Project Manual

For

Orem City Public Safety Building Interior Remodel

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11.21.2024

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SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Apply [**AWI Quality Certification**] [**WI Certified Compliance**] Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **manufacturer**.

B. Research reports.

C. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: [AWI Quality Certification Program] [WI Certified Compliance Program] certificates.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   1. Manufacturer's Certification: [**Licensed participant in AWI's Quality Certification Program**] [**Licensed participant in WI's Certified Compliance Program**].

B. Installer Qualifications: [Manufacturer of products] [Licensed participant in AWI's Quality Certification Program] [Licensed participant in WI's Certified Compliance Program].

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide [**labels**] [**and**] [**certificates**] from [**AWI**] [**WI**] certification program indicating that woodwork complies with requirements of grades specified.

B. Architectural Woodwork Standards Grade: **Economy**.

C. Type of Construction: [**Frameless**] [**Face frame**].

D. Door and Drawer-Front Style: [**Flush**] [**Reveal**] overlay.
1. Reveal Dimension: **As indicated**.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: [**Grade HGS**] [**Grade HGL**].
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: [**Grade HGS**] [**Grade VGS**].
4. Edges: [**Grade HGS**] [**Grade VGS**] [**PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish**] [**PVC T-mold matching laminate in color, pattern, and finish**] [**PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish**].
5. Pattern Direction: [**Vertically for drawer fronts, doors, and fixed panels**] [**Horizontally for drawer fronts, doors, and fixed panels**] [**Vertically for doors and fixed panels, horizontally for drawer fronts**] [**As indicated**].

G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with [**glued rabbeted joints supplemented by mechanical fasteners**] [**or**] [**glued dovetail joints**].

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.
3. As selected by Architect from laminate manufacturer's full range in the following categories:
a. Solid colors, [**gloss**] [**matte**] finish.
b. Solid colors with core same color as surface, [**gloss**] [**matte**] finish.
c. Wood grains, [**gloss**] [**matte**] finish.
d. Patterns, [**gloss**] [**matte**] finish.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: [**5 to 10**] [**8 to 13**] [**4 to 9**] percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard (MDF): ANSI A208.2, [**Grade 130**] <**Insert grade**>.
2. Particleboard: ANSI A208.1, [**Grade M-2**] [**Grade M-2-Exterior Glue**].
3. Straw-Based Particleboard: ANSI A208.1, Grade M-2, except for density.
4. Softwood Plywood: DOC PS 1[**, medium-density overlay**].
5. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction as determined by testing performed on identical products by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in [**Section 08 71 00 "Door Hardware."**] [**Section 08 71 11 "Door Hardware (Descriptive Specification)."**]

B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, [**100**] [**135**] [**170**] degrees of opening[**, self-closing**].

D. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid [metal] [plastic], [**4 inches (100 mm)** long, **5/16 inch (8 mm)** in diameter] [**5 inches (127 mm)** long, **2-1/2 inches (63.5 mm)** deep, and **5/16 inch (8 mm)** in diameter].

F. Catches: [Magnetic catches, ANSI/BHMA A156.9, B03141] [Push-in magnetic catches, ANSI/BHMA A156.9, B03131] [Roller catches, ANSI/BHMA A156.9, B03071] [Ball friction catches, ANSI/BHMA A156.9, B03013].

G. Adjustable Shelf Standards and Supports: [ANSI/BHMA A156.9, B04071; with shelf rests, B04081] [ANSI/BHMA A156.9, B04102; with shelf brackets, B04112].

H. Shelf Rests: ANSI/BHMA A156.9, B04013; [metal] [plastic] [two-pin plastic with shelf hold-down clip].

I. Drawer Slides: ANSI/BHMA A156.9.
1. Grade 1 and Grade 2: Side mounted[**and extending under bottom edge of drawer**].
   a. Type: [**Full**] [**Partial**] extension.
   b. Material: [**Zinc-plated**] [**Epoxy-coated**] steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; [**full**] [**full-overtravel**]-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide [**Grade 2**] [**Grade 1**].
4. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide [**Grade 1**] [**Grade 1HD-100**].
5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide [**Grade 1HD-100**] [**Grade 1HD-200**].
6. For computer keyboard shelves, provide [**Grade 1**] [**Grade 1HD-100**].
7. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide [**Grade 1HD-100**] [**Grade 1HD-200**].

J. Slides for Sliding Glass Doors: ANSI/BHMA A156.9, B07063; [**plastic**] [**aluminum**].

K. Door Locks: ANSI/BHMA A156.11, E07121.

L. Drawer Locks: ANSI/BHMA A156.11, E07041.

M. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

N. Float Glass for Cabinet Doors: ASTM C1036, Type I, [**Class 1 (clear)**] [**Class 2 or 3 (tinted)**], Quality-Q3.
1. Thickness: [**3.0 mm**] [**4.0 mm**] [**5.0 mm**] [**6.0 mm**].
2. Tint Color: [**Blue-green**] [**Bronze**] [**Green**] [**Gray**] <**Insert color**>.

O. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT, Condition A, Type I, [**Class 1 (clear)**] [**Class 2 or 3 (tinted)**], Quality-Q3, 6 mm thick unless otherwise indicated.
1. Tint Color: [**Blue-green**] [**Bronze**] [**Green**] [**Gray**] <**Insert color**>.
2. Unframed Glass Doors: Seam exposed edges seamed before tempering.

P. Mirror Glass for Cabinet Doors: ASTM C1503, Mirror [**Select**] [**Glazing**], Quality-Q3.
1. Thickness: [**3.0 mm**] [**4.0 mm**] [**5.0 mm**] [**6.0 mm**].

Q. Decorative Glass for Cabinet Doors: Provide decorative glass complying with Section 08 81 13 "Decorative Glass Glazing."

R. Tempered Float Glass for Cabinet Shelves: ASTM C1048, Kind FT, Condition A, Type I, [**Class 1 (clear)**] [**Class 2 or 3 (tinted)**], Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
1. Tint Color: [**Blue-green**] [**Bronze**] [**Green**] [**Gray**] <**Insert color**>.

S. Grommets for Cable Passage: [**1-1/4-inch (32-mm)**] [**2-inch (51-mm)**] <**Insert dimension**> OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Color: [**Brown**] [**Black**] <**Insert color**>.

T. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: ANSI/BHMA 605 for brass base; ANSI/BHMA 632 for steel base.
3. Bright Brass, Vacuum Coated: ANSI/BHMA 723 for brass base; ANSI/BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.
5. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
6. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
7. Satin Stainless Steel: ANSI/BHMA 630.

U. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: [**Softwood or hardwood lumber**] [**Fire-retardant-treated softwood lumber**], kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: [Unpigmented contact cement] [Contact cement] [PVA] [Urea formaldehyde] [Resorcinol].
1. Adhesive for Bonding Edges: Hot-melt adhesive[**or adhesive specified above for faces**].

2.7 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

C. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual."
1. For glass in frames, secure glass with removable stops.
2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with [**No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips**] [**No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish**] [**toggle bolts through metal backing or metal framing behind wall finish**].

3.2 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through [**AWI's Quality Certification Program**] [**WI's Certified Compliance Program**] certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
   1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 06 41 16

SECTION 06 46 00 - WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
3. Shop finishing of wood trim.

1.2 ACTION SUBMITTALS

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

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
2. Product Data: For installation adhesives, indicating VOC content.
3. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

D. Samples:
1. Lumber for transparent finish, for each species and cut, finished on one side and one edge.
2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.

1.3 INFORMATIONAL SUBMITTALS

A. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.4 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
1. Species: Clear alder.
2. Cut: Plain sliced/plain sawn.

2.3 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Grade: Custom.

B. Wood Species: Any closed-grain hardwood.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content for Exterior Materials: 10 to 15 percent.
   2. Wood Moisture Content for Interior Materials: 8 to 13 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

2.5 MISCELLANEOUS MATERIALS

A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

   1. Adhesives shall have a VOC content of 70 g/L or less.

2.6 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Edges of Solid-Wood (Lumber) Members: 1.5 mm (1/16 inch) unless otherwise indicated.

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

C. Assemble casings in shop except where shipping limitations require field assembly.

2.7 SHOP FINISHING

A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Section 09 91 23 "Interior Painting" and Section 09 93 00 "Staining and Transparent Finishing" for field finishing wood trim not indicated to be shop finished.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

D. Transparent Finish for Interior Trim:
   1. Grade: Custom.
   2. Finish: System - 5, conversion varnish.
   3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   4. Staining: Match approved sample for color.
   5. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

E. Opaque Finish for Interior Trim:
   1. Grade: Custom.
   2. Finish: System - 4, water-based latex acrylic.

3. Color: As selected by Architect from manufacturer's full range.
4. Sheen: Semigloss, 46-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 3 mm in 2400 mm (1/8 inch in 96 inches).

C. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
1. For shop-finished items, use filler matching finish of items being installed.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 1500 mm (60 inches) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
1. Install wall railings on indicated metal brackets securely fastened to wall framing.
2. Install standing and running trim with no more variation from a straight line than 3 mm in 2400 mm (1/8 inch in 96 inches).

END OF SECTION 06 46 00

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include the following:
1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. North American Door Corp.
4. Rocky Mountain Metals, Inc.
5. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 2.27 W/K x sq. m (0.40 deg Btu/F x h x sq. ft.) when tested according to ASTM C 518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: SDI A250.8, Level 1; SDI A250.4, Level C..
1. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 44.5 mm (1-3/4 inches).
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.8 mm (0.032 inch).
   d. Edge Construction: Model 1, Full Flush.
   e. Core: Manufacturer's standard.
2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 1.0 mm (0.042 inch).
b. Construction: Face welded.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B..
1. Doors:
a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 44.5 mm (1-3/4 inches).
c. Face: Metallic-coated steel sheet, minimum thickness of 1.0 mm (0.042 inch), with minimum ZF120 (A40)coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Polyisocyanurate.
2. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 1.3 mm (0.053 inch), with minimum ZF120 (A40)coating.
b. Construction: Full profile welded.

2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 610 mm (24 inches) of frame height above 2.1 m (7 feet).
3. Postinstalled Expansion Anchor: Minimum 9.5-mm- (3/8-inch-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 51-mm (2-inch) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 12G (04Z) coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.7 FABRICATION

A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
      a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
      b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
   2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 230 mm (9 inches) o.c. and not more than 51 mm (2 inches) o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Hollow-Metal Frames: Comply with SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.

4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.

5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
   a. Squareness: Plus or minus 1.6 mm (1/16 inch), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1.6 mm (1/16 inch), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1.6 mm (1/16 inch), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1.6 mm (1/16 inch), measured at jambs at floor.

B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.

C. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid-core doors with wood-veneer faces.
2. Shop priming flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
2. Section 13 49 00 "Radiation Protection" for lead-lined flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of door.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Fire-protection ratings for fire-rated doors.

1.3 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. ABS- American Building Supply- Doormerica.
2. Algoma Hardwoods, Inc.
3. Marshfield DoorSystems, Inc.
4. Mohawk Flush Doors, Inc.
5. Oregon Door.
6. Oshkosh Door Company.
7. Vancouver Door Company.
8. VT Industries Inc.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Adhesives: Do not use adhesives that contain urea formaldehyde.

C. WDMA I.S.1-A Performance Grade:
1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: public toilets, janitor's closets and patient rooms.

