slope piping in direction of flow.

H. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

3.9 FIELD QUALITY CONTROL

A. Section Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with applicable code.

C. Test sanitary waste and vent piping system in accordance with applicable code.

D. Test storm drainage piping system in accordance with applicable code.

E. Test for Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9.

3.10 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and disinfect domestic water distribution system in accordance with Division 33.

END OF SECTION

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SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Butterfly valves.
   3. Check valves.

1.2 RELATED WORK

A. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.

B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.

C. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.

1.3 REFERENCES

A. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

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

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

A. For drinking water service, provide valves complying with NSF 61.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

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

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.

PART 2 - PRODUCTS

2.1 BALL VALVES

A. Manufacturers:
   1. Crane Valve, North America.
   2. Hammond Valve.
   3. Milwaukee Valve Company.

4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Substitutions: Division 01 - Product Requirements.

B. 2 inches and Smaller: MSS SP 110, bronze, two piece body, chrome plated ball, full port, teflon seats, blow-out proof stem, solder or threaded ends with union, and lever handle.

C. Over 2 Inches: Cast steel, two piece body, full port chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged. Seat material to be compatible with liquid handled.

2.2 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. Crane Valve, North America.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO, Inc.
e. Stockham Valves & Fittings.
f. Substitutions: Division 01 - Product Requirements.

B. Up to 2 Inches: Bronze swing disc, solder or screwed ends.

C. Over 2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends.

2.3 SPRING LOADED CHECK VALVES

A. Iron body, bronze trim, spring loaded, renewable composition disc, screwed, wafer, or flanged ends.

2.4 BUTTERFLY VALVES

A. Manufacturers:
1. Crane Valve, North America.
2. Hammond Valve.
3. Milwaukee Valve Company.
4. NIBCO, Inc.
5. Stockham Valves & Fittings.
6. Substitutions: Division 01 - Product Requirements

B. 2-1/2 inches and Larger: MSS SP 67
1. Body: Cast or ductile iron, wafer or lug ends, stainless steel stem, extended neck.
2. Disc: Aluminum bronze
3. Seat: Resilient replaceable seat suitable for service.

4. Handle and Operator: 10 position lever handle. Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.5 GATE VALVES

A. Not permitted. Use ball or butterfly valves for isolation service.

2.6 GLOBE VALVES

A. Not permitted. Use ball or butterfly valves for throttling service.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors.

3.3 VALVE APPLICATIONS

A. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Install spring loaded check valves on discharge of water pumps.

E. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

F. Install ball and butterfly valves in domestic water systems for shut-off service.

END OF SECTION

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Sleeves.
   4. Formed steel channel.

1.2 RELATED WORK

A. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.

B. Division 07 - Joint Protection: Product requirements for sealant materials for placement by this section.

C. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

D. Section 22 13 00 - Pipes and Tubes for Sanitary Sewer Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

E. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SYSTEM DESCRIPTION

A. Firestopping Materials: Comply with requirements of Division 07.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping Materials: Comply with requirements of Division 07.

B. Conform to applicable code for support of plumbing piping.

1.7 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

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

1.8 QUALITY ASSURANCE

A. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Carpenter & Paterson Inc.
2. Creative Systems Inc.
3. Flex-Weld, Inc.
4. Glope Pipe Hanger Products Inc.
5. Michigan Hanger Co.
6. Superior Valve Co.
7. Substitutions: Division 01 - Product Requirements.

B. Plumbing Piping - DWV:
   1. Conform to MSS SP58.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
   1. Conform to MSS SP58.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   10. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Refer to Division 07.

2.4 FORMED STEEL CHANNEL

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. B-Line Systems Midland Ross Corporation, Electrical Products Division
   3. Unistrut Corp.
   4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Do not drill or cut structural members.

3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 69.

B. Install in accordance with manufacturer's instructions.

C. Support horizontal piping as scheduled.

D. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

E. Place hangers within 12 inches of each horizontal elbow.

F. Use hangers with 1-1/2 inch minimum vertical adjustment.

G. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

H. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

I. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

J. Support riser piping independently of connected horizontal piping.

K. Provide transverse seismic support for all piping systems.

L. Provide copper plated hangers and supports for copper piping.

M. Design hangers for pipe movement without disengagement of supported pipe.

N. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.4 INSTALLATION - SLEEVES

A. Set sleeves in position in forms. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Extend sleeves through floors one inch above finished floor level. Pack and caulk sleeves full depth and provide floor plate.

E. Install chrome plated steel escutcheons at finished surfaces.

3.5 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Requirements for inspecting, testing.

B. Division 01 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.6 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.7 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.8 SCHEDULES

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

B. Related Sections:
   1. Division 09 - Painting and Coating: Execution requirements for painting specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

B. National Fire Protection Association:
   1. NFPA 99 - Standard for Health Care Facilities.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

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

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Craftmark Identification Systems.
   2. Safety Sign Co.
   3. Seton Identification Products.
   4. Substitutions: Division 01 - Product Requirements.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:
   1. Manufacturers:
      a. Craftmark Identification Systems.
      b. Safety Sign Co.
      c. Seton Identification Products.
      d. Substitutions: Division 01 - Product Requirements.
   2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:
   1. Manufacturers:
      a. Craftmark Identification Systems.
      b. Safety Sign Co.
      c. Seton Identification Products.

d. Substitutions: Division 01 - Product Requirements.

2. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Information Tags:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors and lettering size are conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.

c. Seton Identification Products.
d. Substitutions: Division 01 - Product Requirements.

2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
3. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturers:
   a. Craftmark Identification Systems.
   b. Safety Sign Co.
   c. Seton Identification Products.
   d. Substitutions: Division 01 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color-coded head.

C. Color code as follows:
   1. Plumbing valves: Green.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Division 09.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters and pumps with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers or stenciled painting. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plumbing piping insulation, jackets and accessories.
   2. Plumbing equipment insulation, jackets and accessories.

B. Related Sections:
   1. Division 07: Product requirements for firestopping for placement by this section.
   2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:
   1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   2. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   5. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   6. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   9. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   10. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
   11. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   12. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

13. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
14. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
15. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

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

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.
   4. Owens-Corning.
   5. Substitutions: Division 01 - Product Requirements.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:
   1. Aeroflex. Aerocell.
   2. Armacell, LLC. Armaflex.
   3. Nomaco. K-flex.
   4. Substitutions: Division 01 - Product Requirements.

C. Manufacturers for Polyisocyanurate Foam Insulation Products:
   1. Dow Chemical Company.
   2. Substitutions: Division 01 - Product Requirements.

D. Manufacturers for Extruded Polystyrene Insulation Products:
   1. Dow Chemical Company.
   2. Substitutions: Division 01 - Product Requirements.

2.2 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.
   3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
   4. Jacket Temperature Limit: minus 20 to 150 degrees F.

B. TYPE P-2: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
   1. Thermal Conductivity: 0.27 at 75 degrees F.
   2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
   1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:
   1. Product Description: One piece molded type fitting covers and sheet material, off-white color.

C. Aluminum Pipe Jacket:
   1. ASTM B209.
   2. Thickness: 0.020 inch thick sheet.
   3. Finish: Corrugated or textured.
   4. Joining: Longitudinal slip joints and 2 inch laps.

D. Stainless Steel Pipe Jacket:
   1. ASTM A240/A240M OR ASTM 666 Type 304 stainless steel.
   2. Thickness: 0.010 inch thick.
   3. Finish: Corrugated.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

H. Adhesives: Compatible with insulation.

2.5 EQUIPMENT INSULATION

A. TYPE E-1: ASTM C612; glass fiber, rigid board, noncombustible with factory applied reinforced aluminum foil jacket.
   1. Thermal Conductivity: 0.023 at 75 degrees F.
   2. Operating Temperature Range: 0 to 450 degrees F.
   3. Density: 3.0 pound per cubic foot.
   4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.6 EQUIPMENT INSULATION JACKETS

A. PVC Plastic Equipment Jacket:
   1. Product Description: ASTM D1785, sheet material, off-white color.
   2. Minimum Service Temperature: -40 degrees F.
   3. Maximum Service Temperature: 150 degrees F.
   4. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. Aluminum Equipment Jacket:
   1. ASTM B209.
   2. Thickness: 0.020 inch thick sheet.
   3. Finish: Corrugated or textured.
   4. Joining: Longitudinal slip joints and 2 inch laps.

C. Stainless Steel Equipment Jacket:
   1. ASTM ASTM A240/A240M OR ASTM 666 Type 304 stainless steel.
   2. Thickness: 0.010 inch thick.
   3. Finish: Corrugated.

D. Vapor Retarder Jacket:
   1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
   3. Indoor Vapor Retarder Finish:
      a. Cloth: Untreated; 9 oz/sq yd weight.
      b. Vinyl emulsion type acrylic, compatible with insulation.

2.7 EQUIPMENT INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Glass Fiber Board Insulation:
   1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
   2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
   3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Hot Piping Systems less than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

F. Inserts and Shields:
   1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
      a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
   3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

G. Insulation Terminating Points:
   1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
   2. Condensate Piping: Insulate entire piping system and components to prevent condensation.

H. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.
   2. Miter joints at elbows.
   3. Seal seams and butt joints with manufacturer’s recommended adhesive.
   4. When application requires multiple layers, apply with joints staggered.

5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

I. High Temperature Pipe Insulation:
   1. Install in multiple layers to meet thickness scheduled.
   2. Attach each layer with bands. Secure first layer with bands before installing next layer.
   3. Stagger joints between layers.
   4. Finish with canvas jacket.
   5. Cover with aluminum jacket or with seams located on bottom side of horizontal piping.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers or aluminum jacket.

K. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

L. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

M. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:
   1. Insulate entire equipment surfaces.
   2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
   3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with

outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.

4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing Fluids 140 degrees F Or Less:
   1. Do not insulate flanges and unions, but bevel and seal ends of insulation.
   2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
   3. Finish insulation at supports, protrusions, and interruptions.

F. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers or aluminum jacket.

G. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

H. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

I. Prepare equipment insulation for finish painting. Refer to Division 09.

3.4 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

Domestic Hot Water Supply and Recirculation	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Domestic Cold Water	P-1 or P-2	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0

B. Drainage Services Piping Insulation Schedule:

Storm Piping (horizontal above ground within building)	P-1 or P-2	All sizes	1.0
Storm Piping (horizontal and vertical above ground within building when PVC pipe is used)	P-1 or P-2	All sizes	1.0

Sanitary Sewer Piping (horizontal and vertical above ground within building when PVC piping is used)	P-1 or P-2	All sizes	1.0

C. Equipment Insulation Schedule:

Roof Drain Bodies	E-1	1.0

END OF SECTION

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sanitary sewer piping above grade.
   2. Cleanouts.

B. Related Sections:
   1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
   2. Division 08 - Access Doors and Frames: Product requirements for access doors for placement by this section.
   3. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
   4. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   5. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
   6. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
   7. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.
   8. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A112.21.1 - Floor Drains.
   2. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   3. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

B. ASTM International:
   1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   2. ASTM B32 - Standard Specification for Solder Metal.
   3. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

4. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:
   1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Plumbing and Drainage Institute:
   1. PDI G101 - Standard - Testing and Rating Procedure for Grease Interceptors.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
   2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
   3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
   4. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

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

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron, ASTM A74.
   2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV

1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder.

2.2 CLEANOUTS

A. Coated cast iron floor cleanout, internal bronze cleanout plug, adjustable cast iron housing with round nickel bronze scoriated secured top in service areas; Model 4021 manufactured by J.R. Smith.

B. Coated cast iron floor cleanout, internal bronze cleanout plug, adjustable cast iron housing with square nickel bronze scoriated secured top in service areas; Model 4041 manufactured by J.R. Smith.

C. Coated cast iron floor cleanout, internal bronze cleanout plug, adjustable cast iron housing with round nickel bronze depressed cover to accept floor finish in finished floor areas; Model 4141 manufactured by J.R. Smith.

D. Coated cast iron floor cleanout, internal bronze cleanout plug, adjustable cast iron housing with square nickel bronze depressed cover to accept floor finish in finished floor areas; Model 4161 manufactured by J.R. Smith.

E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, bronze plug, and round stainless steel access cover secured with machine screw; Model 4422 manufactured by J.R. Smith.

F. Interior Unfinished Accessible Areas: Caulked or threaded type, Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Establish invert elevations, slopes for drainage to 1/4 per foot minimum. For pipes 4 inch and larger slopes for drainage to 1/8 per foot. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Do not spread piping, conserve space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

K. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.

L. Install piping penetrating roofed areas to maintain integrity of roof assembly.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09.

O. Sleeve pipes passing through partitions, walls and floors.

P. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Division 07.

Q. Support cast iron drainage piping at every joint.

3.4 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test sanitary waste and vent piping system in accordance with applicable code.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Water hammer arrestors.

1.2 RELATED WORK

A. Section 22 05 03 - Plumbing Piping and Valves.

B. Section 22 40 00 - Plumbing Fixtures.

C. Section 22 30 00 - Plumbing Equipment.

D. Section 21 13 00 Facility Sanitary Sewerage

1.3 REFERENCES

A. American Society of Sanitary Engineering:
   1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.

B. Plumbing and Drainage Institute:
   1. PDI WH201 - Water Hammer Arrester Standard.

1.4 SUBMITTALS

A. Product Data: Required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WATER HAMMER ARRESTORS

A. J.R. Smith.

B. Zurn.

C. Josam.

D. Mifab.

E. Substitutions: Division 01 - Product Requirements.

2.2 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; sized in accordance with PDI WH-201, pre-charged suitable for operation in temperature range -100 to 300º F and maximum 250 psig working pressure; Series 5000 manufactured by J.R. Smith.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accordance with manufacturer's installation instructions.

B. Install water hammer arrestors complete with accessible isolation valve.

END OF SECTION

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sinks.
   2. Drinking fountains.

1.2 SUBMITTALS

A. Product Data: Required.
   1. Include fixtures, sizes, utility sizes, trim, and finishes

B. Manufacturer's Installation Instructions: Required.

C. Manufacturer's Certificate: Required.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Required
   1. Include fixture trim exploded view and replacement parts lists.

1.4 WARRANTY

A. Furnish one manufacturer warranty for plumbing fixtures.

1.5 EXTRA MATERIALS

A. Division 01 – Execution and Closeout Requirements: Spare parts and maintenance parts.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Manufacturers for Plumbing Fixtures Throughout Section:
   1. Kohler
   2. American Standard Plumbing.
   3. Sloan.
   4. Delta Faucet Co., Commercial Div.
   5. Haws Drinking Faucet Co.
   6. Just Manufacturing, Inc
   7. Fiat.
   8. Substitutions: Permitted

B. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

2.2 SINKS - ADA

A. Bowl: ANSI A112.19.3M; single compartment 21 x 31 inch outside dimensions, 4-1/2 inch deep, 18 gauge thick, Type 304 stainless steel, self-rimming with undercoating, ledgeback drilled for trim.

B. Trim: ANSI A112.18.1; Lead free, chrome plated brass, single handle deck mounted faucet, with pull-out spout, 9 inch long x 8 inch high gooseneck swing spout, 1.5 GPM vandal resistant aerator, stainless steel crumb cup strainer with removable basket.

2.3 DRINKING FOUNTAINS/BOTTLE FILLER

A. A semi-recessed, wheel chair accessible bottle or cup filling station constructed of durable ABS plastic and 16 gauge, Type 304 Stainless Steel with a satin finish. It features an electric sensor for touch-free hygienic operation and a 30-second timeout, laminar flow, 0.5 gpm flow rate, and antimicrobial treated components, 2,500 gallon carbon block filter.

B. The mounting frame is to be heavy-gauge, galvanized steel.

C. 115 volt, 60Hz, and .14 amp draw when in use.

D. Tailpiece is 1-1/4” O.D. Provision for trap to be made in or behind wall.

E. Provide on spare carbon block filter for each unit installed.

PART 3 - EXECUTION

3.1 INSPECTION

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Verify adjacent construction is ready to receive rough-in work of this Section

3.2 INSTALLATION

A. Provide chrome plated rigid or flexible supplies to fixtures with angle stops, reducers, and escutcheons.

B. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.

C. For ADA accessible water closets, install flush valve with handle to wide side of stall.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall or floor carriers, supports as per the manufacturer's instructions.

F. Solidly attach floor mounted water closets to toilet flange with non-corroding t-bolts, washers and acorn nuts.

G. Install each fixture with removable p-trap for servicing and cleaning

3.3 SCHEDULES

A. Fixture Mounting Heights:
   1. Drinking Fountain:
      a. Standard Adult: 40 inches to top of basin rim.
      b. Accessible: 36 inches to top of spout.

3.4 ADJUSTING AND CLEANING

A. Adjust stops, valves or flow control valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion clean plumbing fixtures and equipment.

END OF SECTION

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. All provisions of the Contract including the General and Supplementary Conditions and the General Requirements apply to this work.

1.2 WORK INCLUDED

A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.

B. Division 01 of the specifications is to be specifically included as well as all related drawings.

1.3 RELATED WORK

A. Related Work Specified Elsewhere:
   1. Electrical Specifications: Division 26

B. Unless otherwise indicated on the electrical drawings or the electrical schedules, provide all mechanical equipment motors, motor starters, thermal overload switches, control relays, time clocks, thermostats, motor operated valves, float controls, damper motors, electric-pneumatic and pneumatic electric switches, electrical components, wiring and any other miscellaneous Division 23 controls. Disconnect switches are included in the electrical work, unless specifically called out on mechanical plans.

C. Carefully coordinate all work with the electrical work shown and specified elsewhere.

1.4 REFERENCED CODES - LATEST ADOPTED EDITION

A. NFPA 13 Installation of Sprinkler Systems

B. NFPA 13R Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

C. NFPA 70 National Electrical Code (NEC)

D. IMC International Mechanical Code

E. UPC Uniform Plumbing Code

F. IFC International Fire Code

G. IFGC International Fuel Gas Code

H. IBC International Building Code

1.5 SUMMARY

A. Section Includes:
   1. Pipe and valve markers for HVAC systems.
   2. Nameplates for HVAC equipment.
   3. Steel channel.

1.6 SUBMITTALS

A. See General Conditions and the General Requirements in Division 01 regarding submittals.

B. Submit by specification section complete and all at one time; partial submittals will not be considered.
   1. Submittals in booklet form: The data shall be arranged and indexed under basic categories. A typewritten index shall be included with dividers and identifying tabs between sections and references to sections of specifications.
   2. Electronic submittals are only acceptable when provided as a complete Division 23 submittal package, except long lead items and HVAC controls. HVAC Controls may be submitted as a separate package. Long lead items will be reviewed independently as required by the project. Electronic submittals shall be in PDF format. All electronic submittals shall be bookmarked by specification section. All electronic product data submittals shall be clearly marked to identify which items in the specification and or drawings are being submitted, including fixture and tag numbers where applicable. Non-bookmarked PDF's will be rejected without review.

C. Catalog sheets shall be complete and the item or model to be used shall be clearly marked, and identified as to which item in the specifications or on the drawings is being submitted and with drawing fixture number where applicable.

D. Only submit on items specifically required by each specification section. If a submittal has not been requested, it will not be reviewed.

1.7 PROJECT RECORD DRAWINGS

A. In addition to other requirements of Division 01, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building.

B. Show the location of all valves and their appropriate tag identification.

C. At completion of project, deliver these drawings to the owner and obtain a written receipt.

1.8 HANDLING

A. See General Conditions and the General Requirements in Division 01 regarding material handling.

B. Deliver packaged materials to job site in unbroken packages with manufacturer's label, and store to facilitate inspection and installation sequence. All items must be labeled and identified as to make, size and quality.

1.9 SUBSTITUTIONS

A. In accordance with the General Conditions and the General Requirements in Division 01, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment. The owner shall be the final authority regarding acceptability of substitutes.

1.10 DIMENSIONS

A. Before ordering any material or doing any work, the Contractor shall verify all dimensions, including elevations, and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and measurements indicated on the drawings.

B. Any differences, which may be found, shall be submitted to the Engineer for consideration before proceeding with the work.

1.11 MANUFACTURER’S DIRECTIONS

A. All manufactured articles shall be applied, installed and handled as recommended by the manufacturer, unless specifically called out otherwise in the plans. Advise the owner of any such conflicts before installation.

1.12 PERMITS, FEES, ETC

A. The Contractor under each section of these specifications shall arrange for a permit from the local authority. The Contractor shall pay for any inspection fees or other fees and charges required by ordinance, law, codes and these specifications.

1.13 TESTING

A. The Contractor under each section shall, at his own expenses, perform the various tests as specified and required by the owner and as required by applicable code, the State, and local authorities. The Contractor shall furnish all fuel and materials necessary for making tests

1.14 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and/or similar phrases occur, it is the intent that the materials and equipment described be furnished, installed and connected under this Division of the Specifications, complete for operation unless specifically noted to the contrary.

B. Where a material is described in detail, listed by catalog number or otherwise called for, it shall be the Contractor's responsibility to furnish and install the material.

C. The use of the word "shall" conveys a mandatory condition to the contract.

D. "This section" refers to the section in which the statement occurs.

E. "The project" includes all work in progress during the construction period.

F. In describing the various items of equipment, in general, each item will be described singularly, even though there may be a multiplicity of identical or similar items.

1.15 SCHEDULE OF WORK

A. The work must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meeting scheduled completion dates, and to avoid delaying any other trade. The owner will set up completion dates. Each contractor shall cooperate in establishing these times and locations and shall process his work so as to ensure the proper execution of it.

1.16 COOPERATION AND CLEANING UP

A. The contractor for the work under each section of the specifications shall coordinate his work with the work described in all other sections of the specifications to the end that, as a whole, the job shall be a finished one of its kind, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.

B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the owner, clear any designated areas or area of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

1.17 INSEPCTION OF SITE - REMODEL PROJECTS

A. The accompanying plans do not indicate completely the existing mechanical installations. The bidders for the work under these sections of the specifications shall inspect the existing installations and thoroughly acquaint themselves with conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work in the present building and underground serving to and from that structure. Failure to comply with this shall not constitute grounds for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work.

1.18 RELOCATION OF EXISTING INSTALLATIONS

A. There are portions of the existing mechanical systems, and electrical system, which shall remain in use to serve the finished building in conjunction with the indicated new installations. By actual examination at the site, each bidder shall determine those portions of the remaining present installations, which must be relocated to avoid interference with the installations of new work of his particular trade and that of all other trades. All such existing HVAC and plumbing installations, which interfere with new installations, shall be relocated by the Contractor.

1.19 SALVAGE MATERIALS

A. The Contractor shall remove existing equipment and other items associated with the mechanical systems where no longer required for the project. Where such items are exposed to view or uncovered by any cutting or removal of general construction and has no continuing function (as determined by the Architect), they shall be removed.

B. All items or materials removed from the project shall be made available for the Owner's inspection. The Owner retains the option to claim any item or material. The Contractor shall deliver any claimed item or material in good condition to the place designated by the Owner. All items not claimed become the property of the Contractor and shall be removed from the site by the Contractor.

1.20 GUARANTEE

A. Unless a longer guarantee is hereinafter called for, all work, materials and equipment items shall be guaranteed for a period of one year after acceptance by the Owner. All defects in labor and materials occurring during this period, as determined by the Architect, shall be repaired and/or replaced to the complete satisfaction of the Architect. Guarantee shall be in accordance with Division 01.

1.21 COMPLETION REQUIREMENTS

A. In accordance with the General Conditions and the General Requirements in Division 01, Project Closeout; before acceptance and final payment, the Contractor shall furnish:
   1. Accurate project record drawings, shown in red ink on blueline prints, showing all changes from the original plans made during installation of the work.
   2. All manufacturers' guarantees.
   3. Warranties.
   4. Test and balance reports.
   5. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All equipment shall be regularly cataloged items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications along with any optional items required for proper installation unless otherwise noted. Maintain manufacturer's identification, model number, etc. on all equipment at all times.

B. Where more than one of an item is to be provided, all of the items shall be identical manufacture, make, model, color, etc.

2.2 RESTRICTED MATERIALS

A. No materials containing asbestos in any form shall be allowed. Where materials or equipment provided by this Contractor are found to contain asbestos, such items shall be removed and replaced with non-asbestos

items. Entire cost of asbestos removal and disposal and cost of installing new items shall be the responsibility of the Contractor for those asbestos containing items installed by the Contractor.

B. No solder or flux containing lead shall be used on this project.

2.3 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

A. Provide the following types of vibration isolators:
   1. Structural bases.
   2. Open spring isolators.
   3. Restrained spring isolators.
   4. Closed spring isolators.
   5. Restrained closed spring isolators.
   6. Spring hanger.
   7. Neoprene pad isolators.
   8. Rubber mount or hanger.
   9. Glass fiber pads.
   10. Seismic snubbers.

2.4 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

A. Plastic Nameplates: Laminated plastic with engraved letters.

B. Plastic Tags: Laminated plastic with engraved letters, minimum 1-1/2 inches diameter.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, for direct burial service.

2.5 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

2.6 FORMED STEEL CHANNEL

A. Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 DRAWINGS

A. The mechanical drawings are generally diagrammatic. Complete details of the building, which affect the mechanical installation, may not be shown. For additional details, see Architectural, Civil and Electrical Drawings. Coordinate work under this section with that of all related trades.

3.2 INSTALLATION

A. All work shall comply with the latest adopted applicable codes and ordinances including, but not limited to, the NFPA, IMC, IFC, UPC, IFGC and IBC Standards; all local and state amendments to all codes and standards.

B. Obtain and pay for all inspection fees, connection charges and permits as a part of the Contract.

C. Compliance with codes and ordinances shall be at the Contractor's expense.

3.3 MEASUREMENTS

A. Verify all measurements on the job site.

B. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc., unless specified otherwise.

C. Check all piping, ducts, etc. to clear openings.

D. Rough-in dimensions shall be per manufacturer's recommendations and in compliance with ADA Guidelines.

3.4 OPERATING INSTRUCTIONS

A. Before the facility is turned over to the Owner, instruct the Owner or Owner's personnel in the operation, care and maintenance of all systems and equipment under the jurisdiction of the Mechanical Division. These instructions shall also be included in a written summary in the Operating Maintenance Manuals.

B. The Operation and Maintenance Manuals shall be utilized for the basis of the instruction. Provide a minimum of eight hours of onsite instruction to the owner designated personnel.

3.5 OPERATING AND MAINTENANCE MANUALS

A. Submit maintenance manuals to the Engineer covering all equipment, fixtures, devices, etc. installed by the Contractor. Submit prior to substantial completion.

B. The operation and maintenance manuals shall be bound in a loose leaf three ring binder with reinforced holes in the sheets so as to prevent lost pages. The manual shall contain, but not limited to, the following types of information:
   1. Cover sheet with name, address, telephone number of Contractor, General Contractor and major equipment suppliers.
   2. Catalog cuts of all equipment, fixtures, etc. installed (Marked to identify the specific items used).
   3. Manufacturer's maintenance and overhaul instruction booklets including exploded views.
   4. Identification numbers of all parts and nearest sources for obtaining parts and services.
   5. Reduced scale drawings of the control system and a verbal description of how these controls operate.
   6. A copy of the final test and balance report.
   7. A copy of valve schedule and reduced scale drawings showing valve locations.
   8. Written summary of instructions to Owner.

C. A periodic maintenance form that includes all of the equipment shall be provided with the maintenance manual. The form shall list each piece of equipment and how often maintenance is required (daily, weekly, monthly, annually). Opposite each task shall be squares for check-off for a full year (initials) to verify that the tasks are being done.

3.6 SYSTEM ADJUSTING

A. In accordance with Section 230593 Testing, Adjusting and Balancing.

B. Each part of each system shall be adjusted and readjusted as necessary to ensure proper functioning of all controls, proper air distribution, elimination of drafts, noise and vibration.

C. Balance air and water systems for volume quantities shown and as required to ensure even temperature and the elimination of drafts. Balancing shall be done by a qualified firm acceptable to the Engineer. Provide balancing log to the Engineer before substantial completion.

3.7 CUTTING, FITTING, PATCHING AND FINISH

A. Arrange and pay for all cutting, fitting, repairing, patching and finishing of work by other trades where it is necessary to disturb such work to permit

installation of mechanical work. Perform work only with craftsmen skilled in their respective trades.

B. Avoid cutting, insofar as possible, by setting sleeves, frames, etc. and by requesting openings in advance. Assist other trades in securing correct location and placement of rough-frames, sleeves, openings, etc. for ducts and piping.