D. Particleboard-Core Doors:
1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

E. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
a. Screw Withdrawal, Face: 3100 N (700 lbf).
b. Screw Withdrawal, Edge: 1780 N (400 lbf).

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:
1. Grade: Custom (Grade A faces).
2. Species: Clear alder.
3. Cut: Rotary cut.
4. Core: Either glued wood stave or structural composite lumber.
5. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: See hardware schedule on drawings.

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
1. Clearances: Provide 3.2 mm (1/8 inch) at heads, jambs, and between pairs of doors. Provide 3.2 mm (1/8 inch) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 6.4 mm (1/4 inch) from bottom of door to top of threshold unless otherwise indicated.

END OF SECTION 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Storefront framing.
   2. Manual-swing entrance doors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   2. Include point-to-point wiring diagrams.

D. Samples: For each type of exposed finish required.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 19.1 mm (3/4 inch), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 3.2 mm (1/8 inch), whichever is smaller.
a. Operable Units: Provide a minimum 1.6-mm (1/16-inch) clearance between framing members and operable units.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 6.35 mm (1/4 inch) for spans greater than 3.6 m (11 feet 8-1/4 inches) or 1/175 times span, for spans of less than 3.6 m (11 feet 8-1/4 inches).

E. Structural: Test according to ASTM E 330/E 330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
a. Maximum air leakage of 0.30 L/s per sq. m (0.06 cfm/sq. ft.) at a static-air-pressure differential of 75 Pa (1.57 lbf/sq. ft.).
2. Entrance Doors:
a. Single Doors: Maximum air leakage of 2.54 L/s per sq. m (0.5 cfm/sq. ft.) at a static-air-pressure differential of 75 Pa (1.57 lbf/sq. ft.).

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 480 Pa (10 lbf/sq. ft.).

H. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 2.33 W/sq. m x K (0.41 Btu/sq. ft. x h x deg F) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.32 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 45 as determined according to NFRC 500.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 67 deg C (120 deg F), ambient; 100 deg C (180 deg F), material surfaces.

2.2 STOREFRONT SYSTEMS

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

1. Arcadia, Inc.
2. Kawneer North America; an Alcoa company.
3. U.S. Aluminum; a brand of C.R. Laurence.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 ENTRANCE DOOR SYSTEMS

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

1. Arcadia, Inc.
2. Kawneer North America; an Alcoa company.
3. U.S. Aluminum; a brand of C.R. Laurence.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 44.5-mm (1-3/4-inch) overall thickness, with minimum 3.2-mm- (0.125-inch-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
   a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: Medium stile; 88.9-mm (3-1/2-inch) nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.

2.4 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:
   a. Egress Doors: Not more than 67 N (15 lbf) to release the latch and not more than 133 N (30 lbf) to set the door in motion and not more than 67 N (15 lbf) to open the door to its minimum required width.
   b. Accessible Interior Doors: Not more than 22.2 N (5 lbf) to fully open door.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Cylinders: As specified in Section 08 71 00 "Door Hardware."

E. Pivot Hinges: BHMA A156.4, Grade 1.
1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

F. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Nonferrous.
3. Quantities:
   a. For doors up to 2210 mm (87 inches) high, provide three hinges per leaf.

G. Continuous-Gear Hinges: BHMA A156.26.

H. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

I. Cylinders: BHMA A156.5, Grade 1.
1. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

J. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

K. Operating Trim: BHMA A156.6.

L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

N. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

O. Weather Stripping: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D 2000 molded neoprene or ASTM D 2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

P. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Q. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 12.7 mm (1/2 inch).

2.5 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

1. Sealant shall have a VOC content of 250 g/L or less.

2.6 MATERIALS

A. Sheet and Plate: ASTM B 209M (ASTM B 209).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221M (ASTM B 221).

C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

D. Structural Profiles: ASTM B 308/B 308M.

E. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.

4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 08 80 00 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
a. Perform a minimum of two tests in areas as directed by Architect.
2. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.45 L/s per sq. m (0.09 cfm/sq. ft.) at a static-air-pressure differential of 75 Pa (1.57 lbf/sq. ft.).
a. Perform a minimum of two tests in areas as directed by Architect.
3. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 300 Pa (6.24 lbf/sq. ft.), and shall not evidence water penetration.

B. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 08 41 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Glass for windows, doors, AND storefront framing.
   2. Glazing sealants and accessories.

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 300 mm (12 inches) square.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
   1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cardinal Glass Industries.
2. Guardian Glass; SunGuard.
3. Oldcastle BuildingEnvelope™.
4. Pilkington North America.
5. Vetrotech Saint-Gobain.
6. Viracon, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.

B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as W/sq. m x K (Btu/sq. ft. x h x deg F).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

C. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
   1. Sealing System: Dual seals.
   2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

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

         1) Technoform Glass Insulation NA, Inc.
         2) Thermix; a brand of Ensinger USA.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Sealant shall have a VOC content of 250 g/L or less.
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

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

      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Sika Corporation.
      d. Tremco Incorporated.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 1270 mm (50 inches).

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.4 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

3.5 MONOLITHIC GLASS SCHEDULE

A. Glass Type : Clear annealed float glass.
   1. Minimum Thickness: 6 mm.

B. Glass Type : Clear annealed fully tempered float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.

3.6 INSULATING GLASS SCHEDULE

A. Glass Type : Clear insulating glass.
   1. Basis-of-Design Product: Solarban 60 (2) Solexia + Clear
   2. Overall Unit Thickness: 25 mm (1 inch).
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Annealed Fully tempered float glass.
   5. Interspace Content: Air.
   6. Indoor Lite: Annealed Fully tempered float glass.
   7. Winter Nighttime U-Factor: 0.29 maximum.
   8. Summer Daytime U-Factor: 0.27 maximum.
   9. Safety glazing required where indicated.

B. Glass Type : Low-E-coated, clear insulating glass.
   1. Basis-of-Design Product: Solarban 60 (2) Solexia + Clear.
   2. Overall Unit Thickness: 25 mm (1 inch).
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Annealed Fully tempered float glass.
   5. Interspace Content: Air.
   6. Indoor Lite: Annealed Fully tempered float glass.
   7. Low-E Coating: Pyrolytic or sputtered on third surface.
   8. Winter Nighttime U-Factor: 0.29 maximum.
   9. Summer Daytime U-Factor: 0.27 maximum.
   10. Visible Light Transmittance: 61 percent minimum.
   11. Solar Heat Gain Coefficient: 0.32 maximum.
   12. Safety glazing required where indicated.

C. Glass Type : Ceramic-coated, low-E, insulating spandrel glass.
   1. Coating Color: As selected by Architect from manufacturer's full range.
   2. Overall Unit Thickness: 25 mm (1 inch).
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Annealed float glass.
   5. Interspace Content: Air.
   6. Indoor Lite: Annealed float glass.
   7. Low-E Coating: Pyrolytic or sputtered on third surface.
   8. Opaque Coating Location: Fourth surface.
   9. Winter Nighttime U-Factor: 0.29 maximum.
   10. Summer Daytime U-Factor: 0.27 maximum.

END OF SECTION 08 80 00

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:
1. Annealed monolithic glass mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:
1. Mirrors: 300 mm (12 inches) square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 300 mm (12 inches) long.

1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction test report.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Guardian Glass; SunGuard.
2. National Glass Industries.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
1. Nominal Thickness: 4.0 mm.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating approved by mirror manufacturer.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.

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

a. Franklin International.
b. Laurence, C. R. Co., Inc.
c. Liquid Nails Adhesive.

2. Adhesives shall have a VOC content of 70 g/L or less.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
1. Bottom and Side Trim: J-channels formed with front leg and back leg not less than 9.5 and 22 mm (3/8 and 7/8 inch) in height, respectively, and a thickness of not less than 1.0 mm (0.04 inch).
2. Top Trim: J-channels formed with front leg and back leg not less than 16 and 25 mm (5/8 and 1 inch) in height, respectively, and a thickness of not less than 1.0 mm (0.04 inch).
3. Finish: Clear bright anodized.

B. Mirror Bottom Clips: As indicated.

C. Mirror Top Clips: As indicated.

D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

2.5 FABRICATION

A. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

B. Mirror Edge Treatment: Flat polished. Seal edges of mirrors with edge sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Install mirrors withmirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

C. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 00

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SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation reports for post-installed anchors and power-actuated fasteners.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, Z120 (G40), hot-dip galvanized unless otherwise indicated.

C. Studs and Tracks: ASTM C 645.
   1. Steel Studs and Tracks:

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

         1) CEMCO; California Expanded Metal Products Co.
         2) Phillips Manufacturing Co.
         3) SCAFCO Steel Stud Company.

b. Minimum Base-Metal Thickness: 0.836 mm (0.0329 inch).

c. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 51-mm (2-inch) minimum vertical movement.

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

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich Building Systems.
3) SCAFCO Steel Stud Company.

2. Single Long-Leg Track System: ASTM C 645 top track with 51-mm- (2-inch-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 305 mm (12 inches) of the top of studs to provide lateral bracing.

3. Double-Track System: ASTM C 645 top outer tracks, inside track with 51-mm- (2-inch-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

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

a. ClarkDietrich Building Systems.
b. SCAFCO Steel Stud Company.

2. Minimum Base-Metal Thickness: 0.836 mm (0.0329 inch).

F. Cold-Rolled Channel Bridging: Steel, 1.367-mm (0.0538-inch) minimum base-metal thickness, with minimum 13-mm- (1/2-inch-) wide flanges.

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

a. ClarkDietrich Building Systems.
b. SCAFCO Steel Stud Company.
c. Steel Construction Systems.

2. Depth: 38 mm (1-1/2 inches).

3. Clip Angle: Not less than 38 by 38 mm (1-1/2 by 1-1/2 inches), 1.72-mm- (0.068-inch-) thick, galvanized steel.

G. Resilient Furring Channels: 13-mm- (1/2-inch-) deep, steel sheet members designed to reduce sound transmission.

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

a. ClarkDietrich Building Systems.
b. SCAFCO Steel Stud Company.

2. Configuration: Asymmetrical or hat shaped.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 1.59-mm- (0.062-inch-) diameter wire, or double strand of 1.21-mm- (0.048-inch-) diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 4.12 mm (0.16 inch) in diameter.

C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 1.367 mm (0.0538 inch) and minimum 13-mm- (1/2-inch-) wide flanges.
   1. Depth: 51 mm (2 inches).

D. Furring Channels (Furring Members):
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 22 mm (7/8 inch) deep.
      a. Minimum Base-Metal Thickness: 0.836 mm (0.0329 inch).
   2. Resilient Furring Channels: 13-mm- (1/2-inch-) deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 150 mm (6 inches) o.c.

E. Direct Furring:
   1. Screw to wood framing.

2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 610 mm (24 inches) o.c.

F. Z-Shaped Furring Members:
1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 610 mm (24 inches) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 610 mm (24 inches) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 305 mm (12 inches) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 3 mm (1/8 inch) from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Installation Tolerances: Install suspension systems that are level to within 3 mm in 3.6 m (1/8 inch in 12 feet) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.
4. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product data.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For each texture finish indicated on same backing indicated for Work.

D. Sustainable Design Submittals:
1. Product Data: For recycled content of required elements.
2. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
3. Product Data: For adhesives and sealants, indicating VOC content.
4. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

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

a. American Gypsum.
b. CertainTeed Corporation.
c. Georgia-Pacific Gypsum, LLC.
d. National Gypsum Company.
e. PABCO Gypsum.
f. USG Corporation.