C. Cut all holes neatly and as small as possible to admit work. Include cutting where sleeves or openings have been omitted. Perform cutting in a manner so as not to weaken walls, partitions or floors. Drill holes required to be cut in floors without breaking out around holes.

3.8 PAINTING

A. Perform all of the following painting in accordance with provisions of Division 9 with colors as selected by the Architect. Provide the following items as a part of mechanical work:
   1. Factory applied prime and finish coats on mechanical equipment.
   2. Factory applied prime and finish coat on all air registers, grilles and diffusers, unless otherwise specified.
   3. Factory applied prime coat on access doors.
   4. Pipe identification where specified.

B. If factory finish on any equipment furnished is damaged in shipment or during construction, refinish to equal original factory finish.

3.9 INSTALLATION OF EQUIPMENT

A. Unless otherwise indicated, mount all equipment and install in accordance with manufacturer's recommendations and approved submittals.

B. Maintain manufacture recommended minimum clearances for access and maintenance.

C. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.

D. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.

E. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all apparatus furnished under this Contract.

F. Access Doors: Provide as necessary for reasonable maintenance of all equipment valves, controls, etc.

END OF SECTION

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SECTION 23 05 03
PIPES AND TUBES FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Glycol piping.
   2. Unions and flanges.

1.2 RELATED WORK

A. Section 23 05 23 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.
B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
C. Section 23 07 00 - HVAC Insulation: Product requirements for piping insulation for placement by this section.
D. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.

1.3 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.3 - Malleable Iron Threaded Fittings.
   2. ASME B16.4 - Gray Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B31.1 – Power Piping.
   6. ASME B31.9 - Building Services Piping.
   7. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
   8. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
   1. ASTM B32 - Standard Specification for Solder Metal.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
   4. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

C. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

1.4 SUBMITTALS

A. Submit product data under provisions of Division 01.

B. Include data on pipe materials and pipe fittings.

C. Include welders' certification of compliance with ASME Section IX.

1.5 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME Section IX, and applicable state labor regulations.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Deliver and store valves in shipping containers with labeling in place.

D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

E. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

PART 2 - PRODUCTS

2.1 HEATING WATER AND GLYCOL PIPING, ABOVE GROUND

A. Copper Tubing: ASTM B88, Type L drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, lead free solder ,AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.
   3. Flux: ASTM B813.

B. Propress piping system is allowed.

C. Grooved piping systems are not allowed.

2.2 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with soldered.
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.3 HEATING GLYCOL SYSTEM CLEANER

A. Physical Properties: Water soluble, 1.12 specific gravity, 212°F boiling point.

B. Appearance/color/odor: Yellow color liquid. Slight ammine odor.

C. Acceptable Manufacturers: CH_2O Inc and Hercules.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING

A. Install in accordance with manufacturer's written installation instructions.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors. Refer to Section 23 05 29.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 05 16.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 00.

H. Provide access where valves and fittings are not accessible.

I. Install non-conducting dielectric connections wherever jointing dissimilar metals.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install valves in accordance with Section 23 05 23.

M. Install hydronic piping specialties in accordance with Section 23 21 16.

N. Insulate piping. Refer to Section 23 07 00.

3.4 INSTALLATION - HEATING AND COOLING PIPING SYSTEMS

A. Install glycol piping in accordance with ASME B31.9.

3.5 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Pressure test natural gas piping in accordance with NFPA 54.

3.6 CLEANING THE HEATING GLYCOL PIPING SYSTEM

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Prior to starting work, verify that the heating glycol piping systems are complete.

C. Fill the heating glycol piping systems system with the system cleaner, one (1) quart hydronic system cleaner for every twenty (20) gallons of water in the hydronic system.

D. Circulate heating glycol piping systems system cleaning solution for a minimum of six (6) hours. Let system cool completely.

E. Upon completion of boil out, completely flush system and drain all low points.

F. Fill system with appropriate glycol solution. See Specification Section 23 21 16 for procedures.

G. Submit a written and signed statement to the Owner that the above referenced cleaning procedures have been completed.

END OF SECTION

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe hangers and supports.
   2. Hanger rods.
   3. Inserts.
   4. Flashing.
   5. Sleeves.
   6. Formed steel channel.
   7. Equipment bases and supports.

B. Related Sections:
   1. Division 03 - Concrete Forming and Accessories: Execution requirements for placement of inserts and sleeves in concrete forms specified by this section.
   2. Division 03 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
   3. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
   4. Division 07 - Joint Protection: Product requirements for sealant materials for placement by this section.
   5. Division 09 - Painting and Coating: Product and execution requirements for painting specified by this section.
   6. Section 23 05 03 - Pipes and Tubes for HVAC Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B31.1 - Power Piping.
   2. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
   1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: Comply with requirements of Division 07.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping Materials: Comply with requirements of Division 07.

1.6 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.

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

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.12 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Carpenter & Paterson Inc.
   2. Creative Systems Inc.
   3. Flex-Weld, Inc.
   4. Glope Pipe Hanger Products Inc.
   5. Michigan Hanger Co.
   6. Superior Valve Co.
   7. Substitutions: Division 01 - Product Requirements.

B. Hydronic Piping:
   1. Conform to MSS SP58.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
   7. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
   8. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
   9. Vertical Support: Steel riser clamp.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Manufacturers:
   1. Hilti Corp.
   2. ITW Buildex and Illinois Tool Works, Inc.
   3. National Pipe Hanger Corporation.
   4. Unistrut, Tyco International, Ltd.

5. US Strut, Unitron Products, Inc.
6. Substitutions: Division 01 - Product Requirements.

B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

D. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Refer to Division 07.

2.6 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems.
3. Midland Ross Corporation, Electrical Products Division.
4. Unistrut Corp.
5. Substitutions: Division 01 - Product Requirements.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.7 FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Division 07.

2.8 FIRESTOPPING ACCESSORIES

A. Installation Accessories: Comply with requirements of Division 07.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Obtain permission from Architect/Engineer before using powder-actuated anchors.

B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with MSS SP 69.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping .

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 00.

3.5 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

C. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.7 INSTALLATION - FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Division 07.

3.8 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements: Requirements for inspecting, testing.

B. Division 01 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.9 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

3.10 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.11 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8

1-1/4	7	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2 (Note 2)	9	11	1/2	1/2
3	10	12	1/2	1/2

B. Plastic and Ductile Iron Pipe Hanger Spacing:

PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
ABS (All sizes)	4	3/8
Ductile Iron (Note 2)		
PVC (All Sizes)	4	3/8

C. Note 1: Refer to manufacturer's recommendations for grooved end piping systems.

D. Note 2: 20 feet maximum spacing, minimum of one hanger for each pipe section close to joint behind bell. Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents, limit span to maximum spacing for water service steel pipe.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Testing adjusting and balancing of air systems.
   2. Testing adjusting and balancing of hydronic systems.
   3. Measurement of final operating condition of HVAC systems.
   4. Sound measurement of equipment operating conditions.
   5. Vibration measurement of equipment operating conditions.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: Requirements for coordination between DDC system and testing, adjusting, and balancing work.
   2. Section 23 09 93 - Sequence of Operations for HVAC Controls: Sequences of operation for HVAC equipment.

1.2 REFERENCES

A. Associated Air Balance Council:
   1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:
   1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

D. Testing Adjusting and Balancing Bureau:
   1. TABB - International Standards for Environmental Systems Balance.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on TABB Report Forms.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, and sample report forms.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience Certified by NEBB.

1.7 SEQUENCING

A. Division 01 - Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.8 SCHEDULING

A. Division 01 - Administrative Requirements: Coordination and project conditions.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:
   1. Systems are started and operating in safe and normal condition.
   2. HVAC control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place or in normal position.
   15. Service and balancing valves are open.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Division 01 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain:
   1. Space temperatures within 5 degrees F.
   2. Minimal objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches differential static pressure near building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Confirm air bleeds indicate system is full of water.

D. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

E. Perform system balance with automatic control valves fully open triple duty valves fully open, and pump VFDs at 100 percent speed.

F. Confirm pump rotation and differential pressure at full flow.

G. Perform adjustment of water distribution systems by the following measures:
   1. Reduce total system flow rate first by reducing speed of VFD.

2. Use balancing cocks, valves, and fittings.

H. Do not use service or shut-off valves for balancing unless designed for balancing and shut-off functions. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Partial list of Equipment Requiring Testing, Adjusting, and Balancing:
   1. Air Coils.
   2. Terminal Heat Transfer Units.
   3. Air Handling Units.
   4. Air Inlets and Outlets.

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Description of systems operation sequence
      d. Summary of outdoor and exhaust flows to indicate building pressurization
      e. Nomenclature used throughout report
      f. Test conditions
   3. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date
   4. Electric Motors:
      a. Manufacturer
      b. Model/Frame
      c. HP/BHP and kW

d. Phase, voltage, amperage; nameplate, actual, no load
e. RPM
f. Service factor
g. Starter size, rating, heater elements
h. Sheave Make/Size/Bore

5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
   c. Driven sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave diameter and RPM
   f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
   a. Identification/number
   b. Manufacturer
   c. Size/model
   d. Impeller
   e. Service
   f. Design flow rate, pressure drop, BHP and kW
   g. Actual flow rate, pressure drop, BHP and kW
   h. Discharge pressure
   i. Suction pressure
   j. Total operating head pressure
   k. Shut off, discharge and suction pressures
   l. Shut off, total head pressure
7. Heating Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Water flow, design and actual
   g. Water pressure drop, design and actual
   h. Entering water temperature, design and actual
   i. Leaving water temperature, design and actual
   j. Entering air temperature, design and actual
   k. Leaving air temperature, design and actual
   l. Air pressure drop, design and actual
8. Air Moving Equipment:
   a. Location
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Arrangement/Class/Discharge
   f. Air flow, specified and actual
   g. Return air flow, specified and actual

h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

9. Return Air/Outside Air Data:
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Design outside air flow
   g. Actual outside air flow
   h. Return air temperature
   i. Outside air temperature
   j. Required mixed air temperature
   k. Actual mixed air temperature
   l. Design outside/return air ratio
   m. Actual outside/return air ratio
10. Duct Traverse:
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   i. Air temperature
   j. Air correction factor
11. Air Monitoring Station Data:
   a. Identification/location
   b. System
   c. Size
   d. Area
   e. Design velocity
   f. Design air flow
   g. Test velocity
   h. Test air flow
12. Flow Measuring Station:
   a. Identification/number
   b. Location
   c. Size
   d. Manufacturer

e. Model number
f. Serial number
g. Design Flow rate
h. Design pressure drop
i. Actual/final pressure drop
j. Actual/final flow rate
k. Station calibrated setting

13. Terminal Unit Data:
    a. Manufacturer
    b. Type, constant, variable, single, dual duct
    c. Identification/number
    d. Location
    e. Model number
    f. Size
    g. Minimum static pressure
    h. Minimum design air flow
    i. Maximum design air flow
    j. Maximum actual air flow
    k. Inlet static pressure
14. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow
15. Vibration Test:
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (when applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)
    b. Test readings:
        1) Horizontal, velocity and displacement
        2) Vertical, velocity and displacement
        3) Axial, velocity and displacement
    c. Normally acceptable readings, velocity and acceleration

d. Unusual conditions at time of test
e. Vibration source (when non-complying)

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. HVAC piping insulation, jackets and accessories.
   2. HVAC ductwork insulation, jackets, and accessories.

B. Related Sections:
   1. Division 07 - Firestopping: Product requirements for firestopping for placement by this section.
   2. Division 09 - Painting and Coating: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

A. ASTM International:
   1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   3. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   4. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
   5. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
   6. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   7. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   8. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   9. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   10. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
   11. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   12. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
   13. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

14. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
15. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
17. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

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

1.4 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
   1. CertainTeed.
   2. Knauf.
   3. Johns Manville.
   4. Owens-Corning.
   5. Substitutions: Division 01 - Product Requirements .

2.2 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Operating Temperature Range: 0 to 850 degrees F.

3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
1. White Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.

B. PVC Plastic Pipe Jacket:
1. Product Description: One piece molded type fitting covers and sheet material, off-white color.
2. Thickness: 10 mil.

C. Aluminum Pipe Jacket:
1. ASTM B209.
2. Thickness: 0.020 inch thick sheet.
3. Finish: Corrugated or textured.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.4 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

G. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

H. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
   1. Thermal Conductivity: 0.27 at 75 degrees F.
   2. Maximum Operating Temperature: 250 degrees F.
   3. Density: 1.5 pound per cubic foot.

B. TYPE D-2: ASTM C612, Type IA or IB, rigid glass fiber, with factory applied all service facing meeting ASTM C1136, Type II.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Density: 3.0 pound per cubic foot.

C. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
   1. Thermal Conductivity: 0.24 at 75 degrees F.
   2. Density: 3.0 pound per cubic foot.
   3. Maximum Operating Temperature: 250 degrees F.
   4. Maximum Air Velocity: 6,000 feet per minute.

D. TYPE D-5: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
   1. Thermal Conductivity: 0.23 at 75 degrees F.
   2. Density: 3.0 pound per cubic foot.
   3. Maximum Operating Temperature: 250 degrees F.
   4. Maximum Air Velocity: 4,000 feet per minute.

2.6 DUCTWORK INSULATION JACKETS

A. Aluminum Duct Jacket:
   1. ASTM B209.
   2. Thickness: 0.016 inch thick sheet.
   3. Finish: Corrugated or textured.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

B. Vapor Retarder Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film 0.0032 inch vinyl.
   2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
   3. Secure with pressure sensitive tape.

C. Canvas Duct Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

D. Outdoor Duct Jacket: Asphalt impregnated and coated sheet, 50 lb/square.

E. Membrane Duct Jacket: ASTM D4637; Type I, EPDM; non-reinforced, 0.060 inch thick, 48 inch wide roll; color as selected.

2.7 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, impact applied welded with integral head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.

H. Adhesives: Compatible with insulation.

I. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify piping, equipment and ductwork has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly.

Finish at supports, protrusions, and interruptions. Refer to Division 07 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
   3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Hot Piping Systems less than 140 degrees F:
   1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
   3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

E. Inserts and Shields:
   1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
   2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
      a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
      b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
   3. Piping Supported by Roller Type Pipe Hangers: Install galvanized steel shield between roller and inserts.

F. Insulation Terminating Points:
   1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
   2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
   3. Condensate Piping: Insulate entire piping system and components to prevent condensation.

G. Closed Cell Elastomeric Insulation:
   1. Push insulation on to piping.

2. Miter joints at elbows.
3. Seal seams and butt joints with manufacturer's recommended adhesive.
4. When application requires multiple layers, apply with joints staggered.
5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers or aluminum jacket.

I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

J. Heat Traced Piping Interior to Building: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer.

K. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

C. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with aluminum jacket.

D. External Glass Fiber Duct Insulation:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Duct Liner:
   1. Adhere insulation with adhesive for 100 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

F. Prepare duct insulation for finish painting. Refer to Division 09.

3.4 SCHEDULES

A. Heating Services Piping Insulation Schedule:

Heating Water Supply and Return 105 to 140 degrees F	P-1	1/4 inches and smaller 1/2 inches and larger	0.5 1.0

B. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Outside Air Intake	D-2	2
Supply and Return Ducts (internally Insulated)	D-4 or D-5	1.0
Transfer Air Ducts (internally insulated)	D-4 or D-5	1.0

END OF SECTION

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SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The existing Siemens Building DDC control system to be modified for control of new terminal heating systems installed under this project. The DDC system shall be connected to the existing controls network serving the building. The system shall include all software necessary for DDC system operation including graphical interface to depict system operation. The DDC system shall be fully expandable to allow for future expansion at the facility.

1.2 SECTION INCLUDES

A. Control equipment.

B. Software.

C. Programming.

1.3 RELATED WORK IN OTHER SECTIONS

A. Section 23 05 00 – Common Work Results for HVAC.

B. Section 23 05 03 – HVAC Piping and Valves.

C. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

D. Section 23 09 93 – Sequence of Operations.

E. Section 23 21 16 – Hydronic Piping Specialties.

F. Division 01 – Submittals.

G. Division 01 – Demonstration and Training.

1.4 APPROVED MANUFACTURERS/VENDORS

A. Siemens Building Technologies.

B. Substitutions: Not permitted.

1.5 QUALITY ASSURANCE

A. The direct digital control system provided shall be designed, furnished, installed, tested, certified and placed into service by a Control Contractor who is regularly engaged in the installation of direct digital control systems in Alaska. The Control Contractor shall maintain an office in Alaska with parts and maintenance personnel to ensure prompt response (24 hour maximum) to an emergency call during the one year correction period.

B. The Control Contractor shall be able to demonstrate that they have experience designing and installing direct digital control systems of comparable type and size to that called for in these Specifications.

C. The Control Contractor, if other than the manufacturer, shall hold a manufacturer's franchise or license to design and install control systems for that manufacturer.

D. Within two weeks after award of contract submit to the Project Manager the following items for Contractor qualification:
   1. Name of manufacturer and proof that the Control Contractor holds a manufacturer's franchise or license to design and install the proposed control system.
   2. Proof of Alaskan Office, with full time service representative.
   3. List of three (3) Alaskan buildings with names, addresses, and phone numbers of Owners which are representative of direct digital control systems that have been installed by the Control Contractor. Include a brief description and approximate control system construction cost of each system submitted

E. Materials and equipment shall be the catalogued commercial quality (no residential grade) 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.

F. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components.

1.6 REFERENCE STANDARDS LATEST ADOPTED EDITION

A. International Building Code (IBC), including local amendments.

B. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

C. National Electrical Code (NEC).

D. FCC Part 15, Subpart J, Class A.

1.7 SUBMITTALS

A. Submit under the provisions of Division 01.

B. Drawings:
   1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval. Drawings shall be submitted in the following standard sizes: 11” x 17” (ANSI B).
      a. System architecture diagram showing power supply to each component; interconnection of direct digital controllers, building management station, and peripherals; and indication of proposed location of direct digital controllers.
      b. Clearly indicate wire and terminal labels, set points, reset schedules, switch over points, signal ranges, and other points required to completely describe the system. Show interface with any existing control systems. Depict circuitry on schematic control diagrams to allow circuits to be traced from connection to connection
      c. Subpanel and panel face layouts.

C. System Documentation. Include the following in submittal package:
   1. System configuration diagrams in simplified block format.
   2. All input/output object listings and an alarm point summary listing.
   3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
   4. Complete bill of materials.
   5. Control component data sheets.
   6. Manufacturer's instructions and drawings for installation, maintenance, adjustment, and operation of all purchased items.

D. Electronic submittals are only acceptable when provided as complete submittal package. Electronic submittals shall be in PDF format. All electronic submittals shall be bookmarked by section and include all information as identified above in drawings and system documentation. Partial submittals will not be considered. Electronic submittals shall be in PDF format. All electronic submittals shall be bookmarked by specification section. All electronic product data submittals shall be clearly marked to identify which items in the specification and or drawings are being submitted. Non-bookmarked PDF’s will be rejected without review.

1.8 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Submit data specified in "Submittals" in final "Record Documents" form.

C. Operation and Maintenance Data:
   1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered system components and devices.
   2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

D. After the final inspection and subsequent punch list inspections update each copy of the Operation and Maintenance Manual to reflect final as-built conditions.

1.9 WARRANTY

A. Provide under the provisions of Division 01.

B. 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 system acceptance. Warranty shall cover all costs for parts, labor, associated travel, and expenses.

C. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment, and all sensors and control devices.

D. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday.

E. The on-line support services shall allow the local BAS subcontractor to connect over the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays. If the problem cannot be resolved with on-line support services, the BAS subcontractor shall dispatch the appropriate personnel to the job site to resolve the problem within three (3) days of the time that the problem is reported.

F. This warranty shall apply equally to both hardware and software.

G. Provide one (1) year manufacturers warranty for field programmable micro-processor based units from the time of completion

1.10 SYSTEMS DEMONSTRATION

A. The Contractor will completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operation.

B. Provide complete demonstration of system operation to the owners' representative at the project substantial completion inspection. The Contactor will demonstrate to the Owner's and Engineer's satisfaction that all equipment and systems operate in accordance with the sequence of operation as outlined under Section 23 09 93. Demonstration will include all equipment controlled by the Direct Digital Control System. Execute digital and analog commands in graphic mode. Demonstrate update, and alarm responsiveness. Demonstrate digital system configuration graphics with interactive upload and download, and demonstrate specified diagnostics

PART 2 - PRODUCTS

2.1 BUILDING CONTROLLER

A. General: Standalone DDC panels shall be microprocessor based, multi-tasking, multi-user, real-time digital control processors. Each standalone DDC panel shall consist of modular hardware with plug-in enclosed processors, communication controllers, power supplies, and input/output modules. A sufficient number of controllers shall be supplied to fully meet the requirements of the specifications.

B. Memory: Each DDC panel shall have sufficient memory to support its own operating system and databases including:
1. Control processes
2. Energy Management Applications
3. Alarm Management
4. Historical/Trend Data for all points
5. Maintenance Support Applications
6. Custom Processes
7. Operator I/O
8. Dial-Up Communications
9. Manual Override Monitoring

C. Point types: Each DDC panel shall support the following types of point inputs and outputs:
1. Digital Inputs for status/alarm contacts
2. Digital Outputs for on/off equipment control

3. Analog Inputs for temperature, pressure, humidity, flow, and position measurements.
4. Analog Outputs for valve and damper position control, and capacity control of primary equipment.
5. Pulse Inputs for pulsed contact monitoring.

D. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators. The system architecture shall support % expansion capacity of all types of DDC panels, and all point types included in the initial installation.

E. Serial Communication Ports: Standalone DDC panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as industry standard printers, laptop workstations, PC workstations, and panel mounted or portable DDC panel Operator's Terminals. Standalone DDC panels shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or network terminals.

F. Hardware Override Switches: As indicated in the point schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC panel via local, point discrete, onboard hand/off/auto operator override switches for binary control points and gradual switches for analog control type points. These override switches shall be operable whether the panel is powered or not. The hand/off/auto switches and gradual switches shall either be built into the DDC output module or located in an outboard equipment panel adjacent to the DDC panel. The override monitoring shall be provided whether the override switches are integral to the output module or located in an outboard equipment panel.

G. Hardware Override Monitoring: DDC panels shall monitor the status or position of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited. DDC panels shall also collect override activity information for daily and monthly reports.

H. Local Status Indicator Lamps: The DDC panel shall provide local status indication for each binary input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

I. Integrated On-Line Diagnostics: Each DDC panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The DDC panel shall provide both local and remote annunciation of any detected component failures, or repeated failure to

establish communication. Indication of the diagnostic results shall be provided at each DDC panel, and shall not require the connection of an operator I/O device.

J. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

K. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of all standalone DDC panels to prevent the loss of database or operating system software. Non-Volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 24 hours.

L. Upon restoration of normal power, the DDC panel shall automatically resume full operation without manual intervention.

M. Should DDC panel memory be lost for any reason, the user shall have the capability of reloading the DDC panel via the local area network, via the local RS-232C port, or via telephone line dial-in.

2.2 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions. All devices and equipment shall be standard devices, approved for use in the required application. Vandal-resistant covers shall be provided on sensors located in public areas or where subject to damage.

B. Analog Temperature Sensors:

1. Digital room sensors shall have backlit LCD display that lights whenever a button is pressed, night setback, day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. Contacts to be rated for the full starting load of the controlled equipment. Display shall indicate room temperature and shall indicate setpoint temperature while being adjusted.

   Temperature monitoring range: +20/120°F -13° to 49°C)
   Output signal: Changing resistance
   Accuracy at Calibration point: ±0.5°F (+/- 0.3°C)
   Set Point and Display Range: 55° to 95° F

2. Liquid immersion temperature

   Temperature monitoring range: +30/250°F (-1°/121°C)
   Output signal: Changing resistance

Accuracy at Calibration point: ±0.5°F (+/-0.3°C)

3. Duct (single point) temperature
   Temperature monitoring range: +20/120°F (-7°/49°C)
   Output signal: Changing resistance
   Accuracy at Calibration point: ±0.5°F (+/-0.3°C)
4. Duct Average temperature
   Temperature monitoring range: +20° ±120°F(-7°/+49°C)
   Output signal: Changing resistance
   Accuracy at Calibration point: ±0.5°F (±03°C)
   Sensor Probe Length: 25' L (7.3m)
5. Outside air temperature
   Temperature monitoring range: -40°±240° F(5ºC to +115ºC)
   Output signal: Changing resistance
   Accuracy at Calibration point: ±0.5°F (+/-0.3°C)

C. Differential Pressure Switch:
   1. Unit for fluid flow proof shall be Penn P74.
      Range: 8 to 70 psi
      Differential: 3 psi
      Maximum differential pressure: 200 psi
      Maximum pressure: 325 psi
   2. Unit for air flow shall be Siemens Building Technologies SW141.
      Set point ranges: 0.5" WG to 1.0" WG (124.4 to 248.8 Pa)
      1.0" WG to 12.0" WG (248.8 to 497.6 Pa)

D. Air Static Pressure Sensor:
   Range 0 to .5" WG (0 to 124.4 Pa)
   0 to 1" WG (0 to 248.8 Pa)
   0 to 2" WG (0 to 497.7 Pa)
   0 to 5" WG (0 to 1.2 kPa
   0 to 10" WG (0 to 2.5 kPa)
   Output Signal 4 – 20 mA VDC
   Combined static error 0.5% full range
   Operating Temperature -40º to 175º F (-40C to 79.5ºC)

E. Air Pressure Sensor:
   Range: 0 to 0.1 in. water (0 to 24.9 Pa)
   0 to 0.25 in. water (0 to 63.2 Pa)
   0 to 0.5 in. water (0 to 124.5 Pa)
   0 to 1.0 in. water (o to 249 Pa)
   0 to 2.0 in water 90 to 498 Pa)
   0 to 5.0 in. water (0 to 1.25 kPa)
   0 to 10.0 in.water (0 to 2.49 kPa)
   Output signal 4 to 20 mA
   Accuracy ±1.0% of full scale

F. Control Valves (all control valves shall have electric actuators):

1. Electric Control
   Range ability: 40:1
   Flow Characteristics: Modified. Equal percentage
   Control Action: Normal open or closed as selected
   Medium: Steam, water, glycol
   Body Type: Screwed ends 2" and smaller, flanged
   Valves 2½" and larger
   Body Material: Bronze
   Body Trim: Bronze
   Stem: Stainless Steel
   Actuator: 0-10 VDC, 4-20 MA or 2 position
   24 VAC/120VAC
2. All automatic temperature control valves in water lines shall be provided with Characterized throttling plugs and shall be sized for a pressure drop or 3 psi.
   a. Two position valves shall be line size.

G. Control Dampers: Furnish Ruskin Model CD-60 or equal control dampers where indicated on the mechanical drawings. Furnish the dampers to the sheet metal contractor for field installation. Air handling unit mixing box dampers are factory mounted and furnished by others with the air handling units.

H. Damper Actuators:
1. Electric control shall be Siemens Building Technologies OpenAir™ direct-coupled actuators.
2. Damper actuators shall be brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal or plastic housing, manual override, independently adjustable dual auxiliary switch.
3. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.

2.3 SENSORS AND MISCELLANEOUS DEVICES

A. Sensors General:
1. Pipe sensors shall be RTD-type. Insertion length suitable to provide adequate sensing for pipe size.
2. Provide outside air temperature sensors with watertight inlet fitting and sunlight shield. All single point sensors shall be accurate to a minimum of + 0.5 degrees F at 77 degrees F calibration point. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor.
3. Immersion wells shall be filled with thermal compound before installation of immersion sensors.

4. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day, outside air sensors shall not be placed in a location that is visible to the public.

B. Current Sensing Relay:
   1. Provide solid-state, adjustable, current operated relay. Provide a relay that changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
   2. Adjust the relay switch point so that the relay responds to motor operation under load as an “on” state and so that the relay responds to an unloaded running motor as an “off” state. A motor with a broken belt is considered an unloaded motor.
   3. Provide relay for status monitoring on fans, motors and pumps.
   4. Veris or equal.
      Internal circuits powered by induced line current.

C. Control Relays:
   1. General: Provide relays rated for current and voltage requirements of controlled equipment.
   2. Panel Mounted Relays:
      a. Plug in type, with DIN rail mountable plug in sockets. IDEC RH series or equal.
      b. UL listed.
   3. Field Mounted Relays:
      a. Solid state packaged relay including relay, LED indicator, provisions for mounting, transient protection and housing. Functional Devices RIB T series or equal.
      b. Where manual override is required provide with a Hand-Off-Auto switch.
      c. Provide internal separation between class 1 and class 2 wiring including separate wire ways or nipples.
      d. UL listed.