2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

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

    a. American Gypsum.
    b. CertainTeed Corporation.
    c. Georgia-Pacific Gypsum, LLC.
    d. National Gypsum Company.
    e. PABCO Gypsum.
    f. USG Corporation.
2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

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

    a. American Gypsum.
    b. CertainTeed Corporation.
    c. Georgia-Pacific Gypsum, LLC.
    d. National Gypsum Company.
    e. PABCO Gypsum.
    f. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

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

    a. American Gypsum.
    b. CertainTeed Corporation.
    c. Georgia-Pacific Gypsum, LLC.
    d. National Gypsum Company.
    e. PABCO Gypsum.
    f. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (control) joint.

B. Exterior Trim: ASTM C1047.
1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:
    a. Cornerbead.
    b. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.

2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Verify adhesives have a VOC content of 50 g/L or less.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumere recycled content not less than 50 percent.

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

F. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."

2.9 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. CertainTeed Corporation.
b. Georgia-Pacific Gypsum LLC.
c. National Gypsum Company.
d. USG Corporation.
2. Texture: Holy smooth.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

3.2 FINISHING OF GYPSUM BOARD

A. Prefill open joints, rounded or beveled edges, and damaged surface areas.

B. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

C. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
   a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

D. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.3 APPLICATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

3.4 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ceramic tile.
2. Porcelain tile.
3. Crack isolation membrane.
4. Metal edge strips.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Samples:
1. Each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide samples of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

A. Ceramic Tile Type: Factory-mounted unglazed ceramic tile.
1. Composition: Porcelain.
2. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
3. Module Size: As shown on the Drawings.
4. Thickness: 6.4 mm (1/4 inch).
5. Face: Pattern of design indicated, with cushion edges.
6. Surface: Slip resistant, with abrasive admixture.
7. Dynamic Coefficient of Friction: Not less than 0.42.
8. Tile Color and Pattern: As shown on the Drawings.
9. Grout Color: As selected by Architect from manufacturer's full range.

B. Ceramic Tile Type: Unglazed porcelain wall and floor tile.

1. Certification: Tile certified by the Porcelain Tile Certification Agency.
2. Face Size: As shown on the Drawings..
3. Face Size Variation: Rectified.
4. Thickness: 9.5 mm (3/8 inch).
5. Face: Plain with square or cushion edges.
6. Dynamic Coefficient of Friction: Not less than 0.42.
7. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
8. Grout Color: As selected by Architect from manufacturer's full range.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Base Cap: Surface bullnose, module size same as adjoining flat tile.
   b. External Corners: Surface bullnose, module size same as adjoining flat tile.
   c. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 12.7 to 6.4 mm (1/2 to 1/4 inch) across nominal 100-mm (4-inch) dimension.

2.3 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 4-mm (3/16-inch) nominal thickness.

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

   a. Schluter Systems L.P.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

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

   a. Bonsal American, an Oldcastle company.
   b. Bostik, Inc.
   c. Custom Building Products.
   d. LATICRETE SUPERCAP, LLC.
   e. MAPEI Corporation.

D. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

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

   a. Bostik, Inc.
   b. C-Cure.
   c. Custom Building Products.
   d. LATICRETE SUPERCAP, LLC.
   e. MAPEI Corporation.

2.4 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

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

   a. Bonsal American, an Oldcastle company.
   b. Bostik, Inc.
   c. C-Cure.

d. Custom Building Products.
e. LATICRETE SUPERCAP, LLC.
f. MAPEI Corporation.

2. For wall applications, provide nonsagging mortar.

C. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

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

a. ARDEX Americas.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. LATICRETE SUPERCAP, LLC.
f. MAPEI Corporation.
g. Merkrete by Parex USA, Inc.

2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
3. Provide prepackaged, dry-mortar mix combined with liquid-latex additive at Project site.
4. For wall applications, provide nonsagging mortar.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

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

a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. LATICRETE SUPERCAP, LLC.
f. MAPEI Corporation.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

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

a. ARDEX Americas.
b. Bostik, Inc.
c. C-Cure.
d. Custom Building Products.
e. LATICRETE SUPERCAP, LLC.
f. MAPEI Corporation.
g. Merkrete by Parex USA, Inc.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; nickel silver exposed-edge material.

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

a. Schluter Systems L.P.

C. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

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

a. Bonsal American, an Oldcastle company.
b. Custom Building Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1:50 (1/4 inch per foot) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
a. Tile floors consisting of tiles 200 by 200 mm (8 by 8 inches) or larger.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 3.2 mm (1/8 inch).
   2. Glazed Wall Tile: 3.2 mm (1/8 inch).
   3. Porcelain Tile: 6.4 mm (1/4 inch).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Ceramic Tile Installation: TCNA F115A; thinset mortar on crack isolation membrane; epoxy grout.
      a. Ceramic Tile Type: Unglazed porcelain wall tile.
      b. Thinset Mortar: Standard dry-set or Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Wood or Metal Studs or Furring:
   1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
      a. Ceramic Tile Type: Unglazed porcelain wall tile and unclased ceramic mosaic tile.
      b. Thinset Mortar: Standard dry-set or Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.

END OF SECTION 09 30 13

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Delegated-Design Submittal: For seismic restraints for ceiling systems.
   1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Product test reports.

C. Research reports.

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E 1264.
   2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS

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

   1. American Gypsum.
   2. Armstrong World Industries, Inc.
   3. CertainTeed Corporation.
   4. USG Corporation.

B. Acoustical Panel Standard: Manufacturer's standard panels according to ASTM E 1264.

C. Classification: Type III, Form 2, Pattern CE.

D. Color: White.

E. Light Reflectance (LR): 0.86.

F. Ceiling Attenuation Class (CAC): 35.

G. Noise Reduction Coefficient (NRC): .60.

H. Edge/Joint Detail: Beveled, kerfed, and rabbeted long edges and square, butt-on short edges.

I. Thickness: 19 mm (3/4 inch).

J. Modular Size: As indicated on Drawings.

2.3 METAL SUSPENSION SYSTEM

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. USG Corporation.

B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M.

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, Z90 (G30) coating designation; with prefinished 15-mm- (9/16-inch-) wide metal caps on flanges.
1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Hold-Down Clips: Manufacturer's standard hold-down.

C. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

2.5 METAL EDGE MOLDINGS AND TRIM

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

1. Armstrong World Industries, Inc.
2. CertainTeed Corporation.
3. Chicago Metallic Corporation.
4. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated.

B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
   2. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
      b. Install panels with pattern running in one direction parallel to short axis of space.
      c. Install panels in a basket-weave pattern.
   3. Install hold-down, impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Thermoset-rubber base.
2. Thermoplastic-rubber base.
3. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Product Data: For sealants, indicating VOC content.
4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For resilient base and stair products and accessories, indicating compliance with requirements for low-emitting materials.

C. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

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

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Johnsonite; a Tarkett company.
3. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:
   a. Style A, Straight: Provide in areas with carpet.
   b. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 3.2 mm (0.125 inch).

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: Match Architect's sample.

2.2 THERMOPLASTIC-RUBBER BASE

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

1. Allstate Rubber Corp.
2. Armstrong World Industries, Inc.
3. Burke Mercer Flooring Products; a division of Burke Industries Inc.

4. Johnsonite; a Tarkett company.
5. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:
   a. Style A, Straight: Provide in areas with carpet.
   b. Style B, Cove: Provide in areas with resilient floor coverings.

C. Thickness: 3.2 mm (0.125 inch).

D. Height: As indicated on Drawings.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: Match Architect's sample.

2.3 RUBBER MOLDING ACCESSORY

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

1. Roppe Corporation, USA.
2. VPI Corporation.

B. Description: Rubber transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: Match Architect's sample.

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

G. Job-Formed Corners:
1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 76 mm (3 inches) in length.
   a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 76 mm (3 inches) in length.
   a. Miter or cope corners to minimize open joints.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.
1. Apply two coat(s).

C. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid vinyl floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For chemical-bonding compounds, indicating VOC content.
   4. Laboratory Test Reports: For chemical-bonding compounds, indicating compliance with requirements for low-emitting materials.
   5. Product Data: For sealants, indicating VOC content.
   6. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
   7. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
   8. Environmental Product Declaration: For each product.
   9. Health Product Declaration: For each product.
   10. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Samples: For each exposed product and for each color and pattern specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 LUXURY VINYL FLOOR TILE - **LVT**

A. Basis of Design: Patcraft, Style: Timber Grove II, Color: Sprout – V2 00173

B. Tile Standard: ASTM F 1700.

C. Thickness: 2 mm (0.079 inch).

D. Size: 15.1 cm by 121.9 cm (5.96 by 48 inches).

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 18.6 sq. m (200 sq. ft.), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis and in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes modular carpet tile.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For carpet tile installation, plans showing the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

D. Samples: For each exposed product and for each color and texture required.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (**CPT**)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Patcraft: Artful & Textured, Charcoal

B. Color: Umber 00700

C. Fiber Type: Pet Polyester.

D. Tufted Weight: 16.0 oz/yd.

E. Primary Backing/Backcoating: Non-Woven Synthetic

F. Secondary Backing/Backcoating: EcoWorx Tile

G. Size: 60.96 by 60.96 cm (24 by 24 inches).

H. Applied Treatments:
1. Soil-Resistance Treatment: Manufacturer's standard treatment.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:
a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

I. Performance Characteristics:
1. Dimensional Tolerance: Within 0.8 mm (1/32 inch) of specified size dimensions, as determined by physical measurement.
2. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
3. Colorfastness to Light: Not less than 4 after 100 AFU (AATCC fading units) according to AATCC 16, Option E.
4. Electrostatic Propensity: Less than 1.1 kV according to AATCC 134.
5. .

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Concrete Slabs:
1. Moisture Testing: Perform tests so that each test area does not exceed 18.6 sq. m (200 sq. ft.), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 1.36 kg of water/92.9 sq. m (3 lb of water/1000 sq. ft.) in 24 hours.
b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 3 mm (1/8 inch) wide or wider, and protrusions more than 0.8 mm (1/32 inch) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings and recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

I. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 91 23 - INTERIOR PAINTING

GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Galvanized metal.
   2. Wood.
   3. Gypsum board.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of paint system and in each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

PRODUCTS

1.5 MANUFACTURERS

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

   1. Benjamin Moore & Co.
   2. Dunn-Edwards Corporation.
   3. Kwal Paint; Comex Group.
   4. PPG Architectural Coatings.
   5. Sherwin-Williams Company (The).
   6. Valspar Corporation - Architectural (Pro).

1.6 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

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

C. Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

a. Flat Coatings: 50 g/L.
b. Nonflat Coatings: 100 g/L.
c. Primers, Sealers, and Undercoats: 100 g/L.
d. Shellacs, Clear: 730 g/L.
e. Shellacs, Pigmented: 550 g/L.

D. Colors: As selected by Architect from manufacturer's full range.
1. Thirty percent of surface area will be painted with deep tones.

EXECUTION

1.7 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

1.8 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

1.9 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1.10 INTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:
1. Latex System MPI INT 5.3A:
a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

B. Wood Substrates: Wood trim.
1. Latex over Latex Primer System MPI INT 6.3T:
a. Prime Coat: Primer, latex, for interior wood, MPI #39.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

C. Gypsum Board Substrates:
1. Latex over Latex Sealer System MPI INT 9.2A:
a. Prime Coat: Latex, interior, matching topcoat.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.