2.4 ELECTRONIC DATA INPUTS AND OUTPUTS

A. Differential and Static Pressure Sensors and Switches:
   1. Liquid differential pressure analog sensors will be high accuracy suitable for the pressures to be encountered, be selected for approximately 50% overrange, and have a 4 to 20 ma output. These differential pressure sensors will be provided with valved lines w/bypass port for testing and calibration, and will have adjustments for zero and span.

B. Control Outputs:
   1. On/Off Outputs: Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of

troubleshooting whether the 120 VAC circuit to the contactor is active. All such relays or digital output modules shall provide a pilot light or LED display of this same status.

C. Modulating Outputs: Modulating outputs shall be industry standard 0-5 VDC, or 0-10 VDC. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.

D. All modulating outputs shall provide within the control panel, a metric gauge, or display indication via on board display or portable operators terminal of the commanded position signal to the actuating device. This meter, gauge, or display must provide either a 0-100 percent position indication, or readout directly in the engineering units of the signal being used. Drive open/drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.

2.5 ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Outdoor enclosures shall be NEMA 4X with integral heater to allow operation to -30 Degrees F.

C. Enclosures shall have hinged, locking doors.

D. Provide stencil or laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate.

2.6 CONTROL SYSTEM WIRING

A. Wiring for DDC system communications buses shall be shielded, containing twisted pairs. Beldon or approved equal. When cabling between panels, shield wire shall be connected at one end only.

B. DDC system input and output cable shall be 2-conductor minimum 18 gauge foil-shielded, stranded twisted pair cable rated 100 VDC at 80 deg C.

C. Low voltage power cable, or low voltage cable for on/off DDC applications shall be 1-conductor, minimum 16 gage non-shielded cable rated for 100 VDC at 80 deg C.

D. All wiring located in air distribution plenums or other spaces carrying environmental air shall comply with NEC Article 300-22.

E. Cable tray, conduit and associated fittings shall comply with Division 26 Sections. All wiring in exposed, or inaccessible, areas shall be in conduit. Where plenum cable is used it shall be sleeved at penetrations and run in conduit if area is not accessible. When plenum cable is used, it shall be run in cable tray where indicated on the drawings.

F. Line voltage installation and wire necessary for control system shall comply with Division 26 and NEC.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

3.2 DEMOLITION

A. Remove existing valves, dampers, operators, sensors, and controllers that are replaced by new devices or that are not reused. Present all removed equipment to owner for first right of refusal before disposing of equipment.

B. Remove existing unused conductors.

C. Repairs: Any portion of the facility damaged, cut back or made inoperable shall be repaired with similar materials as the existing structure and/or damaged item as instructed by the Project Manager.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation.

3.4 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner’s representative prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections, sized to suit pipe diameter without restricting flow.

3.5 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes.

B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. Control wiring above accessible ceiling spaces may be run with plenum rated cable supported on 5 foot intervals in accordance with the local electrical codes.

3.6 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

3.7 TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment. Provide system operator’s training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide on-site training, 4 hours as part of this contract.

3.8 DEMONSTRATION

A. Demonstrate complete operating system to owner's representative at substantial completion.

B. Provide trending and documentation as required to verify system performance and equipment operation.

C. Provide a warranty certificate stating that control system has been tested and adjusted for proper operation. Warranty shall remain in place for one year following completion of the project.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes sequence of operation for:
   1. Hydronic Radiation.
   2. Existing Hydronic Reheat Coil.

B. Related Sections:
   1. Section 23 09 23 - Direct-Digital Control System for HVAC: For equipment, devices, system components, and software to implement sequences of operation.

1.2 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.
   1. Label with settings, adjustable range of control and limits. Submit written description of control sequence.
   2. Submit flow diagrams for each control system, graphically depicting control logic.
   3. Submit draft copies of graphic displays indicating mechanical system components, control system components, and controlled function status and value.
   4. Coordinate submittals with information requested in Section 23 09 23.

1.3 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and set points of controls, including changes to sequences made after submission of shop drawings.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 HYDRONIC RADIATION – FINTUBE (FT-1)

A. Alarms:
   1. High space temperature.
   2. Low space temperature.

B. Digital Control and Indication:
   1. Space temperature setpoint.
   2. Space temperature indication.
   3. Control valve signal indication.
   4. Alarm setpoints.

C. Automated Control:
   1. Operation Mode: Day and night mode of operation will be controlled by a seven (7) day programmable time schedule.
   2. Day Mode: 2-way modulating control valve shall operate to maintain daytime setpoint.
   3. Night Mode: 2-way modulating control valve shall operate to maintain nighttime setpoint. Upon drop in room temperature below night set back temperature, initially set at 60ºF (adjustable).

3.2 VARIABLE AIR VOLUME TERMINAL UNITS (VAV-01 – VAV-20)

A. Alarms:
   1. High space temperature.
   2. Low space temperature.

B. Digital Control and Indication:
   1. Space temperature setpoint.
   2. Space temperature indication.
   3. Operation mode schedule adjustment.
   4. Operation mode indication.
   5. Actual CFM indication.
   6. Minimum airflow setpoint.
   7. Maximum airflow setpoint.
   8. Damper position.
   9. Control valve position.
   10. Alarm Setpoints.

C. Automated Control:
   1. Space sensor will modulate air valve to maintain setpoint.
   2. Where associated with a tempering coil or space radiation heat, upon continued drop in area temperature after airflow is at minimum position, modulate the control valve on the radiant heating unit in series with the reheat coil control valve to maintain the space temperature setpoint.

3. Minimum airflow setpoint for boxes shall be 30% (initial setting, adjustable) unless noted otherwise in plans and specifications.

END OF SECTION

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SECTION 23 21 16
HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Test plugs.
   2. Flexible connectors.
   3. Air vents.
   4. Strainers.
   5. Flow controls.
   6. Glycol solution.

B. Related Sections:
   1. Section 23 05 03 - Hydronic Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.
   2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

C. American Water Works Association:
   1. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
   2. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
   3. AWWA C702 - Cold-Water Meters - Compound Type.
   4. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
   5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. Underwriters Laboratories Inc.:
   1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
   2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 PERFORMANCE REQUIREMENTS

A. Flexible Connectors: Provide at or near pumps where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for manufactured products and assemblies used in this Project.
   1. Manufacturer’s data and list indicating use, operating range, total range, accuracy, and location for manufactured components.
   2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
   3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
   4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

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

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of actual locations of components and instrumentation.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience, and with service facilities within 250 miles of Project.

B. Installer: Company specializing in performing Work of this section with minimum three years experience and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.9 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.10 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for piping specialties.

1.11 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Maintenance service.

B. Furnish service and maintenance of glycol fluid and glycol charging components for one year from Date of Substantial Completion.

1.12 MAINTENANCE MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance materials.

1.13 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish one extra 55 gallon drum of propylene glycol.

PART 2 - PRODUCTS

2.1 TEST PLUGS

A. Manufacturers:
   1. Sisco.
   2. Substitutions: Division 01 - Product Requirements.

B. 1/4 inch NPT or 1/2 inch NPT brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
   1. Neoprene core for temperatures up to 200 degrees F.
   2. Nordel core for temperatures up to 350 degrees F.
   3. Viton core for temperatures up to 400 degrees F.

C. Test Kit:
   1. Carrying case, internally padded and fitted containing:
      a. One 2-1/2 inch diameter pressure gages.
      b. Two gage adapters with 1/8 inch probes.
      c. Two 1-1/2 inch dial thermometers.

2.2 FLEXIBLE CONNECTORS

A. Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 psig.

2.3 AIR VENTS

A. Manufacturers:
   1. Taco.
   2. Hoffman.
   3. Bell & Gosset.
   4. Substitutions: Division 01 - Product Requirements.

B. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

C. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

D. Washer Type:

1. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.4 STRAINERS

A. Manufacturers:
   1. Bell & Gossett.
   2. Taco.
   3. Armstrong.
   4. Substitutions: Division 01 - Product Requirements.

B. Size 2 inch and Smaller:
   1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:
   1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

D. Size 5 inch and Larger:
   1. Flanged iron body for 175 psig working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.5 FLOW CONTROLS

A. Manufacturers:
   1. Griswold.
   2. Bell & Gossett.
   3. Substitutions: Division 01 - Product Requirements.

B. Construction: Brass or bronze body with union on inlet, and outlet, temperature and pressure test plug on inlet combination blow-down and back-flush drain.

C. Calibration: Control within 5 percent of design flow over entire operating pressure.

D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

E. Accessories: In-line strainer on inlet and ball valve on outlet.

2.6 BALANCE VALVES

A. Manufacturers:
   1. Taco.
   2. Armstrong.

3. Bell & Gossett.
4. Substitutions: Division 01 - Product Requirements.

B. Angle or straight pattern, inside screw globe valve for 125 psig working pressure, with bronze body and integral union for screwed connections, renewable composition disc, plastic wheel handle for shut-off service, and lock-shield key cap and set screw memory bonnet for balancing service.

2.7 GLYCOL SOLUTION

A. Manufacturers:
1. Dow Chemical.
2. Substitutions: Division 01 - Product Requirements.

B. Inhibited propylene glycol and water solution mixed 50 percent glycol -50 percent water, suitable for operating temperatures from -23 degrees F to 250 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

A. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.

B. Install gage taps in piping

C. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

F. Coil and conceal excess capillary on remote element instruments.

G. Provide instruments with scale ranges selected according to service with largest appropriate scale.

H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A. Where large air quantities accumulate, provide enlarged air collection standpipes.

B. Install manual air vents at system high points.

C. For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

D. Provide drain and hose connection with valve on strainer blow down connection.

E. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

F. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Provide radiator valves on water inlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.

I. Provide balance valves on water outlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.

J. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

K. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

L. Pipe relief valve outlet to glycol tank.

M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

3.3 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test for strength of glycol and water solution and submit written test results.

3.4 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and flush glycol system before adding glycol solution.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting installed construction.

B. Do not install hydronic pressure gauges until after systems are pressure tested.

3.6 SCHEDULES

A. Pressure Gages.
   1. Pumps.
      a. Scale range: 0-60 psig.

B. Pressure Gage Tapping Location:
   1. Control valves 3/4 inch & larger - inlets and outlets.
   2. Major coils - inlets and outlets.
   3. Heat exchangers - inlets and outlets.
   4. Chiller - inlets and outlets.
   5. Boiler - inlets and outlets.

C. Stem Type Thermometers:
   1. Heating System.
      a. Scale range: 0-240 degrees F.

D. Thermometer Socket Location:
   1. Control valves 1 inch & larger - inlets and outlets.
   2. Reheat coils - inlets and outlets.
   3. Unit heaters - inlets and outlets.

END OF SECTION

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Duct Materials.
   2. Flexible ducts.
   3. Insulated flexible ducts.
   4. Single wall spiral round ducts.
   5. Ductwork fabrication.

1.2 RELATED SECTIONS

A. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.

B. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.

C. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.3 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   4. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   5. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Air Duct Leakage Test Manual.
   2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

D. Underwriters Laboratories Inc.:
   1. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/8” inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
   3. Fittings.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire rated and other walls.
   7. Terminal unit and coil installations.
   8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.

C. Product Data: Submit data for duct materials.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

E. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

1.6 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience approved by manufacturer.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements.

B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

C. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having zinc coating of in conformance with ASTM A90/A90M.

B. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

C. Stainless Steel Ducts: ASTM A167, Type 304.

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Hanger Rod: ASTM A36/A36M; steel , galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 FLEXIBLE DUCTS

A. Product Description: UL 181, Class 0, interlocking spiral of aluminum foil.
   1. Pressure Rating: 2 inches wg positive or 1.5 negative for low pressure ducts and 15 inches wg positive or negative for medium high pressure ducts.
   2. Maximum Velocity: 5000 fpm.
   3. Temperature Range: -100 degrees F to 432 degrees F.

2.3 INSULATED FLEXIBLE DUCTS

A. Product Description: UL 181, Class 0, interlocking spiral of aluminum foil; fiberglass insulation; aluminized vapor barrier film.
   1. Pressure Rating: Same as 2.2A.
   2. Maximum Velocity: 5000 fpm.
   3. Temperature Range: -20 degrees F to 250 degrees F.
   4. Thermal Conductivity: Maximum 0.23 at 75 degrees F.

2.4 SINGLE WALL SPIRAL ROUND DUCTS

A. Product Description: UL 181, Class 1, round spiral lockseam duct constructed of galvanized steel.

B. Duct Coating: Polyvinyl chloride plastic, 4 mil thick on both sides. Temperature range: minus 30 degrees F to 200 degrees F.

C. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22

D. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20

2.5 DUCTWORK FABRICATION

A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Fabricate and support round ducts with longitudinal seams in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible (Round Duct Construction Standards), and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use crimp joints with or without bead or beaded sleeve couplings for joining round duct sizes 8 inch and smaller.

D. Install duct hangers and supports in accordance with Section 23 05 29.

E. Use double nuts and lock washers on threaded rod supports.

F. Connect flexible ducts to metal ducts with draw bands.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.

C. Connect air outlets and inlets to supply ducts with five foot maximum length of flexible duct. Do not use flexible duct to change direction.

3.4 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

3.5 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Steel, Aluminum
Return and Relief	Steel, Aluminum
Outside Air Intake	Steel

B. Ductwork Pressure Class Schedule:

AIR SYSTEM	PRESSURE CLASS
Constant Volume Supply	1 inch wg regardless of velocity.
Supply (Heating Systems)	1 inch wg
Return and Relief	1 inch wg regardless of velocity.

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Duct access doors.
   2. Volume control dampers.
   3. Flexible duct connections.
   4. Duct test holes.
   5. Dial thermometers.
   6. Static pressure gages.

1.2 RELATED SECTIONS

A. Section 23 09 23 - Direct-Digital Control System for HVAC: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.

B. Section 23 31 00 - HVAC Ducts and Casings: Requirements for duct construction and pressure classifications.

C. Division 26 - Equipment Wiring Connections: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers and duct access doors.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Flexible duct connections.
   2. Volume control dampers.
   3. Duct access doors.
   4. Duct test holes.

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

1.5 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of access doors.

1.6 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect dampers from damage to operating linkages and blades.

C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

D. Storage: Store materials in a dry area indoor, protected from damage.

E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Coordinate work where appropriate with building control work.

1.11 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 DUCT ACCESS DOORS

A. Manufacturers:
   1. Duro-Dyne.
   2. Ruskin.
   3. Hart & Cooley.
   4. Substitutions: Division 01 - Product Requirements.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
   1. Less than 12 inches square, secure with sash locks.
   2. Up to 18 inches Square: Furnish two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Furnish additional hinge.
   5. Access panels with sheet metal screw fasteners are not acceptable.

2.2 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

B. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
   4. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.

D. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

E. Quadrants:
   1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.3 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
   1. Duro-Dyne.
   2. Substitutions: Division 01 - Product Requirements.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Connector: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 20 oz per sq yd.
   2. Net Fabric Width: Approximately 3 inches wide.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.4 DUCT TEST HOLES

A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.5 DIAL THERMOMETERS

A. Thermometer: ASTM E1, stainless steel case, bimetallic helix actuated with silicone fluid damping, white with black markings and black pointer hermetically sealed lens, stainless steel stem.
   1. Size: 3-1/2 inch diameter dial.
   2. Lens: Clear Lexan.
   3. Accuracy: 1 percent.
   4. Calibration: Degrees F.

2.6 STATIC PRESSURE GAGES

A. Dial Gages: 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front calibration adjustment, 2 percent of full scale accuracy.

B. Inclined Manometer: Plastic with red liquid on white background with black figures, front calibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify rated walls are ready for fire damper installation.

C. Verify ducts and equipment installations are ready for accessories.

D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.

B. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings.

C. Access Doors: Install access doors at the following locations and as indicated on Drawings:
   1. Upstream of each reheat coil.
   2. Before and after each duct mounted filter.
   3. Before and after each duct mounted coil.
   4. Before and after each duct mounted fan.
   5. Before and after each automatic control damper.

D. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated on Drawings. Review locations prior to fabrication.

E. Install permanent duct test holes where indicated on Drawings and required for testing and balancing purposes.

3.3 INSTALLATION - THERMOMETERS

A. Install thermometers in air duct systems on flanges.

B. Where thermometers are provided on local panels, duct mounted thermometers are not required.

C. Locate duct-mounted thermometers minimum 10 feet downstream of mixing-dampers, coils, or other devices causing air turbulence.

D. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.4 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate re-setting of fire dampers to Owner's representative.

3.5 SCHEDULES

A. Dial Thermometer Location:
   1. Each supply air zone.

END OF SECTION

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SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ceiling fans.

B. Related Sections:
   1. Section 23 07 00 - HVAC Insulation: Product requirements for power ventilators for placement by this section.
   2. Section 23 09 23 - Direct-Digital Control System for HVAC: Controls remote from unit.
   3. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for hangers for placement by this section.
   4. Section 23 33 00 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.
   5. Section Division 26 - Equipment Wiring Connections: Execution and product requirements for connecting equipment specified by this section.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
   1. AMCA 99 - Standards Handbook.
   2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
   3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
   4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American Refrigeration Institute:
   1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

D. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.
   2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:
   1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.

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

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

E. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

1.10 MAINTENANCE SERVICE

A. Division 01 - Execution and Closeout Requirements: Requirements for maintenance service.

B. Furnish service and maintenance of fans for one year from Date of Substantial Completion.

C. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.

D. Perform work without removing fans from service during building normal occupied hours.

E. Provide emergency call back service at all hours for this maintenance period.

F. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.

G. Perform maintenance work using competent and qualified personnel under supervision and in direct employ of manufacturer or original installer.

H. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.11 EXTRA MATERIALS

A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two sets of belts for each fan.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - COMMERCIAL CEILING FANS

A. Panasonic.

B. Leading Edge.

C. Nutone.

D. Substitutions: Division 01 - Product Requirements

2.2 CEILING FANS

A. Impeller: Aerodynamically contoured aluminum blades. Epoxy enamel paint over electrostatically applied epoxy powder primer. Heavy cast aluminum housing, statically and dynamically balanced with blades.

B. Rotor/Stator: High grade cold-rolled carbon steel laminations, precision balanced, varnished dipped. Self-aligning permanently-lubricated chrome steel ball bearings affixed to shaft. U.L. required thermal protector, non-polar weatherproof encapsulated PCB free capacitor. Solid state, U.L. listed motor speed controllers.

C. Frame: Steel yoke, downrod, locknut and pin with cover. Heavy duty upper shackle with lock nuts and pins and rubber bushing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Verify roof curbs are installed and dimensions are as shown on shop drawings and instructed by manufacturer.

3.2 INSTALLATION

A. Secure wall fans with cadmium plated steel lag screws to structure.

B. Provide backdraft dampers on hood from outlet from cabinet and ceiling fans and as indicated on Drawings.

C. Install safety screen where inlet or outlet is exposed.

3.3 MANUFACTURER'S FIELD SERVICES

A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.

B. Furnish services of factory trained representative for minimum of one to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.4 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of fan cabinet.

3.5 DEMONSTRATION

A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate fan operation and maintenance procedures.

3.6 PROTECTION OF FINISHED WORK

A. Division 01 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable volume terminal units.

B. Integral heating coils.

1.2 RELATED SECTIONS

A. Section 23 05 00 – Basic Mechanical Materials and Methods.

B. Section 23 05 48 –Seismic Restraint.

C. Section 23 09 23 – Building Automation System.

D. Section 23 21 13 – Plumbing and Hydronic Piping.

E. Section 23 21 16 – Hydronic Specialties.

F. Section 23 31 00 – Ductwork.

G. Section 23 33 00 – Ductwork Accessories.

H. Division 26 – Equipment Wiring Connections.

1.3 REFERENCES

A. See Section 01 3300 – submittal procedures.

B. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

C. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00 and Section 01 33 00.

B. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate air flow, static pressure, and NC designation.

C. Submit manufacturer's installation instructions under provisions of Section 23 05 00 and Section 01 33 00.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 23 05 00 and Division 01 General Requirements.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.7 WARRANTY

A. Provide warranty under provisions of Division 01 General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Titus.

B. Price.

C. Trane.

D. Substitutions: Under provisions of Division 01 General Requirements.

2.2 VARIABLE AIR VOLUME (VAV) TERMINAL UNITS

A. Variable air volume supply air terminals for connection to single medium pressure duct, central air system. Provide hot water heating coil at units noted on the drawings.

B. Identify each VAV unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory set air flow, minimum factory set air flow, and coil type.

C. The control system serving the VAV air terminal units shall be electronic DDC controls. The contractor shall coordinate fully with Specification Section 23 09 23. Controls will be furnished by Section 23 09 23 for field installation by the successful bidding VAV box manufacturer. Verify controls are compatible with VAV boxes and enclosures are sized to accommodate control components.

D. Boxes to be able to provide accurate flow measurements with 1-1/2 diameters or less of straight ductwork prior to unit inlet.

E. Casings: Minimum 22 gauge galvanized steel.

F. Lining: Minimum one inch thick neoprene or vinyl coated fibrous glass insulation, 3.0 lb./cu. ft. density, meeting NFPA 90A requirements and UL 181 erosion requirements. Line plenum sections with 2 inch thick insulation.

G. Access Doors: Locate an access door in each box, to allow adequate space for cleaning.

H. Assembly: Air volume damper, fans, and controls in single cabinet.

I. Plenum Air Inlets: S and drive connections for duct attachment.

J. Identify each airflow unit with clearly marked identification label and airflow indicator. Label shall include unit nominal airflow, maximum factory set air flow, minimum factory set air flow, and coil type.

K. Locate air volume damper and flow sensor assembly inside unit casing. Construct from extruded aluminum or 20 gauge galvanized steel components. Key damper blades into shaft with nylon fitted pivot points.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure. Do not support from adjacent ductwork.

D. Label ceiling grid adjacent to ceiling tile for access to unit in accordance with Section 23 05 00.

E. Connect to ductwork in accordance with Section 23 31 00.

F. Field verify connection requirements to existing ductwork. Provide ductwork transition as required for connection to existing ductwork.

G. Provide gasketed access door in ductwork downstream of heating coil for access.

END OF SECTION

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Diffusers.
   2. Registers
   3. Grilles.

1.2 RELATED SECTIONS

A. Division 08 - Louvers: Architectural Wall Louvers.

B. Division 09 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.

C. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.3 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.4 SUBMITTALS

A. Division 01- Submittal Procedures: Submittal procedures.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Test Reports: Rating of air outlet and inlet performance.

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

1.5 CLOSEOUT SUBMITTALS

A. Division 01- Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of air outlets and inlets.

1.6 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70.

B. Test and rate louver performance in accordance with AMCA 500.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.8 WARRANTY

A. Division 01- Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 LINEAR CEILING DIFFUSERS

A. Manufacturers:
   1. Titus Model.
   2. E. H Price Company.
   3. Tuttle and Bailey.
   4. Substitutions: Division 01- Product Requirements.

B. Four-foot long one inch wide slot, one slots wide, with adjustable vanes for left, right, or vertical discharge..

C. Fabrication: Steel with baked enamel off-white finish. Margin frame for mounting in slatted wood ceilings.

D. Accessories: extended plenum box with round duct connection.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Manufacturers:
   1. Titus.
   2. E. H Price Company.
   3. Tuttle and Bailey.
   4. Substitutions: Division 01- Product Requirements.

B. Type: Square, multi-louvered diffuser to discharge air in 360 degree pattern.

C. Frame: Surface mount or Inverted T-bartype. In plaster ceilings, furnish plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel off-white finish.

E. Accessories: Radial opposed-blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:
   1. Titus .
   2. E. H Price Company.
   3. Tuttle and Bailey.
   4. Substitutions: Division 01- Product Requirements.

B. Fixed grilles of 1/2 x 1/2 x 1/2 inch core.

C. Fabricate 1-1/4 inch margin frame with countersunk screw mounting or lay-in frame for suspended grid ceilings.

D. Fabricate of aluminum with factory baked enamel finish.

E. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

F. Provide earthquake tabs for installation in lay-in ceiling.

2.4 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Manufacturers:
   1. Titus.
   2. E. H Price Company.
   3. Tuttle and Bailey.
   4. Substitutions: Division 01- Product Requirements.

B. Streamlined blades, depth of which exceeds 3/4 inch spacing, 35 degree deflection, with spring or other device to set blades, horizontal face.

C. Fabricate 1-1/4 inch margin frame with countersunk screw mounting.

D. Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory baked enamel off-white finish.

E. Where not individually connected to exhaust fans, provide integral, gang-operated opposed blade dampers with removable key operator, operable from face.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01- Administrative Requirements: Coordination and project conditions.

B. Verify inlet and outlet locations.

C. Verify ceiling, wall systems are ready for installation.

3.2 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Section 23 33 00.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Division 09.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.4 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Repair minor damaged surfaces as directed by Architect.

END OF SECTION

SECTION 23 45 51
VENTILATION SYSTEMS CLEANING ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork and accessories under the scope of this project specified herein and elsewhere.

1.2 RELATED SECTIONS AND DRAWINGS

A. Section 23 05 00 – Basic Mechanical Materials and Methods

B. Section 23 45 51 – Ventilation System Cleaning Accessories

1.3 REFERENCE

A. HVAC Duct Construction Standards, Metal, and Flexible Sheet Metal and Air-conditioning Contractors National Association SMACNA, 1995 edition.

B. Underwriters' Laboratories (UL) Listing.

C. American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) Standards.

D. National Air Duct Cleaners Association (NADCA) Assessment, Cleaning and Restoration of HVAC Systems ACR 2002.

1.4 SUBMITTALS

A. Provide submittals for all products specified under this section.

1.5 QUALITY ASSURANCE

A. All work under this section shall be performed by firms and persons licensed and experienced in the trade.

PART 2 - PRODUCT

2.1 CLEANING ACCESS POINTS, RECTANGULAR AND ROUND DUCT

A. The contractor shall install access points into supply and return air systems. Maximum distance between accesses shall be 15 feet with maximum of one aggregate 90 degrees change in duct direction and without any obstruction between accesses as to accommodate cleaning of all related ductwork, and to allow inspection by the Owner by bore scope. Exceptions: Duct cleaning access points may be installed at increased intervals on

straight runs of duct providing that cleaning and bore scope inspection can be adequately performed. Additional access points may be required by Owner if adequate cleaning cannot be verified.

B. Access points shall be a permanent and reusable system measuring ¾” to 6” in diameter. Install access points with rubber stop in opening such that when stop is secured in place no noticeable leak is evident.

2.2 CLEANING ACCESS PANELS, RECTANGULAR DUCT

A. Duct Access Size: Provide shop fabricated access panel of sufficient size to allow personnel entry up to shoulder level in ductwork section 18" or larger in dimension and minimum of 8"x8" in ductwork section smaller than 18" in dimension or as large as allowed by the actual dimension of the ductwork. Access panels shall be provided at turning vanes, damper locations, terminal units, duct silencers, coils, and air plenums to allow cleaning of both upstream and downstream surfaces. With the exception of coils, duct cleaning access panels do not necessarily need to be installed on both sides of such devices, providing that all surfaces of such devices can be adequately cleaned and inspected. Additional access panels may be required by Owner if adequate cleaning cannot be verified.

B. Construction:
   1. Hot dipped galvanized steel sheet. Gauge shall be same as the ductwork. Reinforced, cross-braced or otherwise stiffened.

2.3 CLEANING ACCESS PANELS, ROUND DUCT

A. Duct Access Size: Provide shop fabricated access panel of sufficient size to allow personnel entry up to shoulder level in ductwork section 18" or larger in diameter and minimum of 8"x8" in ductwork section smaller than 18" in diameter or as large as allowed by the actual dimension of the ductwork. Access panels shall be provided at turning vanes, damper locations, duct silencers, and coils to allow cleaning of both upstream and downstream surfaces. With the exception of coils, duct cleaning access panels do not necessarily need to be installed on both sides of such devices, providing that all surfaces of such devices can be adequately cleaned and inspected. Additional access panels may be required by Owner if adequate cleaning cannot be verified.

B. Construction:
   1. Hot dipped galvanized steel sheet. Gauge shall be same as the ductwork. Reinforced, cross-braced or otherwise stiffened. Rolled to meet the duct curvature.

2.4 SPECIAL PROVISIONS FOR ARCHITECTURAL EXPOSED DUCT WORK

A. Exposed Architectural Ductwork Access Panel Locations

1. Contractor shall minimize the number of access locations on ductwork in accordance with the following.
2. In duct mains 24” diameter and larger, install access at no more than 50’ on center and at each change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer’s catalog cut sheet.
3. In duct branches and mains between 24” and 16“ diameters, install access at no more than 25 feet on center and at each change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer’s catalog cut sheet.
4. In duct branches and take-offs smaller than 16” diameter. Install access at point of take-off and at every 180-degree aggregate change of direction. Locate access near ductwork support points and on the side of the ductwork away from primary view(s) but with sufficient clearance for work. Access shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors of sizes as recommended by the manufacturer’s catalog cut sheet.
5. At terminal coils, install sheet metal panel hand access hatch on the upstream and downstream side coil connection fittings. Downstream side access may be deleted if downstream coil face may be accessed through terminal diffusers. Access panel shall be of similar construction for rectangular duct work specified in section 23 31 00.
6. Painting Requirements for Affected Exposed Architectural Ductwork.
    a. All access doors and all affected ductwork on existing painted architectural ductwork shall be properly primed and painted to match existing. Contractor shall field match existing paint color and appearances.

2.5 SPECIAL PROVISIONS FOR MEDIUM VELOCITY VAV SUPPLY DUCTWORK

A. Medium Velocity VAV Supply Ductwork Access Point/Access Panel Locations.
    1. Access points and access panels shall be provided in the sizes and locations previously specified for round ductwork.
    2. All access points and access panels shall be a prefabricated access door similar to SEMCO DUCTMATE Sandwich Access Doors.

2.6 ACCESS DOORS FOR CONCEALED DUCTWORK OR EQUIPMENT

A. Unless specifically shown otherwise, ductwork or equipment to be cleaned which is concealed behind permanent construction, such as gypsum board chases or ceilings shall be cleaned to greatest extent possible from nearest

accessible location. Provide access panels in duct at nearest accessible point.

B. Where access doors are specifically indicated, provide doors with minimum 16 gauge steel frame with welded joints and furnished with anchorage for securing into specific construction. Doors shall be hinged to frame and provided with a key operated lock. Prime coat and paint to match adjacent construction. Nystrom, or equal.

2.7 ACOUSTIC DUCT LINING, RESURFACING

A. Resurfacing agent surface burning characteristics shall not exceed flame spreadrating of 25 and smoke development rating of 50 per UL 723.

B. Resurfacing agent shall be a water-based product specifically recommended by the manufacturer for the intended application.

C. Acceptable products: MEI, Fosters, approved equal.

2.8 ACOUSTIC DUCT LINING, REPLACEMENT

A. In accordance with Section 15250.

2.9 FLEXIBLE DUCT, REPLACEMENT

A. In accordance with Section 15890.

2.10 FILTERS

A. Air filter shall be medium efficiency, pleated, disposable type. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid and enclosing frame. The filter shall be listed for Class 1 service.

B. Filter shall have an average efficiency of 25-30% and an average arrestance of 90-92% in accordance with ASHRAE Standard 52.1-1992.

C. Acceptable Product: Farr 30/30 series filters or equal.

D. Additional filter types as required for specific equipment.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate installation with respect to existing equipment, do not block access to electrical junction boxes, light fixtures, and any existing mechanical and electrical equipment requiring maintenance access.

3.2 INSTALLATION OF CLEANING ACCESS

A. Locate cleaning access at readily accessible locations requiring minimum disturbance to adjacent building elements.

B. Arrange access level and plumb with respect to the ductwork section.

C. Smooth out edges of cut out in existing ductwork for access installation. Do not allow any resulting deformation to protrude into air stream.

D. Provide metal angle stiffener at edges more than 18 inches in length or where deemed necessary to maintain structural integrity of the ductwork.

E. Provide additional hangers and bracing as appropriate where the installation of the access compromises the original support of the ductwork.

F. Install access with rubber gasket around opening permanently bonded to the access panel such that when access cover is secured in place no noticeable leak is evident.

G. Secure access cover with hex-head sheet metal screw fastener at maximum of 6 inches on center. Select screw size to limit protrusion into ductwork of no more than 1/2 inch.

H. Where access is installed in lined ductwork, provide lining on interior side of access cover and extend existing lining as appropriate to the edge of the access opening such that the two lining sections mate against each other when the access cover is secured in place. Provide nosing on all end edges of lining. Seal all seams in lining sections.

I. For shop fabricated round duct access panels, provide full circumference one inch width sheetmetal hold down straps around ductwork with ends bolted to hold access panel in place tight against the ductwork. Do not secure straps to ductwork with screws.

J. Where excessive sagging is observed in the ductwork due to the installation of the access panel, provide stiffening rods to retain original ductwork shape.

3.3 RESURFACING OF LINED DUCTWORK

A. When directed by Owner to resurface existing lined ductwork, first clean all surfaces to be resurfaced. Existing lining must be accepted by the Owner as adequately cleaned prior to resurfacing.

B. Resurfacing to be performed in strict accordance with manufacturer's instructions and the requirements of NADCA Standard ACR 2002.

3.4 REPLACEMENT OF ACOUSTIC DUCT LINING OR DUCTWORK

A. When directed by Owner to replace existing duct lining, the existing liner shall be removed prior to installation of replacement liner. Remove all residual existing liner material, fasteners, and glue. Clean surface free of any remaining debris prior to installation of new replacement liner.

B. At Contractor's option, in lieu of replacing acoustical duct lining, the existing acoustically lined ductwork may be completely replaced with new acoustically lined ductwork of the same dimension, configuration, and orientation.

C. Install replacement liners in accordance with SMACNA installation standard with the additional requirement that all edges of acoustical lining shall be treated with adhesive sealant or with proper nosing.

D. Lining to be installed by impaling on welded pins with supplemental surface adhesive.

E. Install replacement ductwork in accordance with SMACNA installation standards.

3.5 INSTALLATION OF REPLACEMENT FLEXIBLE DUCT

A. Layout replacement flexible duct to avoid excessive air flow turns or kinking of duct section.

B. Install replacement flexible duct with both interior and exterior polyester liners folded into the fiberglass insulation with sufficient overlap to seal the fiberglass insulation from the air stream at both the connections to the ductwork and the diffuser.

C. Support flexible duct with 1" steel bands from structure above as necessary to maintain internal air flow path. Do not allow flexible duct to lay on ceiling unsupported.

3.6 INSTALLATION OF FILTERS

A. Install filters in existing filter holding rack in arrangement as intended by the filter holding rack design. Provide new retainer clips if existing clips are missing or damaged.

B. Where bypass gap existing between filters and filter rack, eliminate bypass by providing adequate size sheetmetal bracket between filter and filter rack.

3.7 REPAIR OF EXISTING DUCTWORK WHERE REQUIRED

A. Where existing ductwork shows evidence of significant sagging, deformation, or separation at joints, repair as appropriate to return the ductwork to serviceable condition.

B. Consider minor repair in the immediate area of access panel installation as part of this work at no additional cost to the Owner.

END OF SECTION

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SECTION 23 81 23
COMPUTER-ROOM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air Conditioning Units.

B. Controls and Control Panels.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 26 05 03 - Equipment Wiring Connection.

1.3 RELATED SECTIONS

A. Section 26 05 03 - Equipment Wiring Systems: Electrical supply to units.

1.4 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

B. American Society of Mechanical Engineers:
   1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

C. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.

1.6 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00.

B. Submit product data for manufactured products and assemblies required for this project.

C. Indicate water, drain, electrical and refrigeration rough-in connections on product data.

D. Submit manufacturer's installation instructions under provisions of Section 01 33 00.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 78 23.

B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and protect products to site under provisions of Section 01 60 00.

1.9 WARRANTY

A. Provide manufacturer's warranty under provisions of Section 01 77 00.

1.10 EXTRA MATERIALS

A. Provide one sets of filters.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - COMPUTER-ROOM AIR-CONDITIONERS

A. Liebert.

B. Substitutions: Under provisions of Division 01.

2.2 EVAPORATOR CABINET AND FRAME CONSTRUCTION

A. The cabinet and chassis shall be constructed of heavy gauge, painted furniture steel. The cabinet shall be designed for easy installation and service access from the front only.

2.3 AIR DISTRIBUTION

A. The air distribution system shall be constructed with a quiet, direct-drive fan assembly equipped with multiple double-inlet blowers, self-aligning sleeve bearings, and lifetime lubrication. Fan motor shall be permanent-split capacitor, high efficiency type.

B. Air filters shall be the cleanable foam type. They shall be easily removable from the front of the system by means of quarter-turn fasteners and shall not require system shutdown for service.

2.4 MICROPROCESSOR CONTROL SYSTEM

A. The microprocessor based integral control system shall be factory assembled, wired into the system cabinet and tested prior to shipment. Controls shall be easily accessible from the front of the system display.

2.5 MONITORING

A. The LCD display shall provide an on/off indication, fan speed indication, operating mode indication (cooling, heating and current day, time, temperature indication.

2.6 PROGRAMMABILITY

A. The control shall be programmable on a daily basis or on a 5 day/2 day program schedule. It shall be capable of accepting 2 programs per day.

B. The control shall include the capabilities to calibrate the temperature sensors and adjust the sensor response delay time from 10 to 90 seconds.

C. The control shall be capable of displaying temperature values in °F or °C.

2.7 ALARMS

A. The control system shall monitor unit operation and activate an audible and visual alarm for the following field adjustable conditions.

B. High Temperature (max 90°F, 32.2°C).

C. Low Temperature (min 35°F, 1.7°C).

D. The control shall be capable of disabling any alarm if required.

2.8 DIRECT EXPANSION COIL

A. The evaporator coil shall be constructed of copper tubes and aluminum fins. Refrigerant flow shall be controlled by an externally equalized thermostatic expansion valve. The coil shall be provided with a galvanized steel drain pan.

2.9 REFRIGERATION SYSTEM

A. The refrigeration system shall consist of a hermetic compressor with vibration isolating springs, high pressure safety switch, liquid line filter/drier, and a compressor crankcase heater. Refrigeration components shall be located in remote or close-coupled condensing unit.

2.10 AIR COOLED

A. The air cooled system shall consist of an evaporator section and a condensing unit section. The condensing unit section shall be mounted to the side of the evaporator section. The unit shall have duct connections for both the evaporator section and the condenser section.

2.11 CONDENSATE TRAY

A. The condensate condensate tray shall be complete with integral float switch that shuts down unit on overfill condition.

PART 3 - EXECUTION

3.1 GENERAL

A. Install computer room Air Conditioning units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

3.2 ELECTRICAL WIRING

A. Install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

3.3 PIPING CONNECTIONS

A. Install and connect devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

3.4 CONDENSATE DRAIN PIPING

A. Connect condensate drain to air conditioning unit. Provide pitch and trap as manufacturer's instructions and local codes require.

3.5 FIELD QUALITY CONTROL

A. Start up computer room air conditioning units in accordance with manufacturer's start up instructions. Test controls and demonstrate compliance with requirements.

END OF SECTION

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SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Air coils.
   2. Finned tube radiation.

B. Related Sections:
   1. Section 23 05 03 - Hydronic Piping: Execution requirements for connection of chilled water, hot water, and drain piping to units specified by this section.
   2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for motors for placement by this section.
   3. Section 23 07 00 - HVAC Insulation: Execution requirements for insulation specified by this section.
   4. Section 23 21 16 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.
   5. Section 23 31 00 - HVAC Ducts and Casings: Execution requirements for ducts specified by this section.
   6. Division 16 - Equipment Wiring Connections: Execution requirements for electric connection to units specified by this section.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:
   1. ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

B. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

A. Division 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers

C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.

D. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

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

1.4 CLOSEOUT SUBMITTALS

A. Division 01 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.

C. Operation and Maintenance Data: Submit manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Product storage and handling requirements.

B. Accept units on site in factory packing. Inspect for damage. Store under roof.

C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Warranty: Include coverage of motors.

PART 2 - PRODUCTS

2.1 AIR COILS

A. Manufacturers:
   1. Colmac.
   2. Heatcraft.
   3. Substitutions: Division 01 - Product Requirements

B. Fabrication:
   1. Tubes: 5/8 inch OD seamless copper arranged in parallel or staggered pattern, expanded into fins, brazed joints.
   2. Fins: Aluminum or copper continuous plate type with full fin collars or individual helical spiral finned tube type wound under tension.
   3. Casing: Die formed channel frame of steel with mounting holes on 3 inch centers. Furnish intermediate center tube supports for plate fin coils longer than 36 inches. Furnish intermediate tube supports for spiral fin coils at manufacturer's recommended intervals to eliminate sagging during operation.

C. Glycol Heating Coils:
   1. Headers: Cast iron with tubes expanded into header, seamless copper tube with silver brazed joints, or prime coated steel pipe with brazed joints.
   2. Leak Testing: Air test under water to 200 psig for working pressure of 200 psig and 200 degrees F.
   3. Configuration: Self draining circuitry, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

2.2 FINNED TUBE RADIATION

A. Manufacturers:
   1. Modine.
   2. SlantFin.
   3. Rittling.
   4. Substitutions: Division 01 - Product Requirements

B. Heating Elements: Two tier element 3/4 inch ID seamless copper tubing, 0.042 inches minimum wall thickness, mechanically expanded into evenly spaced aluminum fins, suitable for soldered fittings.

C. Element Hangers: Brackets and hangers shall be channeled steel in hot dipped wiped coat galvanized finish. Furnish required channeled bracket-hanger assemblies with heavy floor mounting flange for rigid front skirt and element support.

D. Enclosures: 16 gauge galvanized steel. Cover shall be of one piece construction. Enclosure shall have two- tier element. Top part of enclosure electro galvanized shall consist of stamped grille with pencil-proof air discharge louvers. All enclosures shall have female to female slip joint connection with interlocking internal splice. The internal splice provides additional strength with a nearly invisible joint.

E. Finish: Factory applied baked enamel on visible surfaces of enclosure or cabinet. Color selected by architect.

F. Access Doors: For otherwise inaccessible valves, provide factory-made permanently hinged access doors, 6 x 7 inch minimum size, and integral with cabinet.

G. Capacity: Based on 65° F entering air temperature, 170° F average water temperature.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. For recessed units, verify recess dimensions are correct size.

C. Verify wall construction is ready for installation.

D. Verify ductwork is ready for installation.

3.2 INSTALLATION

A. Install air coils in ducts and casings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible. Refer to Section 23 31 00.

B. Support air coil sections independent of piping on steel channel or double angle frames and secure to casings. Furnish frames for maximum three coil

sections. Arrange supports to avoid piercing drain pans. Install with airtight seal between coil and duct or casing.

C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

D. Install coils level.

E. Make connections to coils with unions and flanges.

F. On water coils, install isolation valve on supply piping and flow control valve on return piping. Locate water supply at bottom of supply header and return water connection at top. Install air vents at high points complete with stop valve. Install water coils to be drainable and install drain connection at low points. Refer to Section 23 05 03.

G. Install insulation air coil casings. Refer to Section 23 07 00.

H. Insulate headers located outside airflow, insulate as specified for piping. Refer to Section 23 07 00.

I. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.

J. Protection: Install finished cabinet units with protective covers during remainder of construction.

K. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Center elements under windows. Install wall angles where units butt against walls.

3.3 CLEANING

A. Division 01 - Execution and Closeout Requirements: Final cleaning.

B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

D. Install new filters.

END OF SECTION

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SECTION 26 01 26
TESTING AND MAINTENANCE OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Feeder Megohm Testing.

B. Receptacle Branch Circuit Testing.

C. Ground Fault Circuit Interrupter Testing.

D. Phase Rotation.

E. Additional Testing and Maintenance requirements in individual equipment and system Sections

1.2 REFERENCES

A. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. ANSI/IEEE Std 81-1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

C. ANSI/TIA/EIA – 568-B.1 and Addendums, General Cabling System Requirements

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals and Section 26 05 00.

B. Product Data: Submit technical information for each test instrument to include manufacturer, model number, serial number, ratings, accuracy, and National Institute of Standards and Technology (NIST) Traceable calibration certification.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit Test Reports per Section 26 05 00.

1.5 COORDINATION

A. Provide written 72 hours advance notice of all tests to be performed to allow Owner's Representative to witness testing.

1.6 REQUIRED TEST INSTRUMENTS

A. MEGOHMMETER
   1. Product Description: 1000 Volt DC, portable, insulation and resistance test Megohmmeter.
   2. Equipment Accuracy:
      a. 2000 Megohm Range - 3% of full Scale.

B. BRANCH CIRCUIT ANALYZER
   1. Product Description: Branch circuit analyzer capable of receptacle testing of voltage drop under load, hot-neutral-ground conductor resistances, common mode (N-G) Voltage, and G.F.C.I. trip point.
   2. Manufacturer: Ideal SureTest. Model: 61-156 ST-1THD Wiring/Harmonic Distortion Analyzer or approved equal.
   3. Equipment Accuracy:
      a. Accuracy 1% full scale ± 1 digit True RMS.

C. MULTIMETER
   1. Product Description: Digital True RMS Multimeter.
   2. Equipment Accuracy:
      a. AC Voltage Range: 0.75% 6 3 last single digits at 60 Hz.
      b. AC Current Range: 0.90% 6 3 last single digits at 60 Hz.
      c. DC Voltage Range: 0.25% 6 1 last single digit.
      d. DC Current Range: 0.75% 6 1 last single digit.
      e. Resistance Ranges: 0.50% 6 1 last single digit.
      f. Frequency Range: 0.10% 6 1 last single digit @ 60 Hz.

D. SOUND LEVEL METER
   1. Product Description: Sound Level Meter meeting ANSI S.14a Type 2, Specifications for Sound Level Meters. Capable of A-Weighted measurement.

1.7 TEST INSTRUMENT CALIBRATION

A. All test equipment shall be in good mechanical and electrical condition.

B. Provide calibration for each test instrument directly traceable to the National Institute of Standards and Technology (NIST) of higher accuracy than that of the instrument tested.

C. Provide calibration labels visible on all test equipment. Records, which show date and results of instruments calibrated or tested, shall be kept up-to-date.

D. Calibrate instruments in accordance with the following frequency schedule:
   1. Field instruments: 12 months maximum.
   2. Up-to-date instrument calibration instructions and procedures shall be maintained for each test instrument with the equipment.

1.8 MINIMUM REPORT INFORMATION

A. Report Criteria: After each test, promptly submit one copy of report to the Owner's Representative. Include information on the report form where included within this specification otherwise provide form with the minimum following information:
   1. Date issued.
   2. Project title and number.
   3. Name and Model of Tester and witnesses.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Type of inspection or test.
   7. Date of test.
   8. Results of tests.
   9. Indicate compliance or non-compliance with Contract Documents.
   10. Final adjustment setting values where applicable.

B. Submit copy of all tests performed in the O&M manual.

1.9 GENERAL REQUIREMENTS

A. Submit test results within 3 working days of each test and included in the O&M manual.

B. Provide qualified personnel at site to perform all testing.

C. Perform specified testing of products in accordance with specified standards or as denoted in this specification whichever is more stringent.

D. Promptly notify Owner's Representative of irregularities or non-conformance of Work or products.

E. Perform additional tests when test is performed incorrectly, deemed inaccurate, or incorrectly documented.

F. The Contractor shall provide all forms, instrumentation and test equipment, loads, and other consumables required to demonstrate the systems to Owner's Representative satisfaction.

G. Perform and submit all testing prior to substantial completion and system acceptance.

H. Retest all material, cables etc that are disturbed after testing.

I. Replace and retest all material installed which does not meet or exceed the minimum acceptable limits set forth in this specification in accordance with the contract original requirements at no additional charge to Contract Sum/Price.

J. Owner's Representative shall be notified in writing at least 3 days prior to any testing being performed.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 FEEDER CONDUCTOR TEST

A. Tests Criteria:
   1. Use Megohm meter to test all feeder cables.
   2. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential 1000 volts DC for 600 volt rated cable.
   3. Perform test immediately after installation.
   4. Clean exposed cable ends with clean cloth and alcohol.
   5. Test duration shall be one minute.
   6. Disconnect conductors from all equipment.
   7. Record the resistance of the insulated conductor under test with all other conductors connected together and to ground (metallic raceway, grounding conductor, etc).
   8. Perform continuity test to insure correct cable connection.
      a. Submit test results to Owner's Representative.

B. Test Values:
   1. Minimum insulation-resistance value: 50 megohms.
   2. Investigate deviations between adjacent phases.

3.2 RECEPTACLE GROUND FAULT CIRCUIT INTERRUPTER TEST

A. Test Criteria:
   1. Use Branch Circuit Analyzer to perform test of each GFCI protected receptacle.
   2. Record trip level in ma for each outlet.

3. Submit test results to Owner's Representative.

B. Test Values:
   1. Trip Range: Between 6-9 mA.

3.3 PHASE ROTATION TEST

A. Test each three phase circuit and feeder for consistent phase rotation for the entire power system with a phase rotation meter.

B. Bump test each motor for proper rotation prior to use.

C. Correct conductor phase relationship to provide proper phase rotation.

D. Record the rotation sequence on each panelboard and Service circuit schedule.

E. Submit test results of each panelboard and Service to the Owner's Representative.

3.4 PHASE LOAD BALANCE TEST

A. After energizing building loads conduct a phase load balance test for each panelboard with a clamp on ammeter.

B. Shift loads to provide current balance within 10% of the other phases. Revise circuit directory to reflect any changes.

C. Notify Owner's Representative at least 72 hours in advance before test.

END OF SECTION

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SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General Requirements specifically applicable to Division 26, in addition to Division 01 provisions.

B. The electrical system equipment and installation shall comply with all provisions and requirements of this specification, as well as any and all applicable national, state and local codes and standards.

1.2 WORK SEQUENCE

A. Construct Work in sequence under provisions of Division 01.

1.3 COORDINATION

A. Coordinate the Work specified in this Division under provisions of Division 01.

B. Prepare drawings showing proposed rearrangement of Work to meet job conditions, including changes to Work specified under other Sections. Obtain permission of Architect prior to proceeding.

1.4 FUTURE WORK

A. Provide for future work under requirements of Division 01.

1.5 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code, latest adopted edition including all state and local amendments.

B. NECA - Standard of Installation.

C. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. Electrical Reference Symbols: The Electrical "Legend" on drawings is standardized version for this project. All symbols shown may not be used on drawings. Use legend as reference for symbols used on plans.

E. Electrical Drawings: Drawings are diagrammatic; complimentary to the Architectural drawings; not intended to show all features of work. Install material not dimensioned on drawings in a manner to provide a symmetrical

appearance. Do not scale drawings for exact equipment locations. Review Architectural, Structural, and Mechanical Drawings and adjust work to conform to conditions shown thereon. Field verification of dimensions, locations and levels is directed.

1.6 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 70.

B. Conform to the latest adopted edition of the International Building Code and the International Fire Code including all state and local amendments thereto.

C. Obtain electrical permits, plan review, and inspections from authority having jurisdiction.

1.7 SUBMITTALS

A. Submit inspection and permit certificates under provisions of Division 01.

B. Include certificate of final inspection and acceptance from authority having jurisdiction.

C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any requirements of Contract Documents. Submittal not checked for quantity, dimension, fit or proper operation. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provisions of a complete and satisfactory working installation is the sole responsibility of the Contractor.

D. In addition to requirements referenced in Division 01, the following is required for work provided under this division of the specification.
   1. Provide material and equipment submittals containing complete listings of material and equipment shown on Electrical Drawings and specified herein, bound in hard cover, loose-leaf binders separate from work furnished under other divisions. Index and clearly identify all material and equipment by item, name or designation used on drawings and in specifications.
   2. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring diagrams and controls; component parts; finishes; dimensions; and required clearances.
   3. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

4. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
5. Coordinate submittals with requirements of work and of Contract Documents.
6. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Contract Documents. Notify Architect/Engineer in writing at time of submittal, of any deviations from requirements of Contract Documents.
7. Do not fabricate products or begin work which requires submittals until return of submittal with Architect/Engineer acceptance.
8. Equipment scheduled by manufacturer's name and catalog designations, manufacturer's published data and/or specification for that item, in effect on bid date, are considered part of this specification. Approval of other manufacturer's item proposed is contingent upon compliance therewith.
9. Submittals for Division 26 shall be complete and submitted at one time. Unless given prior approval, partial submittals will be returned unreviewed.

1.8 SUBSTITUTIONS

A. In accordance with the General Conditions and the General Requirements, Substitution and Product Options, all substitute items must fit in the available space, and be of equal or better quality including efficiency performance, size, and weight, and must be compatible with existing equipment.

1.9 PROJECT RECORD DRAWINGS

A. Maintain project record drawings in accordance with Division 01.

B. In addition to the other requirements, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all electrical work which will become permanently concealed. Show routing of work in permanently concealed blind spaces within the building. Show complete routing and sizing of any significant revisions to the systems shown.

C. Record drawing field mark-ups shall be maintained on-site and shall be available for examination of the Owner’s Representative at all times.

1.10 OPERATION AND MAINTENANCE MANUALS

A. Provide operation and maintenance manuals for training of Owner's Representative in operation and maintenance of systems and related equipment. In addition to requirements referenced in Division 01, the following is required for work provided under this section of the specifications.

B. Manuals shall be hard cover, loose-leaf binders with pages reinforced to prevent pullout and shall be separate from work furnished under other divisions. Prepare a separate chapter for instruction of each class of equipment or system. Index and clearly identify each chapter and provide a table of contents.

C. Unless otherwise noted in Division 01, provide one copy of all material for approval. After approval, provide five corrected approved copies.

D. The following is the suggested outline for operation and maintenance manuals and is presented to indicate the extent of items required in manuals.
   1. List chapters of information comprising the text. The following is a typical Table of Contents:
      a. Electrical power distribution
      b. Lighting
      c. Fire Detection and Alarm
      d. Other chapters as necessary
   2. Provide the following items in sequence for each chapter shown in Table of Contents:
      a. Describe the procedures necessary for personnel to operate the system including start-up, operation, emergency operation and shutdown.
         1) Give complete instructions for energizing equipment and making initial settings and adjustments whenever applicable.
         2) Give step-by-step instructions for shutdown procedure if a particular sequence is required.
         3) Include test results of all tests required by this and other sections of the specifications.
      b. Maintenance Instructions:
         1) Provide instructions and a schedule of preventive maintenance, in tabular form, for all routine cleaning and inspection with recommended lubricants if required for the following:
            a) Lighting fixtures
            b) Distribution equipment
            c) Fire Detection and Alarm

2) Provide instructions for minor repair or adjustments required for preventive maintenance routines, limited to repairs and adjustments which may be performed without special tools or test equipment and which requires no special training or skills.
3) Provide manufacturers' descriptive literature including approved shop drawings covering devices used in system, together with illustrations, exploded views, etc. Also include special devices provided by the Contractor.
4) Provide any information of a maintenance nature covering warranty items, etc., which have not been discussed elsewhere.
5) Include list of all equipment furnished for project, where purchased, technical representative if applicable and a local parts source with a tabulation of descriptive data of all electrical-electronic spare parts and all mechanical spare parts proposed for each type of equipment or system. Properly identify each part by part number and manufacturer.

1.11 DEMONSTRATION OF ELECTRICAL SYSTEMS

A. During substantial completion inspection:
   1. Conduct operating test for approval under provisions of Division 01.
   2. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.
   3. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.
   4. Have instruments available for measuring light intensities, voltage and current values, and for demonstration of continuity, grounds, or open circuit conditions.
   5. Provide personnel to assist in taking measurements and making tests.

1.12 CERTIFICATE OF COMPLETION

A. Submit, at time of request for final inspection, a completed letter in the following format:

I, NAME , of FIRM , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of DATE. I further certify that the following specification requirements have been fulfilled:

1. ____ megger readings performed, __ copies of logs attached.
2. ____ ground tests performed, __ copies of method used and results attached.

3. ____ operating manuals completed, DATE .
   SIGNED .
   Owner's Representative
4. ____ as-built drawings up-to-date and ready to deliver to Architect.
5. ____ fire detection and alarm system final connections, check out and start up completed on DATE by:
   SIGNED .
   Factory Authorized and Trained Technician
6. Instruction of operating personnel completed on DATE by:
   SIGNED .
   Owner's Representative
7. ____ all other tests required by specifications have been performed.
8. ____ all systems are fully operational.
   SIGNED .

1.13 WARRANTY

A. In addition to the requirements of Division 1, warrant all materials, installation and workmanship for one (1) year from date of acceptance.