END OF SECTION 09 91 23

SECTION 09 93 00 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:
   1. Exterior Substrates:
      a. Exposed framing.
   2. Interior Substrates:
      a. Dressed lumber (finish carpentry or woodwork).
      b. Wood-based panel products.

1.2 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

B. Samples: For each type of finish system and in each color and gloss of finish required.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

   1. Benjamin Moore & Co.
   2. Dunn-Edwards Corporation.
   3. Kwal Paint; Comex Group.
   4. PPG Architectural Coatings.
   5. Sherwin-Williams Company (The).
   6. Valspar Corporation - Architectural (Pro).

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

a. Shellacs, Clear: 730 g/L.
b. Stains: 250 g/L.
c. Clear Wood Finishes (Varnishes, Sanding Sealers, and Lacquers): 275 g/L.

D. Stain Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.
1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 EXTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Exposed framing.
1. Varnish over Stain System MPI EXT 6.2E:
a. Stain Coat: Stain, exterior, solvent based, semitransparent, MPI #13.
b. First Intermediate Coat: Varnish matching topcoat.
c. Second Intermediate Coat: Varnish matching topcoat.
d. Topcoat: Varnish, with UV inhibitor, exterior, semi-gloss (MPI Gloss Level 5), MPI #30.

3.6 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Wood trim and doors.
1. Water-Based Varnish over Stain System MPI INT 6.3W:
a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
b. First Intermediate Coat: Water-based varnish matching topcoat.
c. Second Intermediate Coat: Water-based varnish matching topcoat.
d. Topcoat: Varnish, water based, clear, semi-gloss (MPI Gloss Level 5), MPI #129.

B. Wood Substrates: casework.
1. Water-Based Varnish over Stain System MPI INT 6.4U:
a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
b. First Intermediate Coat: Water-based varnish matching topcoat.
c. Second Intermediate Coat: Water-based varnish matching topcoat.
d. Topcoat: Varnish, water based, clear, satin (MPI Gloss Level 4), MPI #128.

END OF SECTION 09 93 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Public-use washroom accessories.
2. Healthcare accessories.
3. Underlavatory guards.
4. Custodial accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full size, for each exposed product and for each finish specified.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Double-roll dispenser.

3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 114- or 127-mm- (4-1/2- or 5-inch-) diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

B. Automatic Paper Towel (Roll) Dispenser:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Automatic motion sensing mechanism with user-adjustable delay and paper towel length; battery powered.

3. Mounting: Surface mounted.
4. Minimum Capacity: 203-mm- (8-inch-) wide, 244-m- (800-foot-) long roll.
5. Material and Finish: ABS plastic, gray.
6. Lockset: Tumbler type.

C. Waste Receptacle:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Freestanding.

3. Minimum Capacity: 54 L (14 gal.).
4. Material and Finish: Stainless steel, No. 4 finish (satin).
5. Liner: Reusable vinyl liner.

D. Automatic Liquid-Soap Dispenser:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bradley Corporation.
d. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing antibacterial soap in lather form.
3. Mounting: Wall mounted..
4. Capacity: 1000 mL (34 oz.).
5. Refill Indicator: LED indicator.

E. Grab Bar:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Flanges with concealed fasteners.

3. Material: Stainless steel, 1.3 mm (0.05 inch) thick.
   a. Finish: Smooth, No. 4 finish (satin).
4. Outside Diameter: 38 mm (1-1/2 inches).
5. Configuration and Length: As indicated on Drawings.

F. Sanitary-Napkin Disposal Unit Insert drawing designation:

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

   a. AJW Architectural Products.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Surface mounted.

3. Door or Cover: Self-closing, disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Seat-Cover Dispenser:

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

   a. AJW Architectural Products.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. GAMCO Specialty Accessories; a division of Bobrick.

2. Mounting: Surface mounted.

3. Minimum Capacity: 250 seat covers.
4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
5. Lockset: Tumbler type.

H. Mirror Unit:

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

   a. AJW Architectural Products.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. GAMCO Specialty Accessories; a division of Bobrick.

2. Frame: Stainless-steel channel.
   a. Corners: Manufacturer's standard.
3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
   a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
4. Size: As indicated on Drawings.

I. Coat Hook:

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

   a. AJW Architectural Products.
   b. American Specialties, Inc.
   c. Bobrick Washroom Equipment, Inc.
   d. Bradley Corporation.
   e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Double-prong unit.

3. Material and Finish: Polished chrome-plated zinc alloy (zamac).

2.3 HEALTHCARE ACCESSORIES

A. Specimen Pass-Through Cabinet:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: With self-closing doors on both sides, lock that prevents doors from both being opened at same time, and removable stainless-steel tray.

3. Nominal Wall Opening: 305 by 285 mm (12 by 11-1/4 inches), width by height.
4. Material and Finish: Stainless steel, No. 4 finish (satin).

2.4 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:

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

a. American Specialties, Inc.
b. GAMCO Specialty Accessories; a division of Bobrick.
c. Koala Kare Products.

2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.

a. Engineered to support minimum of 113-kg (250-lb) static load when opened.
3. Mounting: Surface mounted, with unit projecting not more than 100 mm (4 inches) from wall when closed.
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: HDPE in manufacturer's standard color.
6. Liner Dispenser: Built in.

2.5 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

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

a. Buckaroos, Inc.
b. Plumberex Specialty Products, Inc.
c. Truebro by IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.

3. Material and Finish: Antimicrobial, molded plastic, white.

2.6 CUSTODIAL ACCESSORIES

A. Utility Shelf:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: With exposed edges turned down not less than 13 mm (1/2 inch) and supported by two triangular brackets welded to shelf underside.

3. Size: 406 mm (16 inches) long by 152 mm (6 inches) deep.
4. Material and Finish: Not less than nominal 1.3-mm- (0.05-inch-) thick stainless steel, No. 4 finish (satin).

B. Mop and Broom Holder:

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

a. AJW Architectural Products.
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Bradley Corporation.
e. GAMCO Specialty Accessories; a division of Bobrick.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.

3. Length: 914 mm (36 inches).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
   a. Shelf: Not less than nominal 1.3-mm- (0.05-inch-) thick stainless steel.
   b. Rod: Approximately 6-mm- (1/4-inch-) diameter stainless steel.

2.7 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 1112 N (250 lbf), when tested according to ASTM F 446.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fire-protection cabinets for portable fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.5 SEQUENCING

A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

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

a. Guardian Fire Equipment, Inc.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Larsens Manufacturing Company.
d. Potter Roemer LLC.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Rolled-Edge Trim: 64-mm (2-1/2-inch) backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:
1. Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
   a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      1) Location: Applied to cabinet glazing.
      2) Application Process: Pressure-sensitive vinyl letters.
      3) Lettering Color: Red.
      4) Orientation: Vertical.

K. Materials:
1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
   a. Finish: Baked enamel or powder coat.
   b. Color: As selected by Architect from full range of industry colors and color densities.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply vinyl lettering at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

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

a. JL Industries, Inc.; a division of the Activar Construction Products Group.
b. Kidde Residential and Commercial Division.
c. Larsens Manufacturing Company.
d. Potter Roemer LLC.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Regular Dry-Chemical Type: UL-rated 2-A, 10-B-C, 7.5 lb nominal capacity, with sodium bicarbonate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10 44 16

SECTION 12 35 30 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes breakroom, lab, and vanity cabinets.

B. Related Requirements:
1. Section 12 36 61.19 "Quartz Agglomerate Countertops."

1.2 DEFINITIONS

A. MDF: Medium-density fiberboard.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
1. Cabinets.
2. Cabinet hardware.

B. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, and hardware.

C. Samples: For cabinet finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For casework.

PART 2 - PRODUCTS

2.1 CABINETS

A. Quality Standard: Provide cabinets that comply with KCMA A161.1.
1. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location of each unit and showing compliance with the above standard.

B. Face Style: Reveal overlay.

C. Cabinet Style: Face frame.

D. Door and Drawer Fronts: Solid-wood stiles and rails, 19 mm (3/4 inch) thick, with 6.4-mm- (1/4-inch-) thick, veneer-faced plywood center panels.

E. Face Frames: 19-by-41-mm (3/4-by-1-5/8-inch) solid wood with glued mortise and tenon or doweled joints.

F. Exposed Cabinet End Finish: Wood veneer.

2.2 CABINET MATERIALS

A. Hardwood Lumber: Kiln dried to 7 percent moisture content.

B. Softwood Lumber: Kiln dried to 10 percent moisture content.

C. Composite Wood Products: Products shall be made without urea formaldehyde.
1. Hardwood Plywood: HPVA HP-1.
2. MDF: ANSI A208.2, Grade MD.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

E. Exposed Materials:
1. Exposed Wood Species: Clear Alder.

a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
b. Staining and Finish: Match Architect's sample.

2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.

F. Semiexposed Materials: Unless otherwise indicated, provide the following:
1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.

G. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.3 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Wire pulls.

C. Hinges: Concealed European-style, self-closing hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.

B. Install cabinets without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install cabinets level and plumb to a tolerance of 3 mm in 2.4 m (1/8 inch in 8 feet).

D. Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 400 mm (16 inches) o.c. with No. 10 wafer-head sheet metal screws through the metal backing or metal framing behind the wall finish.

3.2 ADJUSTING AND CLEANING

A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

END OF SECTION 12 35 30

SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz agglomerate countertops.
   2. Quartz agglomerate backsplashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples: For each type of material exposed to view.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

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

      a. Hanstone.
      b. Cambria.
      c. LG Chemical, Ltd.
      d. Wilsonart.

   2. Colors and Patterns: As shown on the Drawings.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Custom.

B. Configuration:
   1. Front: 38-mm (1-1/2-inch) laminated bullnose.
   2. Backsplash: Straight, slightly eased at corner.
   3. End Splash: Matching backsplash.

C. Countertops: 19-mm- (3/4-inch-) thick, quartz agglomerate.

D. Backsplashes: 19-mm- (3/4-inch-) thick, quartz agglomerate.

E. Joints: Fabricate countertops without joints.

F. Joints: Fabricate countertops in sections for joining in field.

G. Cutouts and Holes:
   1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive.

F. Install aprons to backing and countertops with adhesive.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.19

TABLE OF CONTENTS

SECTION 22 0500 - GENERAL PROVISIONS

PART 1 - GENERAL

A. Provisions of this section apply to all work specified in all sections under Division 22.

B. In addition, work in Division 22 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions and all sections under Division 1, General Requirements.

1.2 Examination of Premises: Visit the site, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.3 The Plumbing Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of two years in the State of Utah as a plumbing contractor.

1.4 The Plumbing Contractor shall have a minimum of five years experience installing commercial plumbing systems similar to those described in these specifications and provide a list of previous projects, including name of project and contact person names and phone numbers.

1.5 The Plumbing Contractor shall be able to bond work he is bidding to perform and shall provide a written statement from the bonding agency proposed to be used for this project as a separate document in addition to the plumbing bid submitted by the General Contractor. The bonding agency shall be one having a Best's insurance rating of A or A+. (Verify all bonding with General Contractor)

1.6 Regulations, Permits, Fees, Charges, Inspections: (Verify with General Contractor)

A. Regulations: Comply with all applicable codes, rules and regulations. All materials and work must comply with local construction, mechanical, plumbing, electrical and fire codes. As a minimum, comply with the following: 1991 IMC, IPC, NEC, UFC, NFPA codes and all City and State codes.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 1.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 1.