B. Copies of manufacturer product warranties for all equipment shall be included in the operation and installation manuals.

1.14 INSTRUCTION OF OPERATING PERSONNEL

A. In accordance with the requirements of Division 01 and this section provide services of qualified representative of supplier of each item or system listed below to instruct designated personnel of Owner in operation and maintenance of item or system.

B. Make instruction when system is complete, of number of hours indicated, and performed at time mutually agreeable.

System or Equipment	Hours of Instruction
Fire detection and alarm system	2

C. Certify that an Anchorage or Fairbanks based authorized service organization regularly carries complete stock of repair parts for listed equipment or systems, that organization is available and will furnish service within 48 hours after request. Include name, address and telephone number of service organization.

D. Have approved operation and maintenance manuals and parts lists for all equipment on hand at time of instruction.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All Materials and Equipment shall be new and shall be listed by Underwriter's Laboratories or equivalent third party listing agency for the use intended.

B. Materials and Equipment shall be acceptable to the authority having jurisdiction as suitable for the use intended when installed per listing and labeling instructions.

C. No materials or equipment containing asbestos in any form shall be used. Where materials or equipment provided by this Contractor are found to contain asbestos such items shall be removed and replaced with non-asbestos containing materials and equipment at no cost to the Owner.

D. In describing the various items of equipment, in general, each item will be described singularly, even though there may be numerous similar items.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Install Work using procedures defined in NECA Standard of Installation and/or the manufacturer's installation instructions.

3.2 TESTS

A. Notify Contracting Officer at least 72 hours prior to conducting any tests.

B. Following completion of installation test all feeders in accordance with NETA ATS 7.3. Submit logs of values obtained, and nameplate data of instruments used prior to final inspection. Include a copy of all data in the power distribution section of the Operation and Maintenance Manuals.

C. Perform additional tests required under other sections of these specifications.

D. Perform all tests in the presence of the Owner's authorized representative.

E. The Contractor shall provide written notification to the Owner's authorized representative and the State Electrical Inspector thirty days in advance of requests for rough-in and substantial completion inspections.

END OF SECTION

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SECTION 26 05 03
EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical connections to equipment specified under other Sections.

1.2 RELATED WORK

A. Division 01 - Administrative Requirements; Summary: Owner-furnished equipment.

B. Division 22 – Plumbing Equipment.

C. Division 23 – HVAC Equipment.

D. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

E. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.

B. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Purpose Wiring Devices.
   2. NEMA WD 5 - Specific-Purpose Wiring Devices.

1.4 SUBMITTALS

A. Division 01 – Submittal Procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.5 COORDINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for extra hard usage in damp locations.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.4 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

B. Make conduit connections to equipment using flexible conduit. Use Liquidtight flexible conduit in damp or wet locations.

C. Install pre-finished cord set where connection with attachment plug is indicated or specified by the equipment manufacturer's installation instructions, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where required.

F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches and connect with conduit and wiring as indicated in the equipment manufacturer's installation instructions.

3.5 ADJUSTING

A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

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SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire.

B. Cable.

C. Wiring connections and terminations.

1.2 RELATED SECTIONS

A. Section 26 05 53 – Identification for Electrical Systems

1.3 REFERENCES

A. Federal Specification FS-A-A59544 – Cable and Wire, Electrical (Power, Fixed Installation)

B. Federal Specification FS-J-C-30B – Cable Assembly, Power, Electrical

C. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

D. NETA ATS – Acceptance testing specifications for Electrical Power Distribution and Systems.

E. NFPA 72 – National Electrical Code.

F. NFPA 262 – Standard Method of test for flame travel and smoke of wires and cables for use in air-handling spaces.

G. UL 62 – Flexible Cords and Cables.

H. UL 83 – Thermoplastic Insulated Wire and Cable.

I. UL 1063 – Standard for Machine and Tool Wire and Cable.

J. UL 1424 – Standard for Cables for Power-Limited Fire Alarm.

K. UL 1479 – Standard for Fire Tests of Through Wall Penetration Fire Stops.

L. UL 1569 – Standard for Metal Clad Cable.

M. UL 1581 – Reference Standard for Electrical Wires, Cables and Flexible Cords.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Thermoplastic-insulated Building Wire: NEMA WC 5.

B. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation, THW, THHN/THWN or XHHW-2 as indicated.

C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THHN/THWN or XHHW-2. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid conductor.

D. Branch Circuit Wire Color Code:
   1. Color code wires by line or phase as follows:
      a. Black, red, blue and white for 120/208V systems.
      b. Brown, orange, yellow, and gray for 277/480V system.
   2. For conductors 8 AWG and smaller, insulation shall be colored. For conductors 6 AWG and larger, identify with colored phase tape at all terminals, splices, and boxes.
   3. When two or more neutrals are installed in one conduit, identify each with the proper circuit number in accordance with Section 260553.
   4. Grounding conductors 8 AWG and smaller shall have green colored insulation. For 6 AWG and larger, use green tape at both ends and at all other visible points in between, including pull and junction boxes.

E. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THWN or XHHW-2.

F. Fire Alarm Notification Appliance Circuits: Copper, solid or stranded conductor 600 volt insulation, THHN/THWN or XHHW-2.

2.2 METAL CLAD CABLE

A. UL 83, 1063, 1479, 1569, and 1581 listed, meets Federal Specification A-A-59544 (formerly J-C-30B). UL rated for installation in cable trays and environmental air handling spaces. Fire wall rated for 1, 2, and 3-hour through penetrations.

B. Type MC Cable, Size 12 Through 10 AWG: Solid copper conductor, 600 volt thermoplastic insulation, rated 90º C dry, 75º wet, insulated green grounding conductor, and galvanized steel armor over mylar.

C. Type MC Cable, Size 8 Through 1 AWG: Stranded copper conductor, 600 volt thermoplastic insulation, rated 90º C dry, 75º wet,, insulated green grounding conductor, and galvanized steel armor over mylar.

D. Fire Alarm/Control Type MC Cable, Size 18 through 12 AWG: UL 62, 83, 1063, 1424, 1479, 1569, and 1581 listed, solid copper conductor, 300 volt thermoplastic insulation, rated 105º C, insulated green grounding conductor, red or red-striped galvanized steel or aluminum armor over mylar. Conductor insulation shall be color-coded in accordance with Section 28 31 00.

E. All metal clad cable shall be provided with color-coded insulation on all ungrounded conductors in accordance with NEC 210.5(C) and Part 3 of this section.

2.3 REMOTE CONTROL AND SIGNAL CABLE

A. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600 volt insulation, rated 90º C, individual conductors twisted together, shielded, and covered with an overall PVC jacket; UL listed.

B. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 90º C, individual conductors twisted together, shielded or unshielded (as required), and covered with a PVC jacket; UL listed.

C. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300 volt insulation, rated 90º C, individual conductors twisted together, shielded or unshielded (as required), and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.4 WIRING CONNECTIONS AND TERMINATIONS

A. For conductors 8 AWG and smaller:

1. Dry interior areas: Spring wire connectors, pre-insulated “twist-on” rated 105 degrees C per UL 468C. Where stranded conductors are terminated on screw type terminals, install crimp insulated fork or ring terminals. Thomas & Betts Sta-Kon or equal.
2. Motor connections: Spring wire connectors, pre-insulated “twist-on” rated 105 degrees C per UL 468C. Provide a minimum of 8 wraps of Scotch 33+ electrical tape around conductors and connector to eliminate connector back off.
3. Wet or exterior: Spring wire connectors, pre-insulated “twist-on”, resin filled rated for direct burial per UL 486D.

B. For conductors 6 AWG and larger:
1. Bus lugs and bolted connections: 600 V, 90 degrees C., two hole long barrel irreversible compression copper tin plated. Thomas & Betts or approved equal.
2. Motor connection: 600 V, 90 degrees C., copper tin plated compression motor pigtail connector, quick connect/disconnect, slip on insulator. Thomas & Betts or approved equal.
3. Two way connector for splices or taps: 600 V, 90 degrees C., compression long barrel, copper tin plated. Thomas & Betts or approved equal. Insulate with Scotch 23 rubber insulating base covering and Scotch 33+ outer wrap.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 18 AWG for control wiring.

B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet, and 20 ampere, 277 volt branch circuit home runs longer than 200 feet.

C. Splice only in junction or outlet boxes.

D. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Make Conductor lengths for parallel circuits equal.

F. Wiring in lighting fixture channels shall be rated for 90º C minimum.

G. Do not share neutral conductors. Provide a dedicated neutral conductor for each branch circuit that requires a neutral.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Verify that raceway is complete and properly supported prior to pulling conductors. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Do not install XHHW-2 conductors when ambient temperatures are below –5 degrees C and THHN/THWN conductors when ambient temperatures are below 0 degrees C.

D. Conductors shall be carefully inspected for insulation defects and protected from damage as they are installed in the raceway. Where the insulation is defective or damaged, the cable section shall be repaired or replaced at the discretion of the Owner and at no additional cost to the Owner.

E. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

F. Route conductors from each system in independent raceway system and not intermix in the same raceway, enclosure, junction box, wireway, or gutter as another system unless otherwise shown on the plans.

G. No more than three current carrying conductors shall be installed in any homerun unless otherwise indicated on the drawings.

H. Completely and thoroughly swab raceway system before installing conductors.

3.3 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or cable ties to support cables from structure. Do not support cables from ceiling suspension system. Include bridle rings or drive rings.

C. Use suitable cable fittings and connectors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

D. Terminate spare conductors with twist on connectors or heat shrink insulation to proper voltage rating.

E. Control systems wiring in conjunction with mechanical or miscellaneous equipment, including motor control center, switchboards, etc., to be identified in accordance with wiring diagrams furnished with equipment.

F. Code sound and signal systems wiring and any special equipment in accordance with manufacturer's diagrams or recommendations.

G. Do not exceed manufacturer's recommended pull tensions.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.6 WIRE AND CABLE INSTALLATION SCHEDULE

A. All Locations: Building wire and/or remote control and signal cable in raceways.

B. At the Contractor’s option Metal Clad cable may be used for branch circuit wiring other than homeruns. Homeruns shall be building wire in raceway. Metal Clad cable used for branch circuit wiring from a light switch to the light fixture shall include a spare conductor for future use.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power system grounding.

B. Electrical equipment and raceway grounding and bonding.

1.2 RELATED SECTIONS

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements and Section 26 05 00 – Common Work Results for Electrical.

B. Division 01 – Quality Requirements.

C. Section 26 05 00 – Common Work Results for Electrical.

D. Section 26 05 19 – Low Voltage Electrical Power conductors and Cables.

1.3 REFERENCE STANDARDS

A. ANSI/NEMA GR-1 – 2001, Ground Rod Electrodes and Ground Rod Electrode Couplings.

B. ANSI/NFPA 70 – 2011 National Electrical Code.

C. ASTM B 3 – 2001 Standard Specification for Soft or Annealed Copper Wire.

D. AWS A5.8/A5.8M – 1992; R2004 Specification for Filler Metals for Brazing and Braze Welding.

E. IEEE Std 81 – 1983 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

F. IEEE Std 142 – Recommended Practice for Grounding of Industrial and Commercial Power System.

G. UL 467 – 2004 Standard for Grounding and Bonding Equipment.

1.4 SYSTEM DESCRIPTION

A. Provide a complete grounding system for services and equipment as required by State Codes, NEC, applicable portions of other NFPA codes, and as indicated herein.

1.5 SUBMITTALS

A. Product Data: Submit product data for all components provided, showing material type and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

B. Shop Drawings: Submit shop drawings indicating location of main grounding bus, system grounding electrode connections (ground rods, etc.), routing of grounding electrode conductor, and size/type of bonding conductors and termination locations of all major bonding connections (water, piping, steel, fuel tanks, etc.).

1.6 CLOSEOUT SUBMITTALS

A. Project Record Drawings
   1. Accurately indicate actual locations of main grounding bus, all grounding rods, etc.
   2. Show the actual installed routing of grounding electrode conductor, and size/type of bonding conductors and termination locations of all major bonding connections (water, piping, steel, fuel tanks, etc.).

B. Test Reports
   1. The results of electrical ground resistance test, performed on the installed grounding system shall be submitted in accordance with the paragraph entitled “Field Quality Control” of this section.
   2. Each test report shall include:
      a. Date of test, soil moisture content, and soil temperature
      b. Test operator
      c. Instrument or other test equipment used
      d. Electrode designation or location matching that shown on shop drawings
      e. Ground impedance in ohms
      f. Assumptions made - if required

1.7 COORDINATIONS

A. Division 01 – Administrative Requirements: Requirements for Coordination.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bonding Conductors: Solid bare copper wire for sizes No. 8 AWG and smaller diameter. Stranded bare copper wire for sizes No. 6 AWG and larger diameter. Conductors may be insulated conductors if used provide green insulation.

B. Grounding Conductors: Copper conductor bare or green insulated.

C. Mechanical Grounding and Bonding Connectors: Non-reversible crimp type lugs only. Use factory made compression lug for all terminations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a separate, insulated equipment-grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing. Multiple conductors on single lug not permitted. Each grounding conductor shall terminate on its own terminal lug.

B. Grounding conductors for branch circuits shall be sized in accordance with NEC, except minimum size grounding conductor shall be No. 12 AWG.

C. Grounding conductor is in addition to neutral conductor and in no case shall neutral conductor serve as grounding means.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Continuity Test: Continuity test shall be performed on all power receptacles to ensure that the ground terminals are properly grounded to the facility ground system.

END OF SECTION

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SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDED

A. Conduit supports.

B. Formed steel channel.

C. Spring steel clips.

D. Sleeves.

E. Mechanical sleeve seals.

F. Firestopping relating to electrical work.

G. Firestopping accessories.

H. Equipment bases and supports.

1.2 RELATED WORK

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.

1.3 REFERENCES

A. International Building Code (IBC), Chapter 16 – Structural Design.

B. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

1.4 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E814 and UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
   1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

1.6 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.7 SUBMITTALS

A. Division 01: Requirements for submittals.

B. Product Data:
   1. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Manufacturer's Installation Instructions:
   1. Firestopping: Submit preparation and installation instructions.

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

E. Seismic Restraint Calculations:
   1. Provide structurally engineered shop drawings for seismic restraint of all electrical equipment required by the International Building Code (IBC), Chapters 16, 17. Structural design shall be based on the Seismic Use Category and Seismic Design Category as designated in these chapters.

2. Shop drawings shall be stamped by a professional engineer registered in the State of Alaska.

1.8 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

B. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage (24.9 Pa) minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
   2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   3. Floor Penetrations Within Wall Cavities: T-Rating is not required.

C. Perform Work in accordance with State of Alaska Standard Specifications.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Division 01: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F (15 degrees C).

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
   1. Allied Tube & Conduit Corp.
   2. Minerallac Fastening Systems.
   3. O-Z Gedney Co.
   4. Substitutions: per Division 01

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One-hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F (85 degrees C). Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
   1. B-Line Systems
   2. Allied Tube & Conduit Corp.
   3. Unistrut Corp.
   4. Substitutions: per Division 01

B. Product Description: Galvanized 12 gage (2.8 mm) thick steel. With holes 1-1/2 inches (38 mm) on center.

2.3 SLEEVES

A. Sleeves Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.

B. Sleeves Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2mm) thick galvanized steel.

C. Sleeves Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

D. Fire-stopping Insulation: Glass fiber type, non-combustible.

2.4 MECHANICAL SLEEVE SEALS

A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.5 FIRE STOPPING

A. Manufacturers:
   1. Dow Corning Corp.
   2. 3M Fire Protection Products.
   3. Fire Trak Corp.
   4. Substitutions: per Division 01

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
   1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
   2. Foam Firestopping Compounds: Single component foam compound.
   3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
   4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
   5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
   6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
   7. Firestop Pillows: Formed mineral fiber pillows.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

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

C. General:
   1. Furnish UL listed products or products tested by independent testing laboratory.
   2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
   2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Owner's Representative before using powder-actuated anchors.

E. Obtain permission from Owner's Representative before drilling or cutting structural members.

3.3 INSTALLATION - GENERAL

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, beam clamps, or spring steel clips. Conduit support plates shall not be used to support conduits entering junction or outlet boxes.

B. Use toggle bolts or hollow wall fasteners in hollow masonry partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not support raceways, low voltage pathways, cables, telecommunication pathways or boxes from ceiling suspension wires or suspended ceiling systems. Provide support from building structure independently to allow ceiling removal and replacement without removal of electrical system. If dedicated support wires are used, wires and wire clips must be painted or color-coded. Exception: Outlet boxes for ceiling-mounted light fixtures, speakers, motion sensors, and smoke detectors may be mounted in the ceiling system.

D. Do not fasten supports to piping, ductwork, mechanical equipment, conduit, or ceiling suspension system.

E. Do not penetrate by drilling or screwing into metal roof decking. All penetrations into metal roof decking must be approved by the Project Manager in writing.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

I. Securely fasten fixtures and equipment to building structure in accordance with manufacturer's recommendations and to provide necessary earthquake anchorage.

J. Provide wall attached fixtures and equipment weighing less than 50 pounds with backing plates of at least 1/8" x 10" sheet steel or 2" x 10" fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.

K. Earthquake Anchorages:
   1. Equipment weighing more than 50 pounds shall be adequately anchored to the building structure to resist lateral earthquake forces.
   2. Total lateral (earthquake) forces shall be 1.5 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.

L. For light fixtures installed in exposed areas (i.e. with no ceiling system), provide safety chains capable of supporting a minimum of 200 pounds. Attach safety chains to building structure and to each end of the light fixtures so as to not allow fixture to drop more than 6 inches upon primary fixture support failure.

M. Provide two minimum color-coded dedicated seismic support wires for each ceiling mounted light fixture weighing less than 50 pounds. Attach support wires to building structure independent from ceiling system and on opposing corners of the light fixtures to not allow fixture to drop more than 6 inches upon ceiling failure. Secure each end with three tight wraps within 1 inch at each end of the wire.

N. Attach the supporting cables for all pendant fixtures to both the building structure and to the ceiling grid which they pass through.

O. Replace or repair any fireproofing damaged by the installation of supporting equipment or devices.

P. Power-driven fasteners are prohibited for tension load applications (such as supporting luminaries or conduit racks from ceiling above). Use drilled-in expansion anchors, or drilled and screw-in anchors such as Kwik-Con II or Tapcon.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating,to uniform density and texture.

D. Place intumescent coating in sufficient coats to achieve rating required.

E. Remove dam material after firestopping material has cured. Dam material to remain.

F. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, and ceiling as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

G. Where conduit, wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

H. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition, floor, and ceiling as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch (25 mm) on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch (25 mm) void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.

I. Install escutcheons, floor plate, or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

J. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

K. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - SLEEVES

A. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install stainless steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

A. Division 01: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.7 CLEANING

A. Division 01: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

A. Division 01: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 26 05 33
RACEWAY AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquidtight metal conduit.

D. Electrical metallic tubing.

E. Nonmetallic conduit.

F. Surface Mounted Raceway.

G. Fittings and conduit bodies.

H. Wall and ceiling outlet boxes.

I. Pull and junction boxes.

1.2 RELATED SECTIONS

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions,

B. Division 01 - General Requirements, Summary, Administrative Requirements

C. Division 07 Thermal and Moisture Protection.

D. Division 08 Openings: Access Doors and Frames.

E. Section 26 05 00 – Common Work Results for Electrical.

F. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.

G. Section 26 05 26 – Grounding and Bonding for Electrical Systems.

H. Section 26 05 29 – Hangers and Supports for Electrical Systems.

I. Section 26 05 53 – Identification for Electrical Systems.

J. Section 26 27 26 – Wiring Devices.

K. Section 27 10 00 – Structured Cabling.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A 123 – Specification for Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.

C. National Electrical Manufacturers Association (NEMA):
   1. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   2. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   3. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
   4. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
   5. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.
   6. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code.

E. Telecommunications Industry Association (TIA) and Electronics Industries Association (EIA)
   1. ANSI/TIA/EIA 568-B Commercial Building Telecommunications Cabling Standard

F. Building Industry Consulting Service International (BICSI):
   1. BICSI Telecommunication Design Methods Manual

G. International Building Code (IBC):
   1. IBC chapters 16 and 17 seismic requirements.

1.4 RACEWAY AND BOX INSTALLATION SCHEDULE

A. Raceway Minimum Size: All branch circuit conduits are sized on the drawings for copper conductors with 600-Volt type XHHW insulation, unless otherwise noted. Size all raceways not shown on the drawings to not exceed the percentage fill specified in the NEC Table 1, Chapter 9 using the conduit dimensions of the NEC Table 4, Chapter 9 and conductor

properties of the NEC Table 5, Chapter 9. Where specific cable is not listed, use cable diameter provided by the manufacturer.

1. Above Grade or Slab on Grade: Provide 1/2 inch minimum, unless otherwise noted. Raceway may be reduced to ½ inch for final connection of raceway up to 6 feet for connection to fixture or device where maximum conduit entry size is ½ inch.

B. Box Minimum Size: Provide all boxes sized and configured per NEC Article 370 and as specified in this section.

C. Concealed Dry Locations:
1. Raceway: Provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
2. Boxes and Enclosures: Provide sheet-metal boxes. Provide vapor barrier boxes in exterior walls and the ceiling.
3. Fittings: Provide galvanized malleable iron and steel.

D. Exposed Dry Locations:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit. EMT conduit may be used where exposed conduit is allowed where it is not subject to physical damage or where installed on the ceiling or a minimum of ten feet above the floor.
2. Boxes and Enclosures: Provide sheet-metal boxes with raised steel covers.
3. Fittings: Provide galvanized malleable iron and steel.
4. Surface Raceway and Boxes. Where specifically noted on the Drawings, provide surface raceway and boxes.

E. Telecommunication Grounding:
1. Raceway: Provide aluminum or PVC conduit (non-ferrous) where the grounding conductor is not concealed within the wall or ceiling; or if the grounding conductor is exposed to physical damage.
2. Boxes and Enclosure: Provide non-ferrous as required.
3. Fittings: Provide non-ferrous as required.

F. Branch Circuits 60 Amperes or Larger and Feeders:
1. Raceway: Provide rigid steel conduit or intermediate metal conduit.
2. Boxes and Enclosures: Provide sheet-metal boxes.
3. Fittings: Provide galvanized malleable iron and steel.

G. Telecommunications Cable:
1. Raceway: Where portions of cabling system are installed in raceway, provide rigid steel conduit, intermediate metal conduit, or electrical metallic tubing.
2. Boxes and Enclosures: Provide sheet metal boxes.
3. Fittings: Provide galvanized malleable iron and steel

H. Fire Alarm Cable:
   1. Raceway: Provide fire alarm EMT in all interior locations. Where portions of raceway are installed outdoors, and in or under the slab, comply with all other requirements of this section, as noted above.
   2. Boxes and Enclosures: Provide sheet metal boxes.
   3. Fittings: Provide galvanized malleable iron and steel

I. Equipment Connections: Provide short extensions (three feet maximum) of flexible metal conduit for connections to light fixtures, motors, transformers, vibrating equipment or equipment that requires removal for maintenance or replacement. Use Liquidtight flexible conduit and fittings for motors and equipment in damp or wet locations or subject to spilling of liquids as at pumps, kitchen equipment, in mechanical rooms, boiler rooms, pump rooms, etc.

J. Liquidtight flexible nonmetallic conduit and electrical nonmetallic tubing are not approved raceway systems for this project.

1.5 DESIGN REQUIREMENTS

A. Conduit Minimum Raceway Size: Conduit is sized on the drawings for copper conductors with 600-Volt type XHHW insulation, unless otherwise noted. Size all raceways not shown on the drawings to not exceed the percentage fill specified in the NEC Table 1, Chapter 9 using the conduit dimensions of the NEC Table 4, Chapter 9 and conductor properties of the NEC Table 5, Chapter 9. Where specific cable is not listed, use cable diameter provided by the manufacturer.

B. Box Minimum Size: Provide all boxes sized and configured per NEC Article 370 and as specified in this section.

C. Seismic Support: Provide support in accordance with section 26 05 29.

D. ANSI/TIA/EIA - 568-B Commercial Building Telecommunications Cabling Standard

E. Telecommunication Pathways layout and configuration: BICSI Telecommunication Design Methods Manual.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittals and Section 26 05 00 - Common Work Results for Electrical.

B. Product Data: Submit data for products to be provided.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.1 RIGID METAL CONDUIT (RMC)

A. Rigid Steel Conduit: ANSI C80.1, UL 6.

B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; Galvanized malleable iron with threaded hubs for all conduit entries. Provide threaded connections and couplings only. Set Screw and running thread fittings are not permitted. Provide copper free aluminum fittings and conduit bodies with Aluminum Conduit.

C. Provide insulated throat bushings at all conduit terminations.

2.2 INTERMEDIATE METAL CONDUIT (IMC)

A. Product Description: ANSI C80.6, UL 1242; Galvanized Steel Conduit.

B. Fittings and Conduit Bodies: NEMA FB 1, UL 514B; use fittings and conduit bodies specified above for rigid steel conduit.

2.3 FLEXIBLE METAL CONDUIT (FMC)

A. Product Description: UL 1, FS WW-C-566; galvanized or zinc-coated flexible steel, full-wall thickness. Reduced-wall flexible metal conduit is not acceptable.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron with insulated throat bushings. Die cast zinc or threaded inside throat fittings are not acceptable.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Product Description: UL 360, flexible metal conduit with interlocked steel construction and PVC jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; liquid tight steel or malleable iron with insulated throat bushings. Die cast fittings are not acceptable.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3, UL 797; galvanized steel tubing.

B. Fire Alarm EMT: Provide EMT with factory-applied red topcoating.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, compression type with insulated throat bushings. Zinc die cast, set screw, or indentor fittings are not acceptable.

D. Maximum size shall be 2". Provide factory elbows on sizes 1-½" and larger.

2.6 RIGID NONMETALLIC CONDUIT (RNC)

A. Not approved for use on this project.

2.7 HIGH DENSITY POLYETHYLENE CONDUIT (HDPE)

A. Not approved for use on this project.

2.8 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Product Description: NEMA TC 2; PVC.

2.9 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, UL514A galvanized steel, with plaster ring where applicable.
   1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
   2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required. Minimum Size: 4 inches square or octagonal, 2-1/8 inches deep.
   3. Telecommunications Outlets: Minimum size 4-11/16 inches square, 2-1/8 inches deep.

B. Vapor Barrier Boxes: Airtight box with vapor barrier flange and integral wire entry seal. Lessco, Nutek, Enviroseal, or approved equal.

C. Cast Boxes: NEMA FB 1, Type FD, galvanized malleable iron. Furnish gasketed cover by box manufacturer. Furnish threaded hubs. “Bell” boxes are not acceptable.

D. Wall Plates: As specified in Section 26 27 26.

2.10 PULL AND JUNCTION BOXES

A. Sheet Metal Pull and Junction Boxes: ANSI/NEMA OS 1, UL514A galvanized steel.
   1. Minimum Size: 4 inches square or octagonal, 1-1/2 inches deep, unless otherwise noted.
   2. Residential Construction: Minimum size is same as sheet metal outlet boxes.

B. Sheet Metal Boxes Larger Than 12 Inches in Any Dimension: Hinged enclosure in accordance with Section 26 27 16. Hoffman or approved equal.

2.11 EXPANSION FITTINGS

A. Galvanized malleable iron, galvanized with grounding bond jumper.

2.12 BUSHINGS

A. Non-grounding: Threaded impact resistant plastic.

B. Grounding: Insulated galvanized malleable iron/steel with hardened screw bond to raceway and conductor lug.

2.13 LOCKNUTS

A. Threaded Electro Zinc Plated Steel designed to cut through protective coatings for ground continuity.

2.14 WIREWAY

A. Product Description: General purpose type wireway. Size per NEC minimum fill capacity required.

B. Knockouts: Field-installed, no factory knockouts acceptable.

C. Cover: Screw cover.

D. Fittings and Accessories: Include factory couplings, offsets, elbows, adapters and support straps required for a complete system. Provide internal ground bonding jumper bonded to each section.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Provide seismic support and fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes with origin and destination in accordance with Section 26 05 53.

D. Unless otherwise noted, do not inter-mix conductors from separate panelboards or any other system in the same raceway system or junction boxes.

3.2 INSTALLATION - GENERAL RACEWAY

A. Install raceway for all systems, unless otherwise noted.

B. Install an equipment grounding conductor inside of all raceways containing line voltage conductors.

C. Provide raceways concealed in construction unless specifically noted otherwise, or where installed at surface cabinets, motor and equipment connections and in Mechanical and Electrical Equipment rooms. Do not route conduits on roofs, outside of exterior walls, or along the surface of interior finished walls unless specifically noted on the plans.