1.7 Drawings and Specifications:

A. Refer to Division 1 for information on submittals and shop drawings.

B. If a conflict exists between the drawings and specifications, promptly notify the Architect.

1.8 Record Drawings: Provide record drawings for all work under sections in Division 22. See Division 1 for detailed requirements covering preparation of record drawings.

1.9 Work and Materials: Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect and is comparable to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified construction Superintendent, to complete the work in the time allotted. The Superintendent must be qualified to supervise all of the work in his work category.

1.10 Approvals of Materials and Equipment: Refer to Division 1 for description of material and equipment for prior approvals and substitutions.

1.11 Maintenance Manual:

A. Prior to completion of the project, compile a complete equipment and maintenance manual for all equipment supplied under sections of Division 22, as described in Division 1.

B. Manuals shall be bound in a three-ring binder. A preliminary submittal of the manual shall be made to the Architect 90 days after receiving approved submittals. Final submittal of the manual shall be made four weeks prior to substantial completion of the project.

1.12 Shop Drawings:

A. Engineer's Review: The Engineer shall review and take appropriate action on shop drawings, product data, samples and other submittals required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Engineer's review shall be conducted with reasonable promptness consistent with sound professional practice. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Engineer shall not be required to review and shall not be responsible for any deviations from the contract documents not clearly noted by the Contractor, nor shall the Engineer be required to review partial submissions or those for which submissions for correlated items have not been received.

B. Submit shop drawings in accordance with Division 1 and all data for all equipment provided under Division 22 within 30 days after award of contract. Index all submittals and reference to these specifications. Submit all shop drawings in a single batch at one time. Submit shop drawings for all equipment provided under Division 22, including the following:

1. Insulation materials and finishes for all types of piping.
2. Water heaters of all types.
3. Access doors.
4. Access panels.
5. Plumbing fixture cuts, trim and fittings, rough-in dimensions and special supports.
6. Plumbing fixtures, equipment and specialties.
7. Domestic water pipe, fittings, valves, hangers and specialties showing manufacturer and type.
8. Waste and vent piping, fittings, couplings, hangers.
9. All other equipment as shown, indicated, specified, required and as directed by Architect.

1.13 Equipment Purchases: Arrange for purchase and delivery of all materials and equipment within 15 days after approval of submittals.

1.14 Cooperative Work:

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. See Division 1 for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 22 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 22.

3. Electrical work as specified herein. Refer to Division 26 for requirements.

1.15 Identification:

A. Pipe:

1. Mark each individual pipe with Brady, Seton, Brimar, or Set Mark identification markers of snap-on type after pipe has been painted or insulated where exposed.

2. Install stencils at all major branch takeoffs, risers and at 10-foot intervals on straight runs and at each entrance or exit from pipe shafts. Markers shall be located for maximum visibility from expected personnel approach.

3. Identification material sizes shall be as follows:

2" and under 1/2" high letters

Over 2" 1" high letters

Provide a typewritten schedule of all markers used, with identification framed under glass and posted in the mechanical equipment room.

4. Identify pipe with following:

Service	Abbreviation
Domestic Cold Water	CW
Domestic Hot Water	DHW
Sanitary Sewer	SS
Equipment Drains	D
Vent	V

1.16 Substitutions:

A. Where Manufacturer's names appear, other Manufacturers may be substituted upon obtaining written approval of Architect **at least 10 days prior to opening of bids**. The contractor will be required to complete and sign a "Proposed Substitution Request Form" that will be reviewed by the Architect, Engineer, and Owner. The submission of the "Proposed Substitution Request Form" shall be **at least 10 days prior to opening of bids**.

B. Any prior approval of alternate equipment does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of

these specifications may result in the total removal of the alternate system at the expense of the contractor.

1.17 Guarantee: Guarantee all material, equipment, and workmanship for all sections under Division 22 in writing to be free from defects of material and workmanship for one year from date of final acceptance as outlined in Division 1. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

1.18 Electrical Work:

A. Electrical wiring, all raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in Electrical Division 26 of the specifications.

B. Before ordering any equipment. Verify the available voltage and phase for all motors with the Electrical Contractor.

C. Submit a complete list of all motors prior to final closeout of job indicating the locations, horsepower, voltage, phase and amperage draw of each motor.

D. All field wiring and equipment must conform to the applicable sections of the Electrical specifications, Division 26.

1.19 Welding Codes and Standards: All welding and other criteria covered by this specification shall be in accordance with the following code:

ASME Boiler and Pressure Vessel Code

Section IX ANSI Code for Power Piping: B31.1

PART 2 - PRODUCTS

2.1 Equipment Design and Installation:

A. Uniformity: Unless otherwise specified, provide all equipment of same type or classification by the same manufacturer.

B. Design: Design all equipment in accordance with ASME, AGA, UL and other applicable technical standards as follows:

Pressures vessels - ASME Code constructed and stamped

Electric appliances - UL labeled

Fans - AMCA rated and stamped

PART 3 - EXECUTION

3.1 Verification of Dimensions:

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact

locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.2 Cutting and Patching: Cut work and patch per Division 1 as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Patching by General Contractor at Mechanical, Plumbing or Fire Protection Contractor's expense. Include as a part of the work under this contract all structural framing required by penetrations through the roof and necessary steel to support ducts and pipes between structural steel unless shown on the structural drawings.

3.3 Closing-in of Unfinished Work: Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.4 Excavation and Backfill:

A. Perform all necessary excavation, shoring and backfilling required for the proper laying of all pipes and conduits inside the building and premises, and outside as may be necessary. Conform to Division 2 requirements. Remove all excess excavated materials from the site or dispose of on site as directed by General Contractor.

B. Excavate all trenches open cut, keep trench banks as nearly vertical as practicable, and sheet and brace trenches where required for stability and safety. Excavate trenches true to line and make bottoms not less than 18" wide but no wider than necessary to provide ample work room. Grade trench bottoms accurately to provide uniform bearing and support for each section of pipe on undisturbed soil along its entire length. Dig "bell" holes after the trench bottom has been graded. Machine grade only to the top line of the pipes, doing the balance by hand. Do not cut any trench near or under footings without first consulting the Architect. Comply with OSHA requirements.

C. Provide backfilling and compaction in accordance with requirement of Division 2 and under the direction of the Architect and the Owner's testing firm to the required density. Make the first 2 feet of fill in 6" layers, each thoroughly compacted as directed, and free from rocks, large clods of earth, leaves, branches, and debris. Compact the rest of the backfill to prevent settlement as directed, using in the backfill no rocks larger than 4" in diameter, and using no rocks at all in the top 12".

3.5 Accessibility:

A. Install valves, dampers, thermometers, gauges, traps, cleanouts, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the contract drawings to be installed above any inaccessible ceiling, the Mechanical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified under Division 8.

C. Refer to drawings and "Finish Schedule" for type of wall and ceiling in each area and for rated construction.

D. Coordinate work of various sections to locate valves, traps, and dampers with others to avoid unnecessary duplication of access doors.

3.6 Roof Flashings: Flash and counterflash all piping, conduits and ductwork penetrating roofing membrane with flashing per roofing manufacturer's recommendations. Refer to architectural drawings for detailing of duct and pipe penetrations through roof.

3.7 Equipment Rough-in:

A. Rough in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the contract drawings shall be anticipated and provided for under this division of the specifications.

D. Rough-in only (unless otherwise designated on the drawings) shall include the following:

1. Plumbing: Provide all services designated and required, including waste and water. Valve and cap all stub-outs for water and gas. Cap all waste and vent outlets.

3.8 Owner-Furnished and Other Equipment:

A. Rough-in only for all Owner-furnished equipment (see Division 1) and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Provide all services designated, valve and cap all piping and cap all waste piping and leave in a clean and orderly manner.

C. Rough-in requirements shall be as outlined in the preceding paragraph titled "Equipment Rough-In."

3.9 Equipment Final Connections:

A. Provide all piping final connections for all equipment under Division 22 as required herein specified and indicated on the drawings.

B. Plumbing: Provide final plumbing connections complete with shutoff valves, risers, traps, vacuum breakers and indirect wastes for all equipment furnished and installed under other sections of these specifications, except as otherwise designated. Included under the Plumbing section of the specifications are the final connections to the following:

1. Miscellaneous equipment specified to be furnished and installed under other divisions of the specifications.

3.10 Pipe and Equipment Supports:

A. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strains and interference with piping connections, tube pulling or other maintenance operations.

B. Grout under all equipment after leveling, filling completely the space between machinery bed plate and foundation surface as specified in Division 3. Finish exposed surface of grout for a neat appearance.

C. Floor Stands: Where equipment is mounted standard or on legs, construct of structural steel or steel pipe and fittings, cross-brace and fasten with flanges or plates bolted to floor.

D. Ceiling or Wall Supports: Use suspended platform, strap hangers, bracket or shelf, whichever is most suitable for equipment and location. Construct of structural steel members, steel plates, rods or pipe as required. Cross-brace and fasten to building structure or inserts in an approved manner.

E. Steel Work: Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

3.11 Cleanup:

A. In addition to cleanup specified under Division 1, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. Thoroughly flush and clean out all water circulating systems. Remove, clean and replace all strainer elements.

C. During the progress of the work, keep the premises clean and free of debris.

3.12 Painting:

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal with one coat of rust-inhibiting primer. (Galvanized ductwork and factory painted equipment shall be considered as having primed surface.)

B. Finished painting is specified under Division 9.

3.13 Connections to Services: Provide all connections to sanitary sewer lines, storm sewer, gas lines, water lines, electrical services furnished under other contracts, except as otherwise specifically designated. Provide all necessary tees, taps and connections required to properly connect to all mains. Verify all required City requirements before making any piping connections to sanitary sewer, storm sewer, or water piping and conform to them during installation.

3.14 Objectionable Noise and Vibration: Construct and brace the metal partitions, ducts and sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through ducts, piping, conduit, sheet metal work, or the building structure. Provide power-driven equipment suspended from the structure with spring type isolation.

3.15 Welding:

A. Procedures:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

2. Architect's inspector or authorized representative will review performance qualification records of individual welders.

B. Welding Processes: The following welding processes are permitted, provided that the procedure is qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code.

1. Manual shielded metal-arc.

2. Gas tungsten-arc.

3. Other welding processes may be used providing they are qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code.

C. Restrictions: Weld bevel preparations shall be provided on all welding fittings and shall be machined or ground to remove all discoloration if flame or arc cut.

D. Welding Filler Material:

1. A filler material control procedure shall be submitted to Owner for review and acceptance prior to performing any welding.

2. All shielded metal-arc welding shall be performed using low-hydrogen type electrodes such as E 7018.

E. Preheat and Interpass Temperature:

1. Preheat for pressure components shall be as specified in Table 132 of ANSI B.1.

2. Preheat and interpass temperature shall be determined by temperature indicating crayons, contact pyrometers or other suitable means.

F. Postweld Heat Treatment: Postweld heat treatment for pressure components shall be as specified in Table 131 of ANSI B31.1.

END OF SECTION 22 0500

SECTION 22 0501 - SUMMARY OF WORK FOR PLUMBING

PART 1 - GENERAL

1.1 Description of Work

A. This section describes the work required under the Plumbing sections of these specifications.

1.2 General and Supplementary Conditions

A. The General and the Supplementary Conditions of this project apply in every respect to all of the sections under this division of these specifications.

1.3 Related Work Specified Elsewhere

A. Concrete, Division.

B. Finished Painting, Division.

C. Mechanical, Division 23.

D. Electrical, Division 26.

1.4 Scope

A. For general convenience these specifications are divided into divisions and sections. The work for the plumbing contract is in general described in Division 22. The work under these sections include furnishing and installing plumbing systems. The work includes, but is not necessarily limited to, the installation of the following:

1. Complete sanitary plumbing waste and vent systems with connections to all plumbing fixtures and equipment to outside sanitary sewer system within 5 feet of building.
2. Domestic water piping with services to all fixtures and equipment, including connections to outside water system within 5 feet of building.
3. Domestic hot water heating equipment including piping, valves, etc. as indicated on the drawings and specified.
4. Insulation specified herein for domestic hot water supply piping, and other pipe as specified.
5. Adequate supervision of erection, balancing and adjustments and instructions for proper operation and maintenance.
6. Plumbing fixtures as specified herein and shown on the drawings.
7. Payment for all plumbing permits, inspection and installation fees. (Coordinate with General Contractor)
8. Sterilization of potable water system.

1.5 Alternate Equipment

A. Specification of all equipment and materials in Division 22 by brand name is intended to establish a standard of quality. Further, this equipment has been checked as to size and weight requirements, and space allocations have been made accordingly. The Contractor is responsible to verify prior to bidding that all specified and alternate items to those specified will be available in time for installation during timely progress of the work.

B. Submittal of equipment by other acceptable manufacturers must be made in accordance to "Instructions to Bidders" section and shall be complete in every detail including space requirements, weight, complete performance data, and supplemental data requested by the Architect. Contractor shall be responsible for assurance that the equipment meets all requirements detailed in this and other sections and as shown on the drawings.

C. The following is a list of manufacturers whose equipment is acceptable as to manufacture, subject to conformance with all drawings.

D. Approved Plumbing Equipment Manufacturers: (Note some items may not be required)

Plumbing Fixtures: American Standard, Kohler, Toto, Gerber, Watts, Zurn, Danze, Sterling, Lasco, Western Pottery, Niagara.

Water Closets: American Standard, Kohler, Toto, Gerber, Sterling, Western Pottery, Niagara.

Plumbing Faucets: Chicago, American Standard, Symmons, Delta, Kohler, Speakman, Royal, T & S, Moen, Gerber, Zurn, Danze, .

Plumbing Supply Stops: Eastman, Crane, Kohler, Wolverine, McGuire, Brasscraft, EBC, Zurn, Chicago.

P-Traps: Crane, Kohler, McGuire, Brasscraft, Dearborn, EBC, Zurn.

Closet Seats: Sperzel, Church, Olsonite, Beneke, Bemis, American Standard, Zurn, Niagara.

Floor Drains: Zurn, Smith, Wade, Josam, Ancon, Mifab, Watts, Oatey, Sioux Chief, Sun Drainage.

Cleanouts: Zurn, Smith, Wade, Josam, Mikro, Mifab, Watts, Sun Drainage.

Shock Absorbers: Zurn, Smith, Wade, Josam, PPP, Sioux Chief, Watts, Mifab.

Stainless Steel Sinks: Elkay, Just, Moen, Titan.

Electric Water Coolers: Elkay, Sunroc, Halsey Taylor, Haws Corporation, Westinghouse, Murdock.

Valves: Milwaukee, Crane, Kennedy, Stockham, Mission, Grinnell, Keystone, Watts, American Valve.

Pressure Gauges: Weksler, Trerice, Palmer, Marsh, Weiss.

Pipe and Equipment Insulation: Owens-Corning, CertainTeed, Manville, Pittsburgh, Armstrong.

Hose Bibs: Mifab, Woodford, Chicago, Acorn, Wolverine, McGuire, Watts, Josam, Prier, Zurn.

Thermostatic Tempered Water Valves: Symmons, Powers, Leonard, Bradley, Watts, Lawler, Caleffi, Acorn.

END OF SECTION 22 0501

SECTION 22 0594 – TESTING

PART 1 - GENERAL

1.1 This section describes the labor, materials and services required for the testing of all systems.

PART 2 - EXECUTION

2.1 Test Procedures

A. Make tests before the rough work is covered. The system may be tested in parts if approved.

B. When the tests show the work in any way defective, remove defective material or equipment from the premises and retest.

C. Make piping tests on all piping as required by code. Pressure test for four hours, unless otherwise noted.

2.2 Testing out

A. Check out and test operate all equipment installed under the sections of these specifications, including a check of all work performed under the Electrical and Mechanical divisions in conjunction with the equipment installed under all sections of this division.

1. Fill water pipe lines, flush and drain, and then refill with clear water. Repeat this procedure three times, under the observation of the Architect's Representative.

2. When the test or observations show that the work is in any way defective or at a variance with the specification requirements, immediately make all changes necessary to correct the work and remedy the defects to the satisfaction of the Architect. Remove any defective material or equipment from the premises. In the event the Contractor does not remedy all defects and make all changes demanded by the Architect within a reasonable time, the right is reserved to have the defects remedied or changes made and to charge the cost of the work against the account of the Contractor.

3. Furnish all appliances, equipment and labor for the tests and meet all expenses of the tests.

2.3 Final Tests

A. Before acceptance and at a time designated, make a complete test to demonstrate that all controls are adjusted and that, in general, the system is placed into proper operation. Furnish a skilled operating engineer for a period of at least eight hours, at time or times designated by the Owner, to instruct the Owner's representative in the operation and maintenance of the equipment.

END OF SECTION 22 0594

SECTION 22 0716 - GENERAL PIPING REQUIREMENTS

PART 1 - GENERAL

1.1 WORK SPECIFIED HEREIN

A. This section describes the workmanship, labor, services and miscellaneous equipment and materials required for the installation of all piping in Division 22.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. Do not close up, furr in, or cover piping before it has been tested and inspected as specified.

B. Cover or plug openings in pipes, drains, fittings and equipment during construction to keep system free of foreign matter.

C. Conceal all piping unless otherwise indicated or specified.

D. Install piping to maintain headroom, keep access openings clear and offset piping as required to maintain clearances.

E. Install piping at right angles or parallel to adjacent walls.

F. Keep piping free from sags, traps and unnecessary bends.

G. Do not spring, bend or force pipe into place. Use fittings for all offsets and changes of alignment in piping.

H. Do not use street elbows, bushings and longscrew nipples.

I. Do not install any pressure piping in floor slabs or in ground under floor slabs, unless otherwise indicated or specified.

J. Do not locate piping in electrical equipment rooms unless it serves that room. Do not locate it directly above electrical equipment in any room. Where piping is located in an electrical equipment room which it serves, provide a 20 gauge galvanized sheet metal drip pan with drain line to floor drain.

K. Where change in pipe size occurs, use appropriate reducing fittings, no bushings.

3.2 UNIONS, FLANGES AND DIELECTRIC COUPLINGS

A. Unions Required: On inlet or outlet of all valves and equipment with connections 2" and smaller and elsewhere as indicated on the contract documents.

B. Flanges Required: On inlet or outlet of all equipment having connections 2-1/2" and larger. On inlet or outlet of all valves and fittings having flanged ends or requiring companion flanges. Do not use slip-on flanges on short radius ells, tees, reducers and fittings that do not have sufficient straight length to permit proper alignment and construction of a flange joint.

C. Dielectric Couplings: Provide dielectric couplings at all points where copper or brass pipe or equipment is joined to ferrous pipe and equipment. This requirement does not apply to brass valves in steel lines or joints between copper and cast iron drainage lines.

3.3 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeve all pipes passing through masonry or concrete floors and walls.

B. Provide piping passing through masonry, concrete, tile and gypsum wall construction with not lighter than 22 gauge galvanized steel sleeves with lock seam, except as otherwise indicated.

C. Sleeves through floor construction shall be a minimum of Schedule 40 black steel pipe with 3" weep ring flange welded to pipe except as otherwise indicated. Flange shall be embedded in concrete.

D. Floor sleeves shall extend a minimum of 2" above the floor.

E. Pipes passing through walls labeled on the architectural drawings as fire-rated shall be sleeved and sealed with fireproof caulking. Refer to the contract drawings for additional information and details.

F. Sleeves for insulated pipe must be large enough to clear insulation.

G. Where sleeves are placed in exterior walls below grade or in floor of finished areas. Make the entire penetration watertight.

H. Where pipe motion due to expansion and contraction will occur, make sleeve of sufficient diameter to permit free movement of the pipes.

I. Provide chrome-plated or stainless steel escutcheons at all pipe penetrations through walls, ceilings or floors of all finished areas.

3.4 VALVES

A. General: Locate and arrange valves for complete regulation and/or removal of equipment.

B. Location: Install valves as indicated and at all the following locations:

1. Pressure connections to equipment.
2. Takeoff from vertical risers.
3. Domestic connections to utilities.

C. Concealment: Unless otherwise indicated, conceal all valves in the finished parts of the building.

D. Grouping: Wherever possible, group valves to provide a neat appearance with all parts accessible.

3.5 PIPE JOINTS

A. Screwed Joints: Cut accurately to measurements established at the building. Ream pipe and remove all burrs. Cut threads per ANSI B2.1 with clean sharp die to full thickness of die. Apply pipe dope or teflon tape to male thread prior to jointing. After jointing, leave not more than 3 full threads exposed.

B. Solder Joints: Cut square and remove burrs. Thoroughly clean outside of male end and inside of female fitting to a bright finish. Coat pipe and fitting with solder flux, applied with brush. Solder joint as specified and remove excess solder. Remove the internal parts of soldered valves prior to soldering. Carefully follow equipment manufacturer's directions for soldering on or adjacent to his equipment.

C. Welded Joints:

1. Electric weld all piping using ASME certified welders (refer to Section 15000 for additional requirements on welding). Carefully follow equipment manufacturers directions for welding on or adjacent to his equipment. Use outlets, fittings and joints designed for welded piping. Use long radius ells at all pump connections and where indicated and butt-welded or socket-welded fittings at all offsets or bends.

2. Make connections to mains with Schedule 40 welding fittings when the branch is the same size as the main or one size smaller.Use "Weldolet" fittings when the branch is 2 or more sizes smaller than the main. Use "Threadolet" fittings for branches 2" or smaller.

D. Mechanical Joints: Install with mechanical couplings or compression joints in strict compliance with the manufacturer's instructions.

E. Solvent Weld Joints: Install solvent welded joints in strict compliance with the manufacturer's instructions and remove all excess solvent.

3.6 PIPE HANGERS

A. General: Secure all piping in place using approved hangers, supports and anchors designed to support the weight of the pipe, fluid and insulation. Arrange hangers to prevent transmission of vibration from the piping to the building structure, with hangers and supports designed to allow for expansion and contraction.

B. Pipe Support: Support piping at each change of direction, at ends of branches, at base and top of riser pipes and drops, and wherever necessary to prevent sags, bending or vibration.

C. Insulation Guards: Size hangers on insulated piping to fit outside the covering. Protect insulation from crushing at hanger locations with sheet metal pipe saddles. Use rigid insulation under saddle.

D. Riser Piping: Support at top and bottoms as specified for horizontal piping. Support at intermediate floors by means of pipe clamps bolted to piping. In addition, support soil and waste piping at base of stack. Where pipe sleeves extend above floor, support from underside of slab.

3.7 EXPANSION AND CONTRACTION

A. Install all pipe work and conduit in such a manner that its contraction and expansion will not do any damage to the pipes, conduit, the connected equipment or the building. Install offsets, swing joints, expansion joints, pipe clamps and anchors as required to prevent excessive strains in the pipe work. Install all supports to permit the systems to contract and expand freely without putting any stress or strain in the respective systems.