D. Raceway routing and boxes are shown in approximate locations unless dimensioned. Where raceway routing is not denoted, field-coordinate to provide complete wiring system.

E. Do not route raceways on floor. Arrange raceway and boxes to maintain a minimum of 6 feet 6 inches of headroom and present a neat appearance. Install raceways level and square to a tolerance of 1/8” per 10 feet. Route exposed raceways and raceways above accessible ceilings parallel and perpendicular to walls, ceiling, and adjacent piping.

F. Maintain minimum 6-inch clearance between raceway and mechanical and piping and ductwork. Maintain 12-inch clearance between raceway and heat sources such as flues, steam pipes, heating pipes, heating appliances, and other surfaces with temperatures exceeding 104 degrees F.

G. Do not install raceway imbedded in spray applied fire proofing. Seal raceway penetrations of fire-rated walls, ceilings, floors in accordance with the requirements of Section 26 05 00 and Division 07.

H. Where raceway penetrates fire-rated walls and floors, provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating, seal opening around conduit with UL listed firestop sealant or intumescent firestop, preserving the fire time rating of the construction. Install in accordance with Section 07 84 00 Firestopping.

I. Raceways and boxes penetrating vapor barriers or penetrating areas from cold to warm shall be taped and sealed with a non-hardening duct sealing compound to prevent the accumulation of moisture, and shall include a vapor barrier on the outside.

J. Arrange raceway supports to prevent misalignment during wiring installation. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

K. Do not attach raceway to ceiling support wires or other piping systems and do not fasten raceway with wire or perforated pipe straps. Remove all wire used for temporary raceway support during construction, before conductors are pulled. Raceway shall be installed to permit ready removal of equipment, piping, ductwork, or ceiling tiles.

L. Group raceway in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps, as specified in Section 26 05 29. Provide space on each rack for 25 percent additional raceway.

M. Cut conduit square; de-burr cut ends. Bring conduit to the shoulder of fittings and couplings and fasten securely. Where locknuts are used, install with one inside box and one outside with dished part against box

N. Use threaded raintight conduit hubs for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations. Sealing locknuts are not acceptable.

O. Install no more than the equivalent of three 90-degree bends between boxes.

P. Install conduit bodies to make sharp changes in direction, such as around beams. “Goosenecks” in conduits are not acceptable.

Q. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch size.

R. Provide protective plastic bushings or insulated throat bushings at each raceway termination not installed to an enclosure. Bushings shall be threaded to the raceway end or connector.

S. Avoid moisture traps; install junction box with drain fitting at low points in raceway system.

T. Install fittings and flexible metal conduit to accommodate 3-axis movements where raceway crosses seismic joints

U. Install fittings designed and listed to accommodate expansion and contraction where raceway crosses control and expansion joints.

V. Use cable sealing fittings forming a watertight non-slip connection to pass cords and cables into conduit. Size cable sealing fitting for the conductor outside diameter. Use Appleton CG series or equal cable sealing fittings.

W. Use suitable caps to protect installed raceway against entrance of dirt and moisture.

X. Provide nylon "jet-line" or approved equal pull string in empty raceway, except sleeves and nipples.

Y. Paint all exposed conduit to match surface to which it is attached or crosses. Clean greasy or dirty conduit prior to painting in accordance with paint manufacturer's instructions. Where raceway penetrates non-rated ceilings, floors or walls, provide patching, paint and trim to retain architectural aesthetics similar to surroundings

Z. Coat non-ferrous conduit threads prior to joining with conductive metallic grease antioxidant.

3.3 INSTALLATION – GENERAL BOXES

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance. All electrical box locations shown on Drawings are approximate unless dimensioned.

B. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Where installation is inaccessible, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaries. Coordinate locations and sizes of required access doors with Division 08.

C. Coordinate layout and installation of boxes to provide adequate headroom and working clearance. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

D. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

E. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems and where normal and emergency power circuits occur in the same box.

F. Adjust box location up to 6 feet prior to rough-in to accommodate intended purpose.

G. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

H. Unless otherwise specifically noted, locate outlet boxes for light switches within 6 inches of the door jamb on the latch side of the door.

I. Position outlets to locate luminaires as shown on reflected ceiling plans.

J. Locate and install boxes to maintain headroom and to present a neat appearance.

K. Provide knockout closures for unused openings.

L. Install boxes in walls without damaging wall insulation or reducing its effectiveness.

M. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. For outlet boxes in walls with combustible finished surfaces such as wood paneling or fabric wall coverings, position box to be flush with finished surface per NEC requirements.

N. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes. Accurately position bridges to allow for surface finish thickness.

O. Do not install flush mounted boxes back-to-back in walls; install with minimum 6 inches separation.

P. Install with minimum 24 inches separation in fire rated walls. Limit penetrations in fire rated walls to 16 square inches each and a maximum total combined penetration area of 100 square inches in any given 100 square feet of wall. Where penetrations are in excess of these requirements provided UL listed fire stop wrap acceptable to Authority having Jurisdiction.

Q. Do not fasten boxes to ceiling support wires or other piping systems.

R. Support boxes independently of conduit.

S. Clean interior of boxes to remove dust, debris, and other material and clean exposed surfaces and restore finish

T. Provide blank covers or plates for all boxes that do not contain devices.

3.4 INSTALLATION – SURFACE RACEWAY

A. Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings. Provide divider to keep power and data pathways separate at all times. Bond each section together to provide electrically continuous system.

B. Close ends and unused openings in wireway and surface raceway.

C. Where wall surface is uneven, installer shall fur out wall section to match Surface Raceway dimensions and Surface Boxes dimensions as required. Furring shall be painted to match surface raceway.

D. Install Surface Raceway cover with no gaps, scratches, or deformities. Covers not acceptable to Owner shall be replaced by the Contractor.

3.5 INSTALLATION – TELECOMMUNICATION RACEWAYS AND SLEEVES

A. Provide continuous pathway system for all telecommunication cables.

B. Provide separation clearances in accordance with Section 27 10 00.

C. Install the telecommunication pathways in accordance with requirements for Installation of General Conduit and General Boxes above unless superceded by more stringent requirements of this section or ANSI/EIA/TIA568-B and the latest published edition of the BICSI Telecommunication Distribution Methods Manual guidelines and recommendations.

D. Provide pathways for all telecommunication cables with Surface Raceway, Conduit, Cable tray, J-hooks, and chases for the entire length of each cable. Provide pathway capacity throughout entire system for each telecommunication outlet served sized to accommodate a minimum of four 4-pair 100-Ohm UTP cables from each outlet location to telecommunication room denoted on the plans.

E. Conduit Pathways:
   1. Install pull boxes in continuous straight runs of conduit longer than 100 feet.
   2. Maximum allowable continuous conduit section length of 100 feet between pull boxes.
   3. Contain no more than two 90-degree bends or de-rate conduit capacity 15% for up to one additional 90-degree bend. Conduits less than 33 feet long, oversized one trade size or with one of the 90-degree bends within 12 inches of a pull box may have up to three 90 degree bends without de-rating.
   4. Rate each offset as a 90-degree bend.

5. Bond each conduit to telecommunication ground system.
6. Condulets (LB fittings) shall not be installed in any telecommunications raceway.
7. Do not use flexible metal conduit unless specifically noted on the plans or approved by the engineer where it is the only practical alternative. Increase raceway one trade size above required size where flexible metal conduit is used.
8. Terminate conduits routed to cable trays within 6 inches of tray. Provide conduit support to building structure within 24 inches of cable tray.
9. Terminate conduits and chases that protrude through floor in telecommunication rooms to 3 inches above finished floor. Terminate conduits and chases that protrude through finished ceiling or above within 12 inches of ladder rack, distribution frame or cable organizer.
10. Provide bend radius of 6 times of the internal conduit diameter of conduits up to 2 inches; 10 times of the internal conduit diameter of conduits above 2 inches and for all fiber optic raceways.
11. Provide conduit pathways through walls with insulated bushings on each end for all wall penetrations of cables.
12. Provide minimum conduit size of ¾ inch. Size all other conduits, sleeves and chases according to the following table:

Conduit Trade size	Conduit Maximum Cable Capacity Based on two 90 degree bends and < 100 ft (Inches OD of Cable)									
	(0.13”)	(0.18”)	(0.22”)	(0.24”)	(0.29”)	(0.31”)	(0.37”)	(0.53”)	(0.62”)	(0.70”)
0.75”	6	5	4	3	2	2	1	0	0	0
1”	8	8	7	6	3	3	2	1	0	0
1.25”	16	14	12	10	6	4	3	1	1	1
1.5”	20	18	16	15	7	6	4	2	1	1
2”	30	26	22	20	14	12	7	4	3	2
2.5”	45	40	36	30	17	14	12	6	3	3
3”	70	60	50	40	20	20	17	7	6	6
3.5”							22	12	7	6
4”							30	14	12	7

F. Provide J-Hooks in accordance with Section 27 05 29 to provide telecommunication pathway anywhere conduit is not denoted on the plans and one or more telecommunication cables are routed.

G. Provide innerduct the entire length in conduits denoted to contain innerducts. Size innerducts to use entire available capacity of the outer conduit.

H. Do not install innerduct and other cables in the same raceway.

3.6 INSTALLATION – TELECOMMUNICATION BOXES

A. Boxes:
   1. All boxes shall be readily accessible.
   2. Do not use boxes for angle pulls or change pathway direction. Locate pull boxes in straight through sections of horizontal conduit pathways.
   3. Provide pull boxes for 3/4-inch and 1-inch through pull for horizontal UTP cabling. Provide all other boxes sized per the following table:

Maximum Trade Size Conduit	Minimum Size of Pull Box in Inches			For each additional conduit increase width in inches
	Width	Length (direction of conduit)	Depth	
0.75”	4	12	3	2
1”	4	16	3	2
1.25”	6	20	3	3
1.5”	8	27	4	4
2”	8	36	4	5
2.5”	10	42	5	6
3”	12	48	5	6
3.5”	12	54	6	6
4”	15	60	8	8

END OF SECTION

SECTION 26 05 36
CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cable trays.

B. Cable tray accessories.

1.2 RELATED SECTIONS

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems.

1.3 REFERENCES

A. NEMA VE 1 - Cable Tray Systems.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

B. Indicate tray type, dimensions, support points, finishes and load data.

C. Submit manufacturer's installation instructions under provisions of Division 01.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include cleaning and bolt-tightening procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. B-Line.

B. P & W.

C. Square D.

D. Cablofil “EZ-Tray”.

E. GS Metals “FlexTray”.

F. CMS “Snake Tray”.

G. Mono-Systems “Mono-Mesh”.

H. Substitutions: Under provisions of Division 01.

2.2 FLEXIBLE CABLE TRAYS

A. Tray: U.L. listed, continuous, rigid, welded steel wire mesh cable tray with welded intersections and continuous safety edge T-welded wire lip.

B. Material and Finish of Tray, Fittings, and Accessories:
   1. Material: Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.
   2. Finish: Electro-Plated Zinc Galvanizing: ASTM B 633, Type III, SC-1. Hot-Dip Galvanizing: ASTM A 123.

C. Nominal Dimensions:
   1. Mesh: 2 by 4 inches.
   2. Straight Section Lengths: 80 inches.
   3. Width: 12 inches.
   4. Internal Depth: 2 inches.
   5. Wire Diameter: .177 inch, minimum.

D. Fittings: Field fabricated from straight sections in accordance with manufacturer's instructions.

E. Accessories and Fittings: Manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, shielding divider strips, connectors, elbows, tees, crosses, risers, dropouts, grounding lugs and other accessories as required for a complete system.

F. Covers: Solid covers, pre-galvanized steel, width to match tray.

2.3 WARNING SIGNS

A. Engraved Nameplates: ½ inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: In conformance with NEMA VE 1 requirements and in accordance with manufacturer's instructions.

B. Assemble cable trays so that joints are not made at support brackets. Install trays level, straight and true to line or grade within plus or minus 1/8 inch in 10 feet and within an accumulative maximum of ½ inch. Make vertical structures plum within a tolerance of 1/8 inch. Install trays to leave no exposed raw edges.

C. Use expansion connectors where indicated in NEMA VE 1.

D. Cut standard straight sections to length in field. Cut wires in one clean cut using side action bolt cutters to eliminate grinding or touch-up.

E. Install warning signs at 50-foot centers along route of cable tray, located to be visible.

F. Provide bonding continuity between cable tray sections and fittings in accordance with manufacturer's instructions. Make connections to aluminum tray and fittings using an anti-oxidant compound.

G. Securely fasten all wires, cables, and bundles to the tray with nylon cable straps to maintain their relative positions in the trays. On horizontal runs, install the fastenings at a maximum interval of 15 feet. On vertical runs, the maximum interval shall be 5 feet.

H. Attach cable tray to structural walls and ceilings as required to route cable tray around existing mechanical piping and ductwork.

I. Where cable tray penetrates fire rated floors, ceilings, or walls, fire stop the opening in accordance with Section 26 05 29 and Division 07.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Wire markers.

D. Conduit markers.

E. Working clearance striping.

F. Low-voltage one-line diagrams and system maps.

1.2 RELATED WORK

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.

B. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables..

C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

D. Section 26 27 26 – Wiring Devices

E. Section 27 10 00 – Structured Cabling.

F. Section 28 31 00 – Fire Detection and Alarm.

1.3 SUBMITTALS

A. Division 01 and Section 26 05 00 – Common Work Results for Electrical.

B. Product Data:
   1. Submit manufacturer’s catalog literature for each product required.
   2. Submit electrical identification schedule including list of wording, symbols, letter size, color-coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Prior to installation, submit power one-line diagram and panel map for review.

E. Prior to Substantial Completion, submit copies of all panel schedules for review by the Owner. The Owner will note any changes to the room numbers/names and the Contractor shall provide revised typed panel schedules to reflect all changes, at no additional cost to the Owner.

F. Electrical One-Line Diagrams and Panel Maps: Provide electronically in AutoCAD format, submitted with the O&M manuals.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Install labels and nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Product Description: Laminated three-layer plastic with engraved white letters on black background. Nameplate for service disconnect shall be engraved white letters on red background.

B. Letter Size:
   1. 1/4-inch high letters for identifying individual panel or equipment.
   2. 1/8-inch high letters for remaining lines with 1/8 inch spacing between lines.

C. Minimum nameplate size: 1/8 inch thick with a consistent length and height for each type of nameplate wherever installed on the project.

2.2 TAPE LABELS

A. Product Description: Adhesive tape labels, with 3/16 inch Bold Black letters on clear background made using Dymo RhinoPro 5000 label printer or approved equal.

B. Embossed adhesive tape will <u>not</u> be permitted for any application.

2.4 WIRE MARKERS

A. Power and Lighting Description: Cloth tape type wire markers for all neutrals and Phase conductors.

B. Low Voltage System Description: Self-adhesive machine printed label with unique wire number that is shown on shop drawing for system.

C. Telecommunications Cable Markers: Self-laminating vinyl with translucent band and minimum 1”W x .5”H printable area with matte white finish. Brady #B-427 series or approved equal.

2.5 FIRE ALARM CONDUIT AND BOX IDENTIFICATION

A. Product Description: Red spray paint for fire alarm boxes.

B. Fire alarm conduit shall have red finish, as specified in Section 26 05 33.

2.6 WORKING CLEARANCE STRIPING

A. Product description: 2” wide epoxy yellow paint with 2 inch high block letters within the clearance area to read: “ELECTRICAL CLEARANCE – NO STORAGE WITHIN THIS ZONE”.

2.7 LOW-VOLTAGE SYSTEMS ONE-LINE DIAGRAMS AND MAPS

A. Provide one-line diagrams and system maps for low-voltage and special systems, such as fire, telecommunications, etc. Requirements are specified in individual specification sections for each system.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

3.2 NAMEPLATE INSTALLATION

A. Secure nameplates to equipment fronts using machine screws tapped and threaded into panelboard, or using rivets. The use of adhesives is not acceptable. Machine screws to not protrude more than 1/16 inch on back side.

B. Distribution Panel Nameplates:
   1. Provide overall equipment identification.
      a. Line 1: Distribution panel name.
      b. Line 2: Source which panelboard is fed.
      c. Line 3: Voltage, phase and wire configuration.
      d. Line 4: AIC rating of the panel.
      e. Line 5: Where applicable, indicate that panel is series-rated.
   2. Provide circuit breaker identification for each feeder breaker.

a. Line 1: Name of panelboard or equipment served.
b. Line 2: Location of served panelboard.

C. Branch Panelboard Nameplates:
1. Provide nameplate for each panelboard with the following information:
a. Line 1: Panelboard name.
b. Line 2: Source from which the panelboard is fed.
c. Line 3: Voltage, phase and wire configuration.
d. Line 4: AIC rating of the panelboard.

D. Disconnects, Starters, or Contactors:
1. Provide nameplate for each device with the following information:
a. Line 1: Load served.
b. Line 2: Panelboard and circuit number from which the device is fed.
c. Line 3: Fuse or Circuit amperage and poles. Where fused disconnect is installed, denote the maximum fuse size to be installed.

E. Control or Low Voltage System Panels:
1. Provide nameplate for each control panel with the following information:
a. Line 1: Unique panel name as shown on the shop drawings.
b. Line 2: System description such as Fire Alarm, BAS, etc.
c. Line 3: Panelboard and circuit number from which the panel is fed if applicable.

3.3 LABEL INSTALLATION

A. Conduit Feeder Labels - Provide conduit labels on all feeder raceways as follows:
1. Distribution Panels – “PANEL xxxx IN ROOM #xxx”.
2. Panelboards – “PANEL xxxx FED FROM MDP xxx”.

B. Spare Raceways: Provide raceway label on each individual raceway denoting the source and termination point at each end.

C. Fire Alarm Device Labels: As specified in Section 28 31 00.

D. Low-Voltage System Device Labels: Provide label on each device, denoting device ID or address where applicable. Affix label to device faceplate for ceiling-mounted devices or wall-mounted devices above 8’-0” AFF. Affix label inside backbox for exterior devices.

3.4 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identification shall be as follows:
   1. Markers shall be located within one inch of each cable end, except at panelboards, where markers for branch circuit conductors shall be visible without removing panel deadfront.
   2. Each wire and cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.
   3. Color code phases, neutral, and ground per NEC requirements and Section 26 05 19.
   4. Color-code all low-voltage system wires and cables in accordance with the individual sections in which they are specified.
   5. For power and lighting circuits, identify with branch circuit or feeder number.
   6. Control Circuits: Control wire number as indicated on schematic and shop drawings.
   7. Fire Alarm Circuits: Provide cable markers showing NAC or SLC loop identification number at all fire alarm junction boxes and pullboxes.
   8. Provide cable markers on each cable, indicating device designation (e.g. “Camera 27”) for all sound systems, CCTV, and CATV systems. Cables shall be labeled at each end, as well as at any intermediate junction boxes or pullboxes.

B. Provide pull string markers at each end of all pull strings. Marker shall identify the location of the opposite end of the pull string.

3.5 JUNCTION BOX IDENTIFICATION

A. Fire Alarm: In accessible ceiling spaces, exposed ceiling spaces, mechanical/electrical rooms, and other non-public spaces, paint fire alarm junction boxes and pullboxes with red spray paint. In all finished spaces where fire alarm boxes are visible, they shall be painted to match the surrounding finish. If there are any questions as to whether fire alarm boxes shall be painted red in a specific area, the Contractor shall get clarification from the Owner prior to painting.

B. Label each lighting and power junction box with the panelboard name and circuit number.

C. For junction boxes above ceilings, mark the box cover with the circuit or system designation using permanent black marker. For junction boxes in finished areas, mark the inside of the cover with the circuit or system designation using permanent black marker.

3.6 DEVICE PLATE IDENTIFICATION

A. Label each receptacle device plate or point of connection denoting the panelboard name and circuit number.

B. Install adhesive label on the top of each plate.

3.7 PANELBOARD IDENTIFICATION

A. Provide panelboard circuit directories as shown on drawings.

3.8 LOW-VOLTAGE SYSTEM IDENTIFICATION

A. Install all labeling in accordance with the requirements of this section and of each section where the individual systems are specified.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Occupancy sensors.

D. Device plates and box covers.

1.2 RELATED SECTIONS

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 - General Requirements and Section 26 05 00 – Common Work Results for Electrical.

B. Section 26 05 26 – Grounding and Bonding for Electrical Systems

C. Section 26 05 33 – Raceway and Boxes for Electrical Systems

D. Section 26 05 53 – Identification for Electrical Systems

1.3 REFERENCE STANDARDS

A. FS W-C-596 – Federal Specification for Electrical Power Connector, Plug, Receptacle, and Cable Outlet.

B. FS W-S-896 – Federal Specification for Switches, Toggle (Toggle And Lock), Flush Mounted.

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. ANSI/NEMA WD 6 – Wiring Devices – Dimensional Requirement

E. UL 20 – General-Use Snap Switches

F. UL 498 - Attachment Plugs and Receptacles

G. UL 943 – Ground-Fault-Circuit-Interrupters

1.4 SUBMITTALS

A. Product Data: Submit product data for all components provided that are specified in this section showing configurations, finishes, and dimensions. Each catalog sheet should be clearly marked to indicate exact part number provided, including all options and accessories.

B. Fixture Compatibility: Submitted occupancy sensors shall have wattage ratings to match the circuits on which they are connected and shall be compatible with submitted lamps and ballasts in the fixtures which they will control.

C. Submit scaled shop drawings of occupancy sensor layout, showing coverage areas and any overlap areas. Shop drawings shall be prepared by occupancy sensor manufacturer. The occupancy sensors on the Contract Drawings are shown in suggested locations. The final quantity, locations, coverage areas, and aiming directions of all sensors shall be determined by the occupancy sensor manufacturer and shown on the shop drawings. Final sensor layout in the rooms shall be coordinated with air diffuser locations to avoid false ON signals. Sensor layout shall also be coordinated with furniture and equipment locations to avoid false OFF signals, due to obstruction of sensors. This coordination is the responsibility of the Contractor.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Drawings: Indicate actual locations and mounting heights of all wiring devices on the project record drawings.

B. Operation and Maintenance Manuals: Submit manufacturer's instructions for occupancy sensor maintenance and adjustment.

1.6 SPARE PARTS

A. Keyed Light Switches: Provide Owner 2 keys to operate switches.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - WALL SWITCHES

A. Hubbell.

B. Leviton.

C. Pass & Seymour.

D. Arrow Hart.

E. Bryant.

F. Substitutions: Under provisions of Division 01.

2.2 WALL SWITCHES

A. Wall Switches for Lighting Circuits: UL 20; NEMA WD 1; and Federal Specification FS W-S-896 AC industrial grade snap switch with toggle handle, rated 20 amperes and 120-277 volts AC. Handle: White nylon. Provide single-pole, 3-ways as indicated on Plans.

2.3 ACCEPTABLE MANUFACTURERS – WALL DIMMERS

A. Lutron.

B. Prescolite.

C. Lightolier.

D. Substitutions: Under Provisions of Division 01.

2.4 WALL DIMMERS

A. Wall Dimmers: Commercial grade, linear slide type, color to match other wiring devices. Device color shall match other switches.

B. Rating: 600 Watts minimum, larger size to accommodate load shown on Contract Drawings.

2.5 ACCEPTABLE MANUFACTURERS - RECEPTACLES

A. Hubbell.

B. Leviton.

C. Pass & Seymour.

D. Arrow Hart.

E. Bryant.

F. Substitutions: Under provisions of Division 01.

2.6 RECEPTACLES

A. Convenience and Straight-blade Receptacles: UL 498, NEMA WD 1 and Federal Specification FS W-C-596 industrial grade receptacle.

B. Locking-Blade Receptacles: NEMA WD 5.

C. Convenience Receptacle Configuration: NEMA WD 1; Type 5-20R, white nylon face.

D. Specific-use Receptacle Configuration: NEMA WD 1 or WD 5; type as indicated on Drawings, black phenolic face.

E. GFCI Receptacles: 20A, duplex convenience receptacle with integral class 'A' ground fault current interrupter, LED indicator lamp, and integral lockout function.

2.7 ACCEPTABLE MANUFACTURERS – OCCUPANCY SENSORS

A. Hubbell.

B. Leviton.

C. Lithonia.

D. Novitas.

E. Wattstopper.

F. Substitutions: Under provisions of Division 01.

2.8 OCCUPANCY SENSORS

A. Ceiling-Mounted Dual-Tech Occupancy Sensor: Dual-technology PIR and ultrasonic sensor with white housing, self-adjusting settings, automatic dual-mode operation, built-in circadian calendar for testing, red/green LEDs for indication of PIR/ultrasonic motion, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area and either 180° or 360° coverage patterns, as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have four selectable timer settings between 8 and 30 minutes. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage.

B. Ceiling-Mounted Ultrasonic Occupancy Sensor: Ultrasonic sensor with white housing, self-adjusting settings, built-in circadian calendar for testing, green LED for indication of ultrasonic motion, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area as required in the space to prevent unintentional tripping in adjacent spaces Sensor shall have four selectable timer settings between 8 and 30 minutes. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage. Device color shall match wall switches.

C. Wall-Mounted Dual-Technology Occupancy Sensor: Multi-technology PIR and ultrasonic sensor with 1600 sq. ft. coverage area, white housing, self-adjusting settings, automatic dual-mode operation, built-in circadian calendar for testing, red/green LEDs for indication of PIR/ultrasonic motion, and non-volatile memory to retain automatic and manual settings during power outages. Provide specific coverage area and either 180° or 360° coverage patterns, as required in the space to prevent unintentional tripping in adjacent spaces. Sensor shall have four selectable timer settings between 30 seconds and 20 minutes. Sensor shall retain all manually adjusted or "learned" settings in event of a power outage.

D. Single-Relay, Dual-Tech Occupancy Sensor Wall Switch: Decora style, dual-technology, PIR and ultrasonic sensor with self-adjusting delayed-OFF time interval, self-adjusting ambient light override, 180° adjustable field of view, "walk-through" feature, manual ON/OFF pushbutton, LED indicator light to verify that detection is active, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have four selectable timer settings between 4 and 30 minutes. Device color shall match other switches. Fluorescent Ratings: 1800VA @120V, 4000VA @ 277V. Incandescent Ratings: 1800W @ 120V.

E. Dual-Relay, Dual-Tech Occupancy Sensor Wall Switch: Decora style dual-technology, PIR and ultrasonic sensor suitable for switching two separate banks of lights from a single unit. Sensor shall have self-adjusting delayed-OFF time interval, self-adjusting ambient light override, 180° adjustable field of view, "walk-through" feature, two manual ON/OFF pushbuttons, LED indicator light to verify that detection is active, and non-volatile memory to retain automatic and manual settings during power outages. Sensor shall have four selectable timer settings between 4 and 30 minutes. Device color shall match other switches. Fluorescent Ratings: Primary Relay - 1200VA @120V, 2700VA @ 277V; Secondary Relay - 800VA @ 120V, 1200VA @ 277V. Incandescent Ratings: Primary/Secondary Relay - 800W @ 120V.

F. Sensor Power Packs: Provide sensor power packs as recommended by the sensor manufacturer and as required for all connected devices and the specified sequence of operation. Note that control of fixtures with multi-level switching may require additional power packs.

G. Sensor Masking: Infrared and dual-technology sensors shall include masking segments for adjusting the coverage of the infrared sensor to avoid false-tripping. If masking is not included with sensor, it shall be provided by Contractor at no additional cost to the Owner.

2.9 ACCEPTABLE MANUFACTURERS – DAYLIGHT SENSORS

A. Nexlight.

B. Hubbell.

C. Substitutions: Under provision of Division 01.

2.10 DAYLIGHT SENSORS

A. Ceiling-Mounted Dual-Tech Occupancy Sensor with integrated daylight sensor: Dual-technology PIR and ultrasonic sensor with white housing, self-adjusting settings, automatic dual-mode operation, built-in circadian calendar for testing, red/green LEDs for indication of PIR/ultrasonic motion, and non-volatile memory to retain automatic and manual settings during power outages. The integrated daylight sensor allows for ambient light override functionality.

2.11 ACCEPTABLE MANUFACTURERS – DEVICE PLATES

A. Hubbell.

B. Leviton.

C. Pass & Seymour.

D. Mullberry.

E. Red Dot.

F. Raco.

G. Substitutions: Under provisions of Division 01.

2.12 DEVICE PLATES

A. Decorative Cover Plate: Smooth 430 or 302 stainless steel.

B. Weatherproof Cover Plate: UL listed, cast aluminum, hinged outlet cover/enclosure, with gasket between the enclosure and the mounting surface, suitable for wet locations while in use.

C. Exposed Work Cover Plate: ½ inch raised, square, pressed, galvanized or cadmium plated steel cover plate supporting devices independent of the outlet box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall switches 48 inches above floor, OFF position down.

B. Unless otherwise noted install wall switches within 6 inches of the door jamb on the strike side.

C. Install wall dimmers 48 inches above floor; derate ganged dimmers as instructed by manufacturer; do not use common neutral.

D. Install convenience receptacles 18 inches above floor, 4 inches above counters or backsplash, grounding pole on bottom.

E. Install specific-use receptacles at heights shown on Contract Drawings.

F. Unless otherwise noted, mounting heights are for finished floor to center line of outlet.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas. Use midsize or jumbo plates for outlets installed in masonry walls, where required to cover up imperfections in the wall opening.

H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

I. Install devices and wall plates flush and level.

J. Ground receptacles to boxes with a grounding wire. Grounding through the yoke or screw contact is not an acceptable alternate to the ground wire.

K. Install circuit label on each receptacle and light switch in accordance with Section 26 05 53.

3.2 OCCUPANCY SENSOR TESTING AND CALIBRATION

A. Set the “Delayed Off” time on all sensors to 30 minutes.

B. Do not activate the “Ambient Light Override” feature on any occupancy sensors.

C. Daylight sensors: Activate the “daylight override mode” feature on daylight sensor to controlled lighting load will only turn on if the ambient light present is less than the preset level.

D. Wall Sensors:
   1. Provide masking on infrared lens to restrict field of view if necessary to prevent unwanted switching from adjacent spaces such as hallways.

E. Ceiling Sensors:
   1. Provide masking on infrared lens to restrict field of view if necessary to prevent unwanted switching from adjacent spaces such as hallways.
   2. Adjust range on sensor to match room size, as a percentage of total sensor coverage. Example: For a 10’ x 10’ room, the maximum

sensing distance in front of the sensor (40') is adjusted down to the minimum setting of 36% coverage.

3. Adjust the PIR and ultrasonic sensitivity settings as required to avoid false tripping due to air movement.

F. Immediately prior to the start of the Engineer/Owner inspection, the Contractor shall ensure that all light switches are in the ON position in rooms where ceiling occupancy sensors are installed. The intent is that the sensors are energized and ready for testing during the inspection, without having to turn the light switches on and then wait for the sensors to time out and turn the lights off.

END OF SECTION

SECTION 26 29 13
ENCLOSED CONTROLLER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Manual motor starters.

B. Magnetic motor starters.

C. Combination magnetic motor starters.

1.2 RELATED WORK

A. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)

B. Section 26 05 29 – Hangars and Supports for Electrical Systems

C. Section 26 05 53 – Identification for Electrical System

1.3 REFERENCES

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements.

B. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

C. NEMA AB 1 - Molded Case Circuit Breakers.

D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

C. Submit manufacturers' instructions under provisions of Division 01.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Division 01.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Store and protect products under provisions of Division 01.

C. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle in accordance with manufacturer's written instructions. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.7 SPARE PARTS

A. Keys: Furnish 2 each to Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - MOTOR STARTERS

A. Square D.

B. Allen Bradley.

C. Siemens.

D. Cutler Hammer.

E. Substitutions: Under provisions of Division 01.

2.2 MANUAL MOTOR STARTERS

A. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, number of poles as required by the load served, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and toggle operator.

B. Enclosure: ANSI/NEMA ICS 6; Type 1, 3R or 4. As indicated on the Drawings.

2.3 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.

B. Full Voltage Starting: Non-reversing type.

C. Coil Operating Voltage: 120 volts, Hertz

D. Size: NEMA ICS 2; size as required by the load served.

E. Overload Relay: NEMA ICS 2; bimetal.

F. Enclosure: NEMA ICS 6; Type 1 or 3R as shown on the drawings.

G. Combination Motor Starters: Combine motor starters with motor circuit protector disconnect in common enclosure.

H. Auxiliary Contacts: NEMA ICS 2; two field convertible contacts in addition to seal-in contact.

I. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

J. Control Power Transformers: 120 volt secondary, VA capacity as required by the load served in each motor starter.

K. Power Monitor: Include a three-phase power monitor in each magnetic starter connected to shut down the motor on loss of any phase, phase reversal, or low voltage on any phase. Power monitor shall automatically reset and restart motor when phase and voltage conditions return to normal. Provide oversize starter enclosures as required to install power monitor.

2.4 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

A. Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions.

B. Select and install heater elements in motor starters to match installed motor characteristics.

C. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

D. After final connections are made, check and correct the rotation of all motors.

E. Field adjust the trip settings of all motor starter magnetic trip only circuit breakers to approximately 11 times motor full load current. Determine full load current from motor nameplate following installation.

F. Motor starting equipment shall be listed for use with the motors specified under Division 15.

G. All motor control centers shall have signage for arc hazard installed. The marking shall be located to be clearly visible to qualified personnel before examination, adjustment, servicing or maintenance of the equipment. At a minimum the signage shall state the following:

Warning

Arc Flash and Shock Hazard

Appropriate PPE Required

END OF SECTION

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Interior Luminaires and Accessories.

B. Lamps.

C. Ballasts.

D. Fluorescent Luminaire Disconnect.

1.2 RELATED WORK

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.

B. Division 09 – Finishes: Painting and ceilings.

C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

D. Section 26 05 29 - Hangers And Supports For Electrical Systems.

E. Section 26 52 00 - Emergency Lighting.

1.3 REFERENCES

A. ANSI C62.41 – Specification for Surge Voltages in AC Power Circuits Rated up to 600V

B. ANSI C82.11 - Specification for High-Frequency Operation Of Fluorescent Lamp Ballasts

C. USGBC LEED NC 2.2 – Leadership in Energy and Environmental Design.

D. UL 935 – Specification for Fluorescent-Lamp Ballasts.

1.4 SUBMITTALS

A. Product Data: Submit the following:
   1. Luminaires: Include manufacturer's product data sheets and/or shop drawings including outline drawings showing support points, weights, and accessory information for each luminaire type.

2. Lamps: Submit manufacturer's product data sheets for each lamp used on the project. Indicate luminaire type where each lamp is used.
3. Ballasts: Submit manufacturer's product data sheets for each different type of ballasts used on the project. Indicate which luminaires each ballast is used in.

B. Interior Fixture Substitutions: Submit calculations to show that substitute interior lighting fixtures meet or exceed the lighting levels, uniformity ratios, fixture electrical load (less than or equal) to comply with designed energy efficiency per anticipated LEED EA1.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Drawings: Indicate actual locations and mounting heights of all lighting fixtures and accessories on the project record drawings.

B. Operation and Maintenance Manuals:
1. Provide recommended luminaire cleaning and re-lamping schedule. If any luminaire lenses require special lubricants for cleaning, include this in the schedule.
2. Provide detailed bill of materials for all items purchased in this section including distributor's contact name, phone number and pertinent information.
3. Provide luminaire manufacturer's installation instructions.
4. Include any specific warranty information provided by the manufacturer for luminaires, lamps and ballasts.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store and protect under provisions of Division 01.

1.7 EXTRA STOCK

A. Provide spare parts under provisions of Division 01.

B. Lamps: Provide one carton (30 lamps) of T5 lamps and 10 of each size of compact fluorescent lamps installed.

C. Lenses: Three percent of quantity furnished, minimum of one of each size and type.

D. Ballasts: Five of each size and type installed.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES

A. Luminaires: Provide UL listed luminaires as scheduled on the drawings or as approved equal.

B. Listing: Luminaires shall be listed for use in the environment in which they are installed. For example, luminaires installed in return air plenums, direct contact with insulation, or in hazardous, wet, damp, or corrosive locations shall be UL listed for such application.

C. Accessories: Provide all mounting kits, supports, interconnecting wiring, power supplies, trim kits, gaskets, etc. for a complete installation.

2.2 ACCEPTABLE MANUFACTURERS - LAMPS

A. General Electric to match existing.

2.3 LAMPS - FLUORESCENT

A. All fluorescent lamp wattages and types shall be as scheduled on the Plans with a configuration and pin base as required for installation in the specified light fixtures.

B. All fluorescent lamps shall be low-mercury type that passes the Toxicity Characteristic Leaching Procedure (TCLP) test at end of life.

C. T5 Fluorescent Lamps (T5): 3500° K, tri-phosphor, linear fluorescent lamp with a minimum CRI of 85, and rated life of 20,000 hours (based on 3 hours per start using programmed start ballast). Acceptable Manufacturer/Model: GE “Starcoat Ecolux XL Extra-Life” to match existing lamps on the campus.

2.4 ACCEPTABLE MANUFACTURERS - BALLASTS

A. Advance.

B. Osram/Sylvania.

C. Universal.

D. Substitutions: Under provisions of Division 01.

2.5 BALLASTS - FLUORESCENT

A. All fluorescent ballasts shall have the following minimum criteria:
   1. Ballasts shall operate with no visible flicker (<3% flicker index) from 60 Hz input source of 120 through 277 Volts, and sustain variations of ± 10% (Voltage & Frequency) with no damage to the ballasts.

2. Ballast shall have Class “A” sound rating, a Power Factor greater than 98% when used with primary lamp, and a Lamp Current Crest Factor (ratio of peak to RMS current) of 1.7 or less in accordance with lamp manufacturer recommendation and ANSI C82.11-1993.
3. Input current Total Harmonic Distortion shall not exceed 10% for the primary lamp.
4. Ballasts shall comply with FCC Part 18 Non-Consumer Equipment for EMI (power line conducted) and RFI (Radiated), shall provide transient immunity as recommended by ANSI C62.41-1991, Location A2, and shall tolerate sustained open circuit and short circuit output conditions without damage.
5. Ballasts shall be Underwriters Laboratory (UL 935) listed, Class P, Type 1 Outdoor, and CSA certified where applicable.
6. Ballasts shall have a five year warranty.

B. T5 Electronic Step-Dimming Ballasts: Provide multi-volt (120-277V), programmed start, high power factor type (above 95% or above), operating lamps at a frequency of 42 kHz or higher with a ballast factor between 0.81 and 1.0. Ballast shall contain a lamp End-Of-Life (EOL) detection and shut down circuit in accordance with ANSI/IEC proposed standard Ballast shall have a minimum start temperature of 0°F, a maximum ionization current (glow current) of 10mA during the preheating interval and shall have a minimum Rh/Rc ratio (resistance measured hot vs. room temperature) >4.00 to ensure proper lamp starting. Ballast shall vary the light output of all connected lamps using two pre-defined ballast factor control levels: 50% and 100% of the rated input power. Basis of Design: Universal “Ballastar” system.

C. Electronic Continuous Dimming Fluorescent Ballast: UL listed, Class P, high power factor (above 95%), Class “A” sound rated, electronic type. Ballasts shall provide smooth and continuous dimming without flicker down to 5% light output as scheduled on Plans. Ballasts and controls shall be by the same (or compatible) manufacturer and shall be capable of striking lamps at any light level without first flashing to full light.

2.6 FLUORESCENT LUMINAIRE DISCONNECT

A. UL listed, 4A, 600V, luminaire disconnect with tin-plated brass contacts, finger-safe polycarbonate female housing, 105º C temperature rating, and two or three-pole configuration to match load served. Ideal “PowerPlug” series or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lamps in luminaires and lampholders.

B. Unless otherwise noted on Plans, provide ballast integral to luminaires, pre-wired and installed at the factory, suitable for use with the selected lamp.

C. Step-Dimming Ballasts: All fluorescent lamps used with step-dimming ballasts shall be burned-in for a minimum of 12 hours at 100% output prior to dimming.

D. Continuous Dimming Ballasts: All fluorescent lamps used with continuous dimming ballasts shall be burned-in for a minimum of 100 hours at 100% output prior to dimming.

E. Support surface-mounted luminaires directly from building structure.

F. Install recessed luminaires to permit removal from below. Use plaster frames in hard ceilings.

G. Support luminaries in suspended ceilings from structure above using a minimum of (4) anchors in accordance with Section 26 05 29.

H. Rigidly align continuous rows of lighting fixtures for true in-line appearance.

I. Provide luminaire disconnecting means in ballast channel of each fluorescent fixture in accordance with NEC requirements. Where the luminaire is fed from a multi-wire branch circuit, provide multi-pole disconnect to simultaneously break all supply conductors to the ballast, including the grounded conductor.

3.2 RELAMPING

A. Re-lamp luminaires that have failed lamps at completion of Work.

3.3 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Touch up luminaire finish at completion of work.

END OF SECTION

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SECTION 26 52 00
EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Emergency exit signs.

B. Emergency ballast power supplies.

1.2 RELATED SECTIONS

A. The Work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 01 General Requirements, and Section 26 05 00 – Common Work Results for Electrical.

B. Section 26 05 19 – Low Voltage Power Conductor and Cables.

C. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

D. Section 26 05 53 – Identification for Electrical Systems.

E. Section 26 50 00 – Interior Lighting.

1.3 REFERENCE STANDARDS

A. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.

B. NECA/IESNA 500 – Recommended Practice for Installation Indoor Commercial Lighting System.

C. UL 924 - Emergency Lighting and Power Equipment.

1.4 REGULATORY REQUIREMENTS

A. Conform to State and local building code and NFPA 101 for installation requirements.

B. Furnish emergency lighting units and exit signs that are UL 924 listed and labeled for their indicated use and location on this project.

1.5 WARRANTY

A. Emergency Lighting Units: Submit a warranty, mutually executed by the manufacturer and the installer, agreeing to replace emergency lighting units

that fail in materials or workmanship within five years, beginning on the date of manufacturer.

B. LED Exit Signs: Submit a warranty, mutually executed by the manufacturer and the installed, agreeing to replace LED exit signs that fail in materials or workmanship within five years, beginning on the date of substantial completion.

C. Emergency Ballasts and Inverters: Three year warranty minimum.

1.6 SUBMITTALS

A. Product Data: Submit product data under describing emergency lighting including data substantiating that materials comply with specified requirements. Arrange data for luminaires in the order of fixture designation.

B. Provide product data on emergency lighting units, exit signs, emergency ballasts, emergency lighting inverters and emergency fluorescent lamp power supply units.

C. Performance Curves/Data: Submit certified photometric data for emergency lighting units.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Manuals: Submit maintenance instructions for inclusion in the operating and maintenance manuals.

PART 2 - PRODUCTS

2.1 EXIT SIGNS

A. Provide exit signs as scheduled on the Plans or approved equal.

2.2 ACCEPTABLE MANUFACTURERS –EMERGENCY BALLASTS

A. Bodine.

B. Iota.

C. Lithonia.

D. Substitutions: Under provisions of Division 01.

2.3 EMERGENCY BALLAST

A. Low-Provide T5 Unit: UL listed self-contained, with automatic transfer to battery supply on power failure, including test switch, AC ON pilot light, fully-automatic two-rate charger, End-Of-Life (EOL) detection, maintenance free nickel cadmium battery, and Class P, 120/277V power supply capable of operating one F28T5 lamp with a minimum output of 1250 lumens for a minimum of 90 minutes. Bodine #LP600 or approved equal.

B. LED Unit: UL listed self-contained emergency LED driver with automatic transfer to battery supply on power failure, optional test switch, AC ON pilot light, full-automatic two-rate charger, ni-cad battery, and power supply capable of operating an LED load of up to the rated fixture wattage (as shown on the Plans) at rated current (700mA) for a minimum of 90 minutes. Bodine #BSL series or approved equal.

C. Test Switches:
   1. Standard and Low-Profile Units:
      a. Recessed Linear Fluorescent Fixtures (T5): Mount test switch in ballast channel so that it is accessible from below. In parabolic fixtures, mount test switch so that it is visible and accessible through the louvers. Affix red ballast identification label (supplied with ballast) to door trim on fixture to denote location of emergency ballast.
      b. Pendant Fixtures: Mount test switch in end cap of fixture, at end closest to ballast. Affix red ballast identification label (supplied with ballast) to bottom of fixture housing below test switch to denote location of emergency ballast.
   2. Recessed Downlights: Mount test switch in ceiling, in recessed single-gang box adjacent to downlight.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fluorescent emergency ballast {or single fixture emergency transfer device} in the ballast channel of the fixtures or the mounting tray of compact fluorescent fixtures indicated on the drawings. Provide an unswitched source of power to the emergency ballast from the same circuit that powers the fixture the ballast is installed in.

3.2 FIELD QUALITY CONTROL

A. Tests: Perform tests listed below according to manufacturer's written instructions. Test unit functions, operations, and protective features. Adjust to ensure operation complies with Specifications. Perform tests required by

NFPA 70, Articles 700 and 701. Perform tests on completion of unit installation and after building circuits have been energized. Provide instruments to permit accurate observation of tests. Include the following tests:

1. Simulate power outage: Verify proper operation of each individual emergency power supply.
2. Verify emergency supply duration.
3. Verify operation of remote test switches.
4. Provide reports for load test conducted on individual batteries.

B. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.3 ADJUSTING

A. Test emergency lighting equipment in accordance with the manufacturer's instructions and NECA/IESNA 500.

3.4 CLEANING

A. On completion of installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and abrasions in finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.5 DEMONSTRATION

A. Walk owner's representative through the emergency lighting system. Note how to maintain, test and troubleshoot all units. Provide maintenance schedule for NFPA required testing and note locations of remote test switches, and which units have self-diagnostic features.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for the design and installation of a telecommunications cabling system including communications cable, telecommunications jacks, raceways, etc. as required for a complete and functional telecommunications cabling system.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceways and Boxes for Electrical Systems: Outlet boxes and conduit for communications system.

B. Section 26 05 29 – Hangers and Supports for Electrical Systems: Supports for conduit and racks.

C. Section 26 05 53 –Identification for Electrical Systems: Nameplates for equipment racks.

1.3 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Division 01.

B. Accurately record location of jacks, pull boxes and equipment racks, routing of all telecommunications raceways and cables, numbering scheme and identification number of all cables and jacks.

C. Provide AutoCAD drawings of the facility on contract size sheets and on CD showing the following:
   1. On a separate layer show each telecommunication jack location and indicate each jack and cable number by the jack location.
   2. Show all cable counts at all cable junction boxes, sleeves, and J-hook intersections.
   3. On a separate layer show the cable path from the telecommunications equipment room to the end jack location.

D. Submit test results for all cables prior to Substantial Completion.

1.4 LISTINGS AND STANDARDS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. and suitable for purpose specified and indicated.

B. Where a UL Standard is in effect equipment shall meet that standard and shall bear the UL label.

1.5 REFERENCE CODES AND STANDARDS

A. The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only, latest version. The reference codes and standards are minimum requirements:
   1. ANSI/NFPA 70 National Electrical Code, latest adopted version.
   2. BICSI Telecommunications Distributions Methods Manual.
   3. TIA/EIA 568-C Commercial Building Telecommunications Cable Standard.
   4. TIA/EIA 569-C Commercial Building Standard for Telecommunications Pathways and Spaces.
   5. TIA/EIA 606-A Administration Standards for the Telecommunications Infrastructure of Commercial Buildings.
   6. J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.6 QUALITY ASSURANCE

A. Install all work in accordance with the above reference standards and codes. The Owner reserves the right to reject all or a portion of the work performed either on technical or aesthetic grounds.

B. All telecommunications cabling system layout and installation shall be overseen by a BICSI-certified Registered Communications Distribution Designer (RCDD). The installer shall either have an RCDD on permanent staff or shall have an RCDD on contract for the duration of the project. The RCDD shall sign and attest to all cable distribution design submittals and project record drawings and shall attest to the completeness and accuracy of the system layout and installation.

C. All workmen employed for installation of equipment and cabling specified under this section shall be specifically trained and certified in the installation of the specified Category 6 UTP and fiber optic cabling systems, and shall have at least three years experience installing, terminating, and testing Category 6 UTP and fiber optic cable on this size and complexity of project.

D. The intended function of the telecommunications cable system is to transmit voice and data signals from a central location to individual telecommunications outlet locations. Upon completion of the work, the UTP cable system shall be capable of transmitting a data signal that meets and exceeds the following requirements:
   1. Category 6: Supports data rates up to and including 1 Gb/s.

1.7 SUBMITTALS

A. Submit product data under provisions of Division 01. Provide factory test results for cables and connectors. Provide product data for the following products:
   1. UTP Telecommunications Cable
   2. UTP Telecommunications Jacks and Faceplates
   3. UTP Modular Patch Panel
   4. UTP Patch Cables
   5. Cable Management Panels
   6. UTP Telecommunications Cable Tester
   7. UTP Sample Test Report (with all required testing parameters shown).

B. Submit certification for RCDD.

C. Submit qualifications and certifications to install the specified cabling system.

D. Submit scaled drawings showing the locations of all telecommunications jacks, equipment racks, telecommunications pullboxes, raceway and cable routing, and all penetrations of fire-rated walls and ceilings. Drawings shall show jack labels and cable counts. Provide a complete schedule of all new telecommunications jacks with their jack numbers and associated cable number. Shop drawings shall be approved prior to installation of any portion of the telecommunications system. Electronic AutoCAD® drawings of the facility are available upon request for preparation of the shop drawings.

1.8 LABELING SYSTEM

A. Labeling shall conform to ANSI/TIA/EIA-606 standards. In addition, provide the following:
   1. Labels on all outlets shall have minimum 1/8-in. high characters and shall be installed behind recessed clear plastic covers on faceplate.
   2. Provide labels on face of patch panels. Update the facility assignment records at the telecommunications rack so that it has the new jack ID information.
   3. Labels shall be machine-printed. Hand-lettered labels are not acceptable.
   4. Labeling Scheme: Match the existing labeling scheme currently in use at the facility.
   5. Provide computer-generated Project Record Drawing drawings showing outlet locations, type, and designation. Turn these drawings over to the Owner's Representative prior to substantial completion, to allow the Owner's Personnel to connect and test Owner-provided equipment in a timely fashion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Throughout this specification, specific manufacturers and manufacturer's catalog numbers are cited. These citations are for the purpose of establishing quality and performance criteria and are not intended to be proprietary. All products in the structured cabling system shall be provided from one of the approved manufacturing partnerships listed below, or an alternate system shall be substituted under the provisions of Division 1.
   1. Belden.
   2. Ortronics/Superior Essex.
   3. CommScope Uniprise.
   4. Corning Cable System (Fiber Products).
   5. Hubbell/Mohawk.
   6. Leviton/Berk-Tek.
   7. TE Connectivity (formerly ADC/Krone/Amp).
   8. Substitutions: Under provisions of Division 01.

B. Structured Category 6 cabling systems shall include, but not be limited to, UTP telecommunications cable, UTP jacks, faceplates, modular patch panels, and UTP patch cables.

2.2 TELECOMMUNICATIONS BACKBOARD

A. Material: ACX Plywood, painted to match the surrounding walls with fire-rated paint.

B. Size: As indicated, ¾" thick.

C. Grounding Busbar: Wall-mounted, solid copper, 12 inch by 4 inch by ¼ inch thick busbar with two insulators and standoff brackets. Chatsworth #40153-012 or approved equal.

D. Cable Support: Provide cable management rings and cable support straps for all cables routed on backboard.

2.3 TELEPHONE PUNCHDOWN BLOCKS

A. Wall-mounted type 66 block for cross-connect with incoming telephone utility cable: 50-pair capacity with cable management.
   1. Siemon S66B3-50 or approved equal with S20A cable management.

B. Wall-mounted type 110 wiring block with 100-pair capacity and standoff legs for cross-connect of intra-building telephone backbone cables. Use 5-pair connecting blocks.
   1. Ortronics #OR-30200145 or approved equal.

2.4 TELECOMMUNICATIONS EQUIPMENT RACKS

A. Acceptable Manufacturers – Rack Equipment.
   1. Chatsworth.
   2. Cooper B-Line.
   3. Hubbell.
   4. Ortronics.
   5. Substitutions: Under provisions of Division 01.

B. Floor Racks: Chatsworth #46353-703 or approved equal, seven-foot high, self-supporting, floor mounted, pre-drilled and tapped, 19 inch, aluminum EIA equipment rack with black finish. The floor rack shall have the following features:
   1. Vertical Cable Manager:
      a. One Chatsworth “Evolution Series” #35571-703 or approved equal double-sided 6” wide vertical cable manager with black finish on each side of the rack.
   2. Rack Numbering: Provide RMU numbering on the rack.
   3. Provide 12” wide cable tray (as specified in Section 26 05 36) above rack row, from rack to wall.
   4. Provide Chatsworth #10562-001 or approved equal universal earthquake bracing kit, along with all associated hardware required to seismically brace racks to wall.
   5. One Chatsworth #40172-001 or approved equal vertical rack ground bar kit with pre-punched ground mounting holes. Mount the grounding bar along the front vertical rail of the equipment rack.
   6. One Tripp-Lite #ISOBAR12-20ULTRA or approved equal rack-mounted surge protective outlet strip with 2 NEMA 5-15R outlets (front), 10 NEMA 5-20R outlets (rear), guarded On/Off switch, integral 15-amp circuit breaker, 15-foot cord, and black housing. Outlet strip shall have 3840 joules/96,000 amp network-grade AC surge suppression with EMI/RFI filtering. Mount outlet strip at base of rack.

2.5 UTP TELECOMMUNICATIONS CABLE

A. All UTP telecommunications cables that stay within the building envelope shall be UL listed, plenum-rated CL2P, Category 6, 4 pair, 23-24 AWG, solid copper conductor.
   1. Superior Essex “DataGain” CMP or approved equal.

2.6 UTP TELECOMMUNICATIONS JACKS

A. All UTP telecommunications jacks shall be Category 6, T568A/B, 8P8C, single, white finish, telecommunications jack with flush exit. Unless otherwise noted on the drawings, install each telecommunications jack in a single gang faceplate at each telecommunications outlet. The quantity of faceplate openings shall match the quantity of jacks at each location. The

Contractor shall verify the actual wiring configuration (T568A or 568B) with the Owner prior to submittal.

B. UTP Jacks:
   1. Ortronics “TracJack Clarity 6” #OR-TJ600 for T568A/B wiring.

2.7 TELECOMMUNICATIONS OUTLET FACEPLATES

A. Unless otherwise noted, all faceplates shall be single-gang plastic faceplates with white finish. The number of openings in each faceplate shall match the jack count of each outlet shown on the Drawings. (x in part numbers = designation for number of openings in faceplate).
   1. Ortronics “TracJack” #OR-4030054x or approved equal.

2.8 UTP MODULAR PATCH PANEL

A. Provide and install high-density Category 6, modular patch panels in the existing telecom rack. The front of the patch panels shall be equipped with T568A/B, 8P8C Category 6 compliant jacks. The jacks shall be factory wired to a 110 type IDC connector. The complete assembly shall exceed the requirements of TIA/EIA 568-B (Category 6), and be factory tested to 1000 Mbps data rates. Install the number of patch panels in each equipment rack as shown on the drawings or as required to terminate all UTP cables at the rack plus 25% spare capacity. The Contractor shall verify the actual wiring configuration (T568A or 568B) with the Owner prior to submittal.
   1. 48-port Panel: Ortronics “Clarity6” #OR-PHD66U48 or approved equal.

2.9 UTP CABLE MANAGEMENT PANELS

A. Horizontal cable management panels shall have five metal horizontal cable rings. Unless otherwise noted on the drawings, install one cable management panel between each patch panel and below the last patch panel.
   1. 2 RMU Panel: Ortronics #OR-60400057 or approved equal.

2.10 UTP PATCH CABLES

A. All patch cables shall be factory manufactured to match the applicable cable/connectivity solution (i.e. the Ortronics/Superior Essex system shall use Ortronics manufactured patch cords, etc.).

B. Telephone Cross-Connect: Provide 7-foot Category 6 patch cables with white jacket for cross-connect between the telephone patch panel and the telecommunications patch panels. Provide one patch cable for each port in all the telephone patch panels.
   1. Ortronics #OR-MC607-09 or approved equal.

C. Network Equipment Connections: Provide Category 6 patch cables with blue jacket for installation between network equipment in the rack and dedicated data ports in the telecommunications patch panels. Provide one patch cable for each port in all the telecommunications patch panels. Where the patch panels and switches are in the same rack, provide 7' cables. Where the patch panels and switches are in different racks, provide 15' (14' for CommScope) cables. (xx in part numbers = cable length)
   1. Ortronics #OR-MC6xx-06 or approved equal.