END OF SECTION 22 0716

SECTION 22 0718 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED HEREIN

A. Provide and install piping specialties as specified herein and as shown on the drawings.

PART 2 - PRODUCTS

2.1 PIPE HANGERS

A. Piping 2-1/2" and Smaller: Use adjustable, split ring malleable iron type (Grinnell Fig. 104) or adjustable steel clevis type (Grinnell Fig. 260) with threaded solid steel hanger rods.

B. Piping 3" and Larger: Use adjustable steel clevis type hangers (Grinnell Fig. 260) with threaded solid steel hanger rods.

C. Grouped Piping: Trapeze type hangers with rollers may be used where 2 or more pipes run parallel to each other. Submit shop drawings of all trapeze hangers for approval before progressing with any work.

D. Size all hangers on insulated piping to fit outside covering.

E. Hanger Rod Sizes:

Pipe Size	Rod Diameter (Inches)
2" and smaller	3/8
2-1/2" and 3"	1/2
4" and 5"	5/8
6"	3/4
8" through 14"	7/8

F. Hanger Rod Spacing (Horizontal Piping):

Pipe	Max. Hanger Spacing (Ft. O.C.)
Steel pipe 3/4" and smaller	6
Steel pipe 1"	8
Steel pipe 1-1/4" through 12"	10
Steel pipe 14" and larger	12
Copper tubing 1-1/4" and smaller	6
Copper tubing 1-1/2" and larger	8
PVC & ABS piping	4
Special piping materials	as recommended by manufacturer.

2.2 SAFETY COVERS

A. Install Handy-Shield, as manufactured by Plumberex Specialty Products, safety covers on all supply piping and waste piping beneath handicapped lavatories. Shields shall meet the requirements of Uniform Federal Accessibility Standards 4.19.4 GSA and ANSI Document A117-1-1980.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. Refer to structural drawings and details for acceptable methods and locations of attachment to structural members.

B. Provide hangers at all offsets, tees, within 12" of all horizontal elbows, and elsewhere as herein described.

C. Support all piping from walls, structural members, or from the ceiling as specified or as detailed.

D. Support vertical piping as specified or as detailed.

E. Where structural or piping conditions or clearance requires other than the specified means of supporting the pipes, use means as directed by the Architect.

F. Wrap piping wherever lines run through joists, studs and framing 12" in length with felt on paper backing to prevent the pipe from rubbing.

G. Install chrome-plated split escutcheons around all pipes passing through finished walls, floors and ceilings.

H. Sleeve and seal air and watertight all piping passing through exterior walls, through plenum or fire walls above ceilings, and elsewhere as designated. All sealers shall be waterproof and fireproof.

END OF SECTION 22 0718

SECTION 22 0719 - PIPE INSULATION FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE

A. Apply insulation after piping has been installed, tested, approved, dry, and in a clean condition.

B. Insulate Main Cold Water Supply Line in any areas that it is exposed or installed in unconditioned spaces. Insulation shall have thickness as indicated in the Piping Insulation Detail. Coordinate any heat tape as needed with Electrical Contractor.

C. Hot water pipe insulation shall have thickness as indicated in the Piping Insulation Detail. Provide and install insulation where required by code and as indicated on the plumbing plans and details.

D. Provide sound insulation on drain lines that transition above common areas and below upper floor rooms to deaden noise. (existing as well as new)

PART 2 - PRODUCTS

2.1 MATERIAL

A. Premolded fiberglass insulation, maximum K factor 0.24 at 75°F mean temperature, minimum 3.75-pound density. Insulation shall have all-service jacket with white finish.

PART 3 - EXECUTION

3.1 APPLICATION

A. Piping: Insulation end joints to be tightly butted together with butt joint strips and the longitudinal seam stapled closed with outward clinch staples 2" on centers. Where possible, locate all longitudinal seams out of sight. Coat all staples with adhesive. Cover exposed pipe insulation with 6-ounce canvas jacket coated 100% with Foster lagging adhesive 30-36.

B. Valves, Fittings and Flanges (Concealed): Insulate all concealed valves, fittings and flanges with Zeston premolded sectional covering.

C. Valves, Fittings and Flanges (Exposed): Insulate all exposed valves, fittings and flanges as specified for concealed fittings, and cover with 6-ounce canvas coated 100% with Foster lagging adhesive 30-36.

D. Hangers and Rollers: Provide a protective shield covering of 18 gauge galvanized steel placed centrally at all hangers and rollers. Shield shall cover half of the insulation and have a length of not less than 12". Insert a 12" section of cellular glass or calcium silicate at each hanger and roller location.

END OF SECTION 22 0719

SECTION 22 1116 - DOMESTIC WATER SYSTEM

PART 1 - GENERAL

1.1 Provide PVC Sleeves for PEX Piping where it passes under slabs.

1.2 Provide Copper Termination at all shut-off valves. Provide required transition fittings from PEX to Copper Pipe at the wall termination.

PART 2 - PRODUCTS

2.1 Piping: (Shall meet the standards set forth in IPC Tables 605.3, 605.4, 605.5.)

A. The Water Piping from the PRV Station for all lines larger than 2-inches shall be CPVC or PPR Piping Product (provide all manufacturer recommended expansion joints). Water lines that are 2-inches and smaller will be PEX.

2.2 Fittings:

A. Shall be compatible with piping material.

2.3 Backflow Preventers: Specified in Plumbing Specialties section.

PART 3 - EXECUTION

3.1 Extend water piping to all fixtures, outlets and equipment. Provide shutoff valves or fixture stops as required for proper service.

3.2 Provide capped or plugged and valved outlets where indicated for future equipment connections.

3.3 Hold lines which are specified to be insulated a sufficient distance from other work to permit installation of insulation.

3.4 Provide necessary allowance in piping systems to handle expansion and contraction. Install ample swings or offsets in branch connections to avoid undue strains on fittings or short pipe supplies. Provide expansion loops and pipe anchors as indicated on the drawings.

3.5 Provide approved pressure type backflow prevention devices required by governing authorities.

3.6 Coordinate overhead piping with mechanical ductwork and electrical conduits.

3.7 Provide a mechanical shock absorber at any fixtures using a quick-closing valve device (flush valves, dishwasher (residential), fridge water connection, washing machines, etc.).

3.8 Sterilization: Sterilize the entire water distribution system thoroughly with a solution containing not less than 50 parts per million of available chlorine. For the chlorinating material use sodium hypochlorite solution, conforming to Federal Specification 0-8-441, Grade D, and introduce into the system in a manner approved by the Architect. Allow the sterilizing solution to remain in the system for a period of 8 hours, during which time all valves and faucets shall be opened and closed several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million, unless otherwise directed. *** NOTE: CONTRACTOR SHALL PROVIDE ARCHITECT/ENGINEER WITH CERTIFICATION OF TEST RESULTS. ***

3.9 Test: Fill system with water and pressurize to 125 psi and hold for four (4) hours with no pressure drop. Test and obtain approval on all underground piping before covering work.

END OF SECTION 22 1116

SECTION 22 1313 - SANITARY WASTE AND VENT SYSTEM

PART 1 - PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To

1. The Drain Waste and Vent System will be Schedule-40 PVC Piping rated for Drain Waste and Vent where indicated in the plumbing plans.
2. The Drain Waste and Vent System will be Cast Iron Piping rated for Drain Waste and Vent where indicated in the plumbing plans.
3. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building. Continuation of sewer system will be indicated on Civil Plans.
4. Perform excavation and backfill required by work of this Section.

PART 2 PRODUCTS

2.1 COMPONENTS (Shall meet the standards set forth in IPC Tables 702.1, 702.2, 702.3, 702.4.)

A. Indicated in Section Summary.

B. Buried Piping

1. Minimum size of waste piping installed under floor slab on grade shall be 2 inches.

PART 3 EXECUTION

3.1 INSTALLATION

A. Excavate and backfill as specified

1. Runs shall be as close as possible to those shown on Drawings.
2. Excavate to required depth and grade to obtain fall required. Grade soil and waste lines within building perimeter in direction of flow.
3. Bottom of trenches shall be hard. Tamp as required.
4. Remove debris from trench prior to laying of pipe.
5. Do not cut trenches near footings without consulting Architect.

B. Thermoplastic Pipe And Fittings

1. General - Piping and joints shall be clean and installed according to Manufacturer's recommendations. Break down contaminated joints, clean seats and gaskets and reinstall.
2. Above Grade - Locate pipe hangers every 4 feet on center maximum and at elbows.

3. Below Grade -

a. Install in accordance with Manufacturer's recommendations and ASTM D 2321.

b. Stabilize unstable trench bottoms.

c. Bed pipe true to line and grade with continuous support from firm base.

1) Bedding depth - 4 to 6 inches.

2) Material and compaction to meet ASTM standard noted above.

d. Excavate bell holes into bedding material so pipe is uniformly supported along its entire length. Blocking to grade pipe is forbidden.

e. Trench width at top of pipe -

1) Minimum - 18 inches or diameter of pipe plus 12 inches, whichever is greater.

2) Maximum - Outside diameter of pipe plus 24 inches.

f. Do not use back hoe or power equipment to assemble pipe.

g. Initial backfill shall be 12 inches above top of pipe with material specified in referenced ASTM standard.

h. Minimum cover over top of pipe not under building slab -

1) 36 inches before wheel loading.

2) 48 inches before compaction.

C. Install piping so cleanouts may be installed as follows

1. Where shown on Drawings and near bottom of each stack and riser.

2. At every 135 degrees of accumulative change in direction for horizontal lines.

3. Every 100 feet of horizontal run.

4. Extend piping to accessible surface. Do not install piping so cleanouts must be installed in carpeted floors. In such locations, configure piping so wall type cleanouts may be used.

D. Vent entire waste system to atmosphere. Join lines together in fewest practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley. Vent line terminations shall be

1. 12 inches minimum above roof and 12 inches minimum from any vertical surface. Local Code Official may require additional height.

2. Same size as vent pipe.

3. In areas where minimum design temperature is below 0 deg F or where frost or snow closure may be possible -

a. Vent line terminations shall be same size as vent pipe, except no smaller than 2 inches in diameter.

b. Vents shall terminate 12 inches minimum above roof or higher if required by local codes.

E. Furnish and install firestopping at penetrations of fire-rated structures.

3.2 FIELD QUALITY CONTROL

A. Site Tests

1. Conduct tests for leaks and defective work. Notify Architect prior to testing.

2. Thermoplastic Pipe System -

a. Before backfilling and compacting of trenches, cap all open ends and pressure test to 20 psi for 4 hours with no leaks. Correct leaks and defective work.

b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

END OF SECTION 22 1313

SECTION 22 3430 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 Scope

1.2 All electrical equipment and controls shall be UL listed. Provide ASME approved temperature and pressure relief valves on all domestic heating equipment.

PART 2 - PRODUCTS

2.1 Domestic Water Heaters

A. Existing water heater – verify installation and proper operation.

1. ASME combination temperature and pressure relief valve rated in excess of heater input. Run full size drain to atmosphere. Verify installation.