D. Computer/VoIP Connections: Provide 9-foot Category 6 patch cable with white jacket for installation between the data jacks in each telecommunications outlet and the Owner-provided computers. Provide one patch cable for each data jack in all the telecommunications outlets, plus 25% additional cables for future expansion or replacement cables.
   1. Ortronics #OR-MC609-09.

E. Wireless Access Point Connections: Provide 7-foot Category 6 patch cables with white jacket for connection to wireless access points. Provide one patch cable for each access point location shown on the Drawings.
   1. Access Point Connection: Ortronics #OR-MC6 series or approved equal. Contact manufacturer for custom part number for plenum-rated cable.
   2. Network Equipment Connection: Ortronics #OR-MC6xx-09 or approved equal. Where the wireless controller and network switches are in the same rack, provide 7' cables. Where the wireless controller and network switches are in different racks, provide 15' cables. (xx in part numbers = cable length).

F. Computer Connections: Provide 9-foot Category 6 patch cable with white jacket for installation between the data jacks in each telecommunications outlet and the Owner-provided computers. Provide one patch cable for each data jack in all the telecommunications outlets, plus 25% additional cables for future expansion or replacement cables.
   1. Ortronics #OR-MC609-09 or approved equal.

2.11 VOICE BACKBONE CABLE

A. Unless otherwise noted on the drawings provide and install plenum-rated CL2P, as noted on the drawings and as required by the space the cable is passing through, Category 3, 24 AWG, solid copper conductor multi-pair telephone backbone cable. (xx in part numbers = pair count, as shown on Drawings).
   1. Superior Essex #18-xxx-xx or approved equal.

2.12 MULTIMODE FIBER OPTIC BACKBONE CABLE

A. Indoor Multimode Fiber Cables: All multimode fiber optic cables that stay within the building envelope shall be UL listed, plenum-rated, tight buffered, 62.5/125 micron laser optimized OM1, FDDI indoor fiber optic cable meeting National Electrical Code plenum (OFNP) standards. Cables shall have a flame-resistant outer jacket and operate in a range from -20°C to 70°C. Fiber count as shown on Drawings
   1. Corning “InfiniCor 300” series or approved equal.

2.13 FIBER CONNECTORS

A. All fibers shall be field-installable with ST type connectors with ceramic ferrule.
   1. Corning “Unicam” #95-000-51-Z.

2.14 FIBER CONNECTOR PANELS

A. All fiber connector panels shall have ST fiber adapters with ceramic sleeve and fiber designation strip.
   1. Corning #CCH-CP24-5TP03-KH or approved equal panel with 24 duplex adapters.

2.15 FIBER CONNECTOR HOUSINGS

A. Single-drawer housing with space for horizontally mounted connector panels. Housing shall have slide-out drawer with label sheet, smoked shatterproof polycarbonate door with latch, and deep front shelf area to provide adequate strain relief for cables.
   1. 1RMU Housing: Ortronics #OR-615MMC-36P-00 or approved equal housing with capacity for three adapter panels to terminate up to 24 fibers.

2.16 FIBER STORAGE RING

A. Leviton #48900-IFR or approved equal 12-inch diameter inside plant fiber storage ring with Velcro retaining loops. Provide one storage ring in each closet, adjacent to the rack where the fiber cables are terminated.

2.17 FIBER PATCH CORDS

A. Where the fiber connector housings and network switches are in the same rack, provide 2-meter cords. Where the fiber connector housings and network switches are in different racks, provide 3 or 4-meter cords as required. (x in part numbers = cable length)

B. All multimode fiber optic patch cords shall be UL listed, 62.5/125 micron laser optimized OM1, multimode fiber cords with flame-resistant PVC outer jacket. Cords shall have duplex ST type connectors with ceramic ferrule. Patch cords shall be factory terminated and tested to 10 Gb/s data rates.
   1. Ortronics #OR-P1DF2LRGZGZ00xM or approved equal.

2.18 CABLE SUPPORT

A. All cables not installed in conduit shall be supported using J-hooks, Caddy CableCat series or approved equal, with a minimum J-hook size equivalent to Caddy #Cat32 or approved equal. Size all J-hooks to support the quantity of cables installed, plus a minimum of 25% spare capacity.

B. Cables shall be bundled using Velcro “One-Wrap” or approved equal reusable straps with a minimum ¾ inch width. Plastic tie-wraps or cinch-straps are not allowed.

2.19 EXTRA MATERIALS

A. Furnish to the owner the following spares parts:
   1. Five (5) percent of each type of UTP telecommunications jack.
   2. Five (5) percent of each type of telecommunications faceplate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

3.2 GENERAL INSTALLATION

A. Follow cable manufacturer’s specification regarding handling methods, retaining/support methods, bending radius and maximum pulling tension limitations. Where manufacturer does not provide bending radius information, minimum bending radius shall be 10 times the diameter of the cable. Use a tension-monitoring device to ensure that the maximum pulling tension that may be applied to the cable to be pulled into a conduit section is not exceeded. Provide replacement cable if cable manufacturer’s maximum pulling tension is exceeded at any time during a pull.

B. Cable shall be carefully inspected for sheath defects or other irregularities as it is paid out from the reel. When defects are detected, pulling shall stop immediately and the cable section shall be repaired or replaced at the discretion of the Contracting Agency. A system of communications shall be maintained between pulling and feed locations so that pulling can be stopped instantly, when required.

C. Adequate care shall be exercised when handling and storing reels of cable to prevent damage to the cable. Cable with dents, flat spots, or other sheath distortions shall not be installed.

D. Store a maximum of one foot of slack UTP cable for each UTP jack at each telecommunications outlet.

E. In the telecommunications closet, ten feet of slack UTP cable shall be provided at the racks. Route the service loop around the cable runway above the racks. No cables shall encroach or interfere with rack equipment space. All cables shall be protected from physical damage and should not be routed on the floor. Coiling the slack cable adjacent to the rack is not acceptable. The intent of this installation method is to provide slack cable for future work without causing increased inductance by coiling the cables.

F. All cabling shall be run continuous with no splices from each telecommunications jack to the cable connector at the patch panels. Telecommunications cables shall be terminated at each end on their respective jack. No cable run shall exceed 90 meters (295 feet) in length from the jack on the peripheral end to the patch panel.

G. All cable shall be routed in such a way as to minimize EMI and RFI interference. Cables shall be routed to maintain the following minimum distances from noise producing devices:
   1. Open or Nonmetallic Communications Pathways:
      a. 12 inches from electrical equipment and power lines of 3 kVA or less.
      b. 18 inches from fluorescent and HID ballasts.
      c. 36 from electrical equipment and power lines greater than 5 kVA.
      d. 48 inches from transformers and motors.
   2. Grounded Metal Conduit Communications Pathways:
      a. 3 inches from electrical equipment and power lines of 2 kVA or less.
      b. 6 inches from electrical equipment and power lines of 2 kVA to 5 kVA.
      c. 12 inches from 5 kVA or greater power lines.

3.3 TERMINATIONS

A. The jacket of UTP cables shall be maintained to a point within one half inch of the telecommunications jack. The twists on the individual pairs shall be maintained as close as possible to the contacts of the termination points but shall in no case exceed 1/4 inch.

B. Pairs from each cable shall be terminated sequentially from left to right, top to bottom starting with the lowest assigned number at the upper left-hand corner of the panel.

C. Fibers shall be terminated sequentially from left to right in connector housing, based on standard color code sequence of individual fiber coatings.

3.4 PATHWAYS AND RACEWAYS

A. Unless otherwise noted, all cables shall be installed in raceway from the telecommunications jack to the space above the accessible ceiling, within 18" of the J-hook or cable tray pathway. Portions of cables not installed in conduit shall be supported in accordance with TIA/EIA standards at intervals not exceeding four (4) feet in length using J-hooks. The cable shall not be supported from ducts, pipes, conduits, ceiling grid hangar wires, etc. At any point where the cable changes direction, slack shall be provided to prevent rubbing or binding on the corner supports. Extreme care shall be taken to ensure that the cable is not compressed, kinked or otherwise deformed during installation. Any cable that is stretched, compressed, kinked or otherwise deformed shall be replaced at no cost to the Owner.

B. Cables to be installed in raceway, cable tray, continuous cable support system or J-hooks (as specified above) for the entire length of each cable. Provide raceway through areas that will not be accessible for future cable replacement or additions.

C. Provide pathway capacity throughout entire system for each telecommunication outlet served, sized to accommodate a minimum of four 4-pair cables from each outlet location to the designated telecommunication room, as shown on the plans.

D. Telecommunication cables shall not be installed in the same raceway or pathway as power cables.

E. Install polyethylene pulling string in each empty conduit containing a bend or over 10 feet in length.

F. Install all telecommunications outlets in outlet boxes under the provisions of Section 26 05 33. Unless otherwise noted on the Drawings or in the Specifications, outlets shall be mounted at 18 inches above floor, 4 inches above counters or backsplash, with the jacks oriented in the standard "pins down" position.

G. Support raceways, outlet boxes, junction boxes and equipment racks under the provisions of Section 26 05 29.

3.5 LABELING

A. Label equipment racks as noted here-in and under the provisions of Section 26 05 53.

B. Furnish and install labels and documentation to identify all cables, jacks, and connections in accordance with TIA/EIA standards, as shown on the Drawings, and under the provisions of Section 26 05 53. As a minimum each jack in each faceplate shall have a unique identifier that matches the identifier at the patch panel. Identifiers shall be installed on the front of the telecommunications faceplate, on the cable behind the faceplate, and on the front of the patch panel at the associated jack.

3.6 GROUNDING

A. Provide and install as indicated on the Drawings, a #2 AWG, copper telecommunications bonding backbone (TBB) conductor from the wall-mounted telecom main grounding busbar (TMGB) in the telecom room to the ground bus in the main switchboard.

B. The TBB shall be routed along the telecom backbone pathway. In areas above accessible ceilings, the TBB conductor may be routed exposed. In inaccessible areas, the TBB conductor shall be routed in conduit and shall be bonded at both ends. All grounding and bonding shall be done in accordance with TIA/EIA standards.

C. Provide and install a #2 AWG, copper telecommunications bonding backbone (TBB) conductor from the ground bar in each telecom rack (TGB) to the wall-mounted telecom main grounding busbar (TMGB). Do not connect racks in series.

3.7 CABLE ACCEPTANCE TESTING

A. Prior to any cable testing, use the rack-mounted LAN static discharge unit to remove static charges from all cables. Cable testers with built-in static discharge capability are also acceptable.

B. Each UTP cable shall be tested for compliance with TIA/EIA 568B.2-1, Addendum 1 Category 6 standards after installation using a Fluke #DTX or approved equal tester. At a minimum, the Contractor shall perform the following tests with the maximum frequency of the tester set at 350MHz:

1. Signal Attenuation / Insertion Loss
2. Near End Cross Talk (NEXT)
3. Power Sum Near End Cross Talk (PS-NEXT)
4. Equal Level Far End Cross Talk (ELFEXT)
5. Power Sum Equal Level Far End Cross Talk (PS-ELFEXT)
6. Attenuation to Crosstalk Ratio (ACR)
7. Power Sum Attenuation to Crosstalk Ratio – Near End (PSACR-N)
8. Power Sum Attenuation to Crosstalk Ratio – Far End (PSACR-F)
9. Propagation Delay
10. Delay Skew
11. Return Loss

12. Wiremap
13. Overall Cable Length

C. Test, analyze, and record compliance for the following network protocols:
   1. 10 Base-T
   2. 100 Base-T
   3. 1000 Base-T (1 Gb/s)

D. The Contractor shall provide 100% testing for each “permanent link” (i.e. from the work area outlet to the patch panel). Provide test results for all tests noted above in the form of printouts from the test equipment and provide an electronic copy of the test data for each cable on CD. If proprietary software is used, the submitted CD shall include any necessary software required to view test results. If the results are delivered in a standard format such as Excel or Access, the viewing software need not be provided. At the front of the test report, the Contractor shall provide an index showing the pass/fail results of each cable, along with the cable length and a corresponding cable label.

E. Initially test each fiber optic cable with a light source and power meter, utilizing procedures as stated in TIA/EIA-526-14A: OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant and TIA/EIA-526-7 (currently Standard Proposal Number 2974-B). Measured results shall be plus/minus 1dB of submitted loss budget calculations. If loss figures are outside this range, test cable with an Optical Time Domain Reflectometer (OTDR) in accordance with TIA/EIA 455-61 to determine the cause of variation. Improper terminations shall be re-done and damaged cable shall be replaced at no additional cost to the Owner. The maximum acceptable signal loss through the entire fiber path, including cable, couplings, and jumpers shall not exceed TIA/EIA 568-B.3 standards. Test each multimode cable in both directions for signal attenuation at 850 and 1300 nm, using “Method B” – One jumper reference.

F. Where any portion of the system does not meet the Specifications, the Contractor shall correct the deviation and repeat any applicable testing at no additional cost to the Owner.

G. Provide three working days advance notice of tests. The Owner’s Representative shall reserve the right to be present during the testing of any or all cables in the system. Submit a copy of the test report for each cable prior to substantial completion of the project.

H. Acceptance of the telecommunications system shall be based on the results of the above tests, functionality, and the receipt of documentation.

I. Prior to Substantial Completion, submit the measured values for the telecommunications rack AC ground resistance and the voltage at the dedicated plug strip on the telecommunications rack.

3.8 SYSTEM CROSS-CONNECT

A. Provide all labor and materials as required to cross-connect between the installed telecommunications cabling system and the Owner's telephone and computer systems. This shall include the following:

1. Telephone System: Provide cross-connect between Owner's telephone switch and the telephone punchdown blocks or patch panel. The intent is to connect the Owner's telephone system to the installed telecommunications cabling system so that designated ports throughout the facility can be activated as telephone lines with dial tone capability. All telephone system programming required for this function shall be provided by the Owner under separate Contract. For bidding purposes, assume a 50-pair cross-connect but coordinate with the Owner for the exact requirements prior to installation.
2. Network System: Provide cross-connect between Owner's network switches and the installed fiber patch panels and horizontal patch panels. The intent is to assist the Owner in activating designated computer ports throughout the facility. All network programming required for this function shall be provided by the Owner under separate Contract. For bidding purposes, assume a total of 50 cross-connections between the network cabling system and the active equipment.

END OF SECTION

SECTION 28 31 00
ADDRESSABLE FIRE ALARM AND SMOKE DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor designed and installed addressable fire alarm and smoke detection system. This is a performance type specification describing the minimum acceptable fire alarm system. The Contractor shall design and install the fire alarm and smoke detection system in accordance with the requirements of NFPA 72. The fire alarm devices on the drawings are shown in suggested locations. The final locations of all devices shall be solely determined by the Contractor and shall be in accordance with NFPA 72.

1.2 RELATED SECTIONS

A. Division 08 - Door Hardware: Door Closers.

B. Division 21 - Sprinkler System.

C. Division 25 – Mechanical: Fire/Smoke dampers.

D. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables.

E. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

F. Section 26 05 53 – Identification for Electrical Systems.

1.3 REFERENCES

A. NFPA 72 - National Fire Alarm Code.

B. NFPA 101 - Life Safety Code.

C. International Mechanical Code (IMC).

D. Americans with Disabilities Act (ADA) and ADA Guidelines for Buildings and Facilities (ICC/ANSI A117.1)

E. ANSI S3.41 - Audible Emergency Evacuation Signals.

1.4 REGULATORY REQUIREMENTS

A. System: UL and FM listed.

B. Conform to the requirements of UL 864.

C. Conform to requirements of NFPA 101.

D. Install system in accordance with NFPA 72.

1.5 SYSTEM DESCRIPTION

A. System Supervision: Provide extension to electrically-supervised class B, addressable fire alarm system with fault tolerant supervised signaling line circuits and notification appliance circuits. Existing fire alarm system panel is an Edwards EST-2 addressable system, all new fire alarm devices and installation thereof must be compatible with the existing panel and devices. Provide extension of existing signaling line circuit and notification appliance circuit as required. Occurrence of single ground or open condition in signaling line circuit or notification appliance circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

B. The existing Edwards EST-2 addressable fire alarm and smoke detection system will be upgraded to an EST3 addressable fire alarm and smoke detection with voice annunciation within eighteen months. Provide a second set pair of NAC wires to each strobe device to allow for future installation of MASS Notification System.

1.6 QUALIFICATIONS

A. The installation of the system shall conform to the State of Alaska requirements and be supervised by a representative with a current State Fire Alarm License.

B. Manufacturer: Company specializing in addressable smoke detection and fire alarm systems with five years documented experience.

C. Installer: Installation of the system shall be 100% field checked by a factory trained and authorized NICET Level III technician certified in the Fire Alarm System Program. The actual supervising technician must be approved prior to start of work.

1.7 SUBMITTALS

A. Submit product data under the provisions of Division 01.

B. Submit manufacturer's installation instructions.

C. Submit shop drawings prepared and signed by a NICET Level III technician certified in fire alarm systems under the provisions of Division 01. Shop drawings shall have the following requirements:

1. The Shop Drawings shall be reproduced electronically from a Master Copy supplied in digital format. Electronic copy of the Contract

Drawings will be available at no charge to use as base plan for generation of electronic submittal. Shop Drawings shall be printed at Contract Drawing size and scale of floor plans on Shop Drawings shall match Contract Drawings.

2. All text on the drawings shall be legible without magnification when the shop drawings are reduced to 11" x 17".
3. Provide minimum 1/8" scale floor plans with all new fire alarm control and auxiliary panels, field devices, raceway and conductor routing, quantities and connection requirements for every component.
4. Provide point-to-point system wiring diagrams showing interconnection of all devices.
5. Provide a riser diagram showing all devices on each NAC, SLC, and auxiliary circuit connected to the fire alarm control panel. Individual device addresses on riser diagram are not required for initial shop drawing submittal but shall be provided on the as-built drawings.
6. Provide calculations to support battery size selection. Provide voltage drop calculations for each SLC and NAC circuit. Show the voltage drop at the furthest notification appliance from the control panel. Show all formulas and acceptable limits for all calculations. All calculations shall be shown on the shop drawings.

D. Submit shop drawings and product data to the State Fire Marshal for review and approval. All shop drawings and product data shall be reviewed and approved by the authority having jurisdiction prior to procurement and installation of materials or devices for the system.

E. Device Names: All device names that are displayed on the LCD text annunciators in the fire alarm panel shall be approved by the Owner. The Contractor shall request a list of approved room names for the facility prior to programming the fire alarm panel or any field devices.

1.8 PROJECT RECORD DRAWINGS

A. Submit documents under the provisions of Division 01.

B. Accurately indicate actual locations of notification appliances, initiating devices, fire alarm control panel, annunciators, etc.

C. Provide Point to Point as-built wiring diagrams of the entire Life Safety System as installed. This shall include all connected devices with actual addresses and locations of all T-taps. All drawings shall be provided in AutoCAD .DWG format. Paper plots of each sheet shall also be provided.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit operating instructions and maintenance and repair procedures under the provisions of Division 01.

B. Include manufacturer representative's letter stating the system is operational.

C. Include an 11" x 17" set of the fire alarm system project record drawings.

D. Include a completed copy of the NFPA 72 Inspection and Testing Form.

1.10 DEMONSTRATION AND TRAINING

A. The Manufacturer's Representative shall be responsible for an on-site demonstration of the operation of the system and initial staff training.

B. Under the provisions of Division 01 and Section 2 60500, provide formal instruction in the operation, maintenance, and troubleshooting of all equipment, provided at the project site with manufacturer's representative with the Owner's personnel

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site, store and protect, under provisions of Division 01.

1.12 EXTRA MATERIALS

A. Provide spare parts under provisions of Division 01.

B. Provide two keys of each type.

C. Provide four addressable smoke detectors.

D. Provide two 135°F addressable heat detectors.

E. Provide one fire alarm horn/strobe.

F. Provide two fire alarm strobe lights.

G. Provide one set of each type of fuse in the system.

1.13 WARRANTY

A. The Contractor shall be able to provide initial contact on warranty service and/or service contract requests from their principal location within eight (8) hours of notification. During the warranty period, the Contractor may choose to attempt troubleshooting of the system by telephone, with the facility maintenance staff. If the problem cannot be resolved within 24 hours, the Contractor shall travel to the facility on the next available flight to repair the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Edwards Systems Technology (EST)

B. No Substitution.

2.2 INITIATING DEVICES

A. Manual Station: Semi-flush mounted, double action addressable manual station. Provide with high impact clear polycarbonate protective cover in gymnasium and multipurpose rooms.

B. Ceiling Mounted Smoke Detector: Addressable, NFPA 72, photoelectric type with adjustable sensitivity, plug-in base, and visual indication of detector actuation, suitable for mounting on 4-inch outlet box.

C. Heat Detector: Addressable combination rate-of-rise and fixed temperature, rated 135° F, and temperature rate of rise of 15° F. Provide fixed temperature devices rated 200° F where indicated. Heat detectors in the elevator machine rooms shall have both a lower temperature rating and a higher sensitivity as compared to the sprinkler head in the room.

D. Provide any specialized tools or interface equipment as required to program the addressable devices (i.e. Siemens “Sensor LINK FPI-32”). Turn over one of each type of tool to Owner at completion of project.

2.3 INTELLIGENT MODULES

A. A control relay/transponder shall be installed where building services (i.e. fan shutdown, door holder or release, etc.) are to be automatically controlled by the fire alarm system during a fire emergency. The control relay shall be of a type that only consumes power momentarily while transferring from the deenergized to the energized state or back again. The command to change state shall come from the control panel in accordance with the system program. The control relay shall be condition (deenergized or energized) supervised, and its condition shall be confirmed and corrected, if necessary, during each polling cycle. The control relay/transponder shall be capable of operating on the same communication channel with initiating devices/transponders so that it can be located within 3 feet of the building service device it is controlling as required by NFPA 101-Life Safety Code while its integrity is being monitored from the control panel. The address code of the control relay transponder shall be field selectable and changeable in the same manner as for other transponders. The control relay/ transponder type code shall be factory preset and not be field changeable.

2.4 NOTIFICATION APPLIANCES

A. All appliances shall be U.L. Listed for Fire Protective Service.

B. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to assure absolute compatibility between the appliances and the control panels, and to assure that the application of the appliances is done in accordance with the single manufacturer's instructions.

C. Any appliances that do not meet the above requirements, and are submitted for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purposes intended.

D. Fire Alarm Strobe Lights: NFPA 72 compliant, flush wall mounted, self-synchronizing, xenon, fire alarm strobe lamp and flasher with flashrate of one flash per second, complying with the requirements of ICC/ANSI A117.1. Provide red lettered FIRE on clear lens. The strobe shall be field-selectable to provide 15, 30 75, or 110 candela synchronized flash outputs. The settings of all strobes shall be determined by the Contractor during the shop drawing process.

E. Fire Alarm Horn: ANSI S3.41 and NFPA 72 compliant, flush mounted fire alarm horn with adjustable sound output level. Sound Rating: 87 dBA (reverberant) at 10 feet on the "high" setting and 82 dBA (reverberant) at 10 feet on the "low" setting. Provide minimum sound pressure level of 15 dBA above the average ambient sound level in every occupied space within the building. Provide integral fire alarm strobe light as specified above where indicated on the drawings.

2.5 AUXILIARY DEVICES

A. Door Release: Magnetic hold open as specified in Division 8. Provide power supply to power all door holders. Provide power connection to 120 V primary source and overcurrent protection.

B. NAC Booster Power Supplies:
   1. Power supply quantity, rating and battery size shall be determined by the Contractor. All locations of new power supplies shall be approved by the Owner prior to shop drawing submittal. All new power supplies shall be connected to a dedicated circuit and a handle lock shall be provided on the breaker.

2.6 FIRE ALARM WIRE AND CABLE

A. Fire Alarm System Power Branch Circuits: Building wire as specified in Section 26 05 19.

B. Notification Appliance Circuits: Minimum #12 AWG copper building wire, as specified in Section 26 05 19.

C. Initiating and Signaling Line Circuits: Twisted, shielded or unshielded fire alarm cable as recommended by the fire alarm system manufacturer. Minimum size #16 AWG.

2.7 FIRE ALARM SYSTEM MAP

A. On wall beside each fire alarm panel and text annunciator, provide a system map under clear 1/8” plexiglass with black metal frame permanently screwed to the wall with 4 screws around the perimeter of the map.

B. Map to denote locations of all panels, annunciator, and device address and room numbers that correlate with text display on panel to locate system event.

C. Orientate each map consistent with location the map is installed. Provide call denoting “YOU ARE HERE” at the installation point for each map.

D. The map shall be color-coded for clarity.

E. The final layout to be approved prior to final printing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the fire alarm system in accordance with the manufacturer's instructions.

B. Install manual station with operating handle 48 inches above floor. Install notification appliances 80 inches above floor or 6 inches below ceiling, whichever is lower.

C. Install all smoke detectors a minimum of three feet from any air supply, return, or exhaust diffuser and a minimum of one foot from any light fixture.

D. Install all fire alarm system wiring in a dedicated conduit system separate from any other system wiring. Provide minimum 8 inch wire tails at each device box and 50 inch wire tails at the fire alarm control panel.

E. Make conduit and wiring connections to door release devices, sprinkler water flow switches, sprinkler valve tamper switches, fire/smoke dampers, and other items as shown on the drawings or required by NFPA 72. Note that the sprinkler system is a design build system and not all valve tamper switches and flow switches may be shown on the drawings. The Contractor is responsible to field coordinate all tamper and flow switch locations and connect all switches to the fire alarm system.

F. Mount outlet box for magnetic door holder to withstand 80 pounds pulling force.

G. The Contractor is responsible to field coordinate the final location of all initiating devices and notification appliances to comply with the requirements of NFPA 72. Any initiating devices or notification appliances that are not installed in accordance with NFPA 72 shall be relocated to comply with the requirements of NFPA 72 at no cost to the Owner.

H. Detectors shall not be installed until after the construction clean up of all trades is complete and final. Protective dust covers shall be installed on all detectors prior to final clean-up. Detectors that have been installed without dust covers prior to final clean-up shall be replaced at no cost to the Owner.

I. Where surface mounted devices are used, the Contractor shall install the manufacturer's approved surface mounting boxes and decorative skirts. The use of standard outlet boxes as specified in Section 260533 is not acceptable.

J. Program the system to identify each device with the submitted and approved designation in the LCD annunciators on the control panel.

3.2 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Test in accordance with NFPA 72 and local fire department requirements. Provide a completed NFPA 72 Inspection and Testing Form for inclusion in the Operation and Maintenance manual at the completion of testing and commissioning the fire alarm system.

C. Provide all equipment, devices and manpower as necessary to test each and every device in the fire alarm system both for function and supervision. Demonstrate that all devices connected to the system function properly.

D. The facility will not be accepted as substantially complete until the fire alarm system has been tested and demonstrated to the Owner's authorized representative as 100 percent complete and fully functional; a completed NFPA 72 Inspection and Testing form is submitted.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Division 01.

B. Include services of a certified technician to supervise installation, adjustments, final connections, programming and system testing.

3.4 FIRE ALARM SYSTEM IDENTIFICATION

A. Wire and Cable: Provide fire alarm unit conductors with color coded insulation, or use color coded tape at each conductor termination and in each junction box as follows:
   1. Power Branch Circuit Conductors: Black, red, white.
   2. Initiating Device Circuit: Black, red.
   3. Detector Power Supply: Violet, brown.
   4. Notification Appliance Circuit: Blue (positive), white (negative).
   5. Door Release: Gray, gray

B. Identify all circuit conductors at all terminal and junction boxes per NEC 760.30. Use the circuit designations (i.e. “NAC 1”, “SLC 1”, etc.), as indicated on the shop drawings.

C. Fire Alarm Device Labels:
   1. Install machine-printed device address labels on all addressable devices, including smoke/heat detectors, control relays, monitor modules, etc. Unless otherwise noted, in public spaces where devices are mounted below +80” on walls, install label on inside cover of device. At all other locations, install label on exterior cover of device. Device labels shall show the unique device address corresponding to the text annunciator description. For smoke detectors, the label shall be affixed to the base and not to the detector itself.
   2. Provide label on each remote test station indicating description and location of device being tested.

D. The circuit disconnecting means for the fire alarm control panel circuit, remote power booster supply, or other control equipment circuits shall have a painted red handle and handle lock. The circuit(s) shall be labeled “Fire Alarm Circuit”. The circuit assignment and panel location shall be permanently identified on all fire alarm control equipment.

END OF SECTION

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