2. Water heater drain pan with drain as indicated in plumbing detail.

3. Secure water heater as indicated in water heater detail.

END OF SECTION 22 3430

SECTION 22 4200 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 Use polished chrome-plated, adjustable brass P-traps with wall escutcheons at all exposed locations. Fixtures and supply fitting shall be of one manufacturer. Provide diaphragm type, polished chrome-plated flush valves with integral vacuum breakers and screwdriver stops. Provide fixture stops or valves ahead of all equipment or fixtures. After fixtures are set in place and secured to walls, caulk all around between fixtures and wall with either Dow Corning #780 or G.E. Construction Sealant white silicone caulking compound. See Section 22 0501 for other acceptable and approved plumbing equipment manufacturers.

1.2 See Plumbing Fixture Schedule for Model Numbers and additional information.

1.3 Match existing fixtures as directed by owner representative.

1.4 Provide and install new supply stops and supply hoses for all new or relocated plumbing fixtures.

PART 2 - PRODUCTS

2.1 Lavatories and sinks:

A. All lavatories and sinks shall include supply stops, p-trap, and necessary mounting hardware.

B. Common area Lavs: without drain lever and stationary grid strainer.

2.1 Floor Drains

A. Public Toilet Rooms and Finished Areas: J. R. Smith 2005-A-P round nickel bronze strainer. Floor drain shall be compatible with flooring in area of installation.

B. Provide and install Trap Guard insert (or approved equal) in areas that do not receive condensate (year round) to prevent trap seal evaporation. Note that Fan Coils will not have condensate while in heating mode and the respective condensate drains will need to have the Trap Guard insert provided and installed.

A. Provide with all mounting hardware.

B. Provide with trap and water shut-off.

2.2 Water Closets

A. ADA Water Closet: provide with supply stop, seat, seat cover and supply hose. Seat and seat cover shall be compatible with water closet provided.

B. Water Closet (floor mounted): provide with supply stop, seat, seat cover and supply hose. Seat and seat cover shall be compatible with water closet provided.

C. See architectural details for all ADA requirements. Flush handle shall be on approach side.

D. Shall have MAP rating of 1000 minimum.

E. Common area toilets shall be open front without seat cover.

END OF SECTION 22 4200

TABLE OF CONTENTS

SECTION 23 0501 - GENERAL PROVISIONS

PART 1 - GENERAL

1.1 Scope:

A. Provisions of this section apply to all work specified in all sections under Division 23.

B. In addition, work in Division 23 is governed by the provisions of the Bidding Requirements, Contract Forms, General Conditions and all sections under Division 1, General Requirements.

C. Mechanical Contractor shall provide green stickers and associated testing and adjustments for all gas-fired appliances (water heater, furnaces, etc.)

1.2 Examination of Premises: Visit the site, verify all measurements and job conditions, and pay all costs necessary to perform the work.

1.3 The Mechanical Contractor shall be licensed and hold a current contracting license that has been valid for a minimum of two years in the State of Utah as a Mechanical Contractor.

1.4 The Mechanical Contractor shall have a minimum of five years' experience installing commercial cooling and heating systems similar to those described in these specifications and provide a list of previous projects, including name of project and contact person names and phone numbers as a separate document in addition to the mechanical bid submitted by the General Contractor.

1.5 The Mechanical Contractor shall be able to bond work he is bidding to perform and shall provide a written statement from the bonding agency proposed to be used for this project as a separate document in addition to the mechanical bid submitted by the General Contractor. The bonding agency shall be one having a Best's insurance rating of A or A+. (Verify bonding with General Contractor)

1.6 Regulations, Permits, Fees, Charges, Inspections: (Verify with General Contractor)

A. Regulations: Comply with all applicable codes, rules and regulations. All materials and work must comply with local construction, mechanical, plumbing, electrical and fire codes. As a minimum, comply with the following: 1991 IMC, IPC, NEC, UFC, NFPA codes and all City and State codes.

B. Fees and Permits: Pay all connection, installation, use, development, etc., fees and/or charges. Obtain and pay for all required permits and licenses. Refer to Division 1.

C. Inspections: All work must be inspected and approved by local authorities. Prior to final approval, furnish the Architect with certificates of inspections and approvals by the local authorities in accordance with Division 1.

1.7 Drawings and Specifications:

A. Refer to Division 1 for information on submittals and shop drawings.

B. If a conflict exists between the drawings and specifications, promptly notify the Architect.

1.8 Record Drawings: Provide record drawings for all work under sections in Division 23. See Division 1 for detailed requirements covering preparation of record drawings.

1.9 Work and Materials: Unless otherwise specified, all materials must be new and of the quality specified. The workmanship shall be of a quality that is acceptable to the Architect and adheres to the standards of the trades. Contractor must staff the project with sufficient skilled workmen, including a fully qualified

construction Superintendent, to complete the work in the time allotted. The Superintendent must be qualified to supervise all of the work in his work category.

1.10 Approvals of Materials and Equipment: Refer to Division 1 for description of material and equipment for prior approvals and substitutions.

1.11 Maintenance Manual:

A. Prior to completion of the project, compile a complete equipment and maintenance manual for all equipment supplied under sections of Division 23, as described in Division 1.

B. Manuals shall be bound in a three-ring binder. A preliminary submittal of the manual shall be made to the Architect 90 days after receiving approved submittals. Final submittal of the manual shall be made four weeks prior to substantial completion of the project.

1.12 Shop Drawings:

A. Engineer's Review: The Engineer shall review and take appropriate action on shop drawings, product data, samples and other submittals required by the contract documents. Such review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. It shall not include review of quantities, dimensions, weights or gauges, fabrication processes, construction methods, coordination with the work of other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The Engineer's review shall be conducted with reasonable promptness consistent with sound professional practice. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Engineer shall not be required to review and shall not be responsible for any deviations from the contract documents not clearly noted by the Contractor, nor shall the Engineer be required to review partial submissions or those for which submissions for correlated items have not been received.

B. Submit shop drawings in accordance with Division 1 and all data for all equipment provided under Division 23 within 30 days after award of contract. Index all submittals and reference to these specifications. Submit all shop drawings in a single batch at one time. Submit shop drawings for all equipment provided under Division 23, including the following:

1. Intake/exhaust hoods and caps, penthouses, curbs.

2. Insulation materials and finishes for all types of piping.

3. Ductwork, dampers, air distribution accessories, supports, grilles, registers, diffusers, louvers.

4. Heating equipment.

5. Fans.

6. Temperature control equipment.

7. Air balance contractor (Common Areas)

8. Access doors.

9. Access panels.

10. All other equipment as shown, indicated, specified, required and as directed by Architect.

1.13 Equipment Purchases: Arrange for purchase and delivery of all materials and equipment within 15 days after approval of submittals.

1.14 Cooperative Work:

A. Correct without charge any work requiring alteration due to lack of proper supervision or failure to make proper provision in time. Correct without charge any damage to adjacent work caused by the alteration. See Division 1 for additional requirements.

B. Cooperative Work Includes:

1. General supervision and responsibility for proper location, rough-in and size of work related to Division 23 but provided under other divisions of these specifications.

2. Installation of sleeves, inserts and anchors bolts for work under sections in Division 23.

3. Electrical work as specified herein. Refer to Division 26 for requirements.

1.15 Substitutions:

A. Where Manufacturer's names appear, other Manufacturers may be substituted upon obtaining written approval of Architect **at least 10 days prior to opening of bids**. The contractor will be required to complete and sign a "Proposed Substitution Request Form" that will be reviewed by the Architect, Engineer, and Owner. The submission of the "Proposed Substitution Request Form" shall be **at least 10 days prior to opening of bids**.

B. Any prior approval of alternate equipment does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

1.16 Guarantee: Guarantee all material, equipment, and workmanship for all sections under Division 23 in writing to be free from defects of material and workmanship for one year from date of final acceptance as outlined in Division 1. Replace without charge any material or equipment proving defective during this period. The guarantee shall include performance of the equipment under all conditions of load, installing any additional items of control and/or protective devices as required and the replacing of any refrigerant lost.

1.17 Mechanical Wiring:

A. Provide all temperature control wiring, all interlock wiring, and equipment control wiring for the equipment that is to be provided under this Division unless specifically shown on electrical drawings.

B. All wiring shall be not less than No. 14 insulated, color coded wire in electrical metallic tubing. Installation shall comply with Division 26.

C. The following schedule is intended to summarize the division of work material responsibilities between the Mechanical Contractor and the Electrical Contractor.

Item	Furn. By	Set By	Power Wiring	Control Wiring
Equipment motors	MC	MC	EC	--
Motor starters, contactors				

and overload heaters	MC*	EC	EC	MC
Fused and unfused disconnect switches	EC	EC	EC	--
Manual operating switches, multispeed switches, push-button stations and pilot lights	EC	EC	EC	EC
Control relays and transformers	MC	MC	EC	MC
Thermostats, time switches**	MC	MC	EC	MC
Smoke detectors	MC	MC	EC	CC
Motor and solenoid valves, damper motors,	PE and EP			
switches	MC	MC	--	MC
Refrigeration equipment controls	MC	MC	EC	MC

MC = Mechanical Contractor

EC = Electrical Contractor

CC = Controls Contractor

** Motor-drive units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract. However, if the control device does not conduct full load current, then the responsibility shall be that set forth in the above schedule. (Example: A 208 volt, 3-phase, 3-wire motor requires 120 volt control.) Electrical Contractor shall furnish a 120 volt circuit for control and 208 volt circuit for power and wire the power circuit. Mechanical Contractor shall wire the control circuit.

D. Under this section provide all shop drawings and wiring diagrams complete with all connection details. Wiring diagrams must be free from confusing optional methods that do not apply. Wiring diagrams must be complete with all necessary information and must correctly indicate the conditions of this specific job.

E. Under this section be responsible for the checking and testing of all controls and interlocks for a complete and satisfactory operating system.

F. Before ordering motors, equipment, etc., verify the available voltage and phase with the electrical trades.

1.18 Electrical Work:

A. Electrical wiring, including power wiring and control wiring (except as otherwise specified under Automatic Temperature Controls), all raceways, wiring, outlet and junction boxes, and labor for installation of the wiring and equipment shall be included in Electrical Division 26 of the specifications.

B. Under the Automatic Temperature Control section of these specifications, furnish and install all wiring, conduit, electric automatic temperature control devices, thermostats, relays, automatic control switches and pilot lights. See the Automatic Temperature Control Section, for additional detailed information.

C. All loose starters and control devices for equipment furnished under Division 23 (except as otherwise specified under Automatic Temperature Control Section) are to be furnished under that particular section of Division 23 and installed under the electrical division.

D. Contractor shall provide all shop drawings and wiring diagrams complete with all connection details. Wiring diagrams must be free from confusing optional methods that do not apply. Wiring diagrams must be complete with all necessary information and must correctly indicate the conditions of this specific job.

E. Contractor shall be responsible for the checking and testing of all controls and the interlocks for a complete and satisfactory operating system.

F. Before ordering any motors and equipment. Verify the available voltage and phase for all motors with the Electrical Contractor.

G. Submit a complete list of all motors prior to final closeout of job indicating the locations, horsepower, voltage, phase and amperage draw of each motor.

H. All field wiring and equipment must conform to the applicable sections of the Electrical specifications, Division 26.

1.19 Welding Codes and Standards: All welding and other criteria covered by this specification shall be in accordance with the following code:

ASME Boiler and Pressure Vessel Code

Section IX ANSI Code for Power Piping: B31.1

PART 2 - PRODUCTS

2.1 Machinery Drives:

A. Use V-belts designed for 150% of capacity for all belt drives. For multiple belt drives, use matched sets, so marked at the factory.

B. On drives with not more than two belts, provide adjustable pitch motor sheaves with the midpoint of the adjustment range such as required to achieve the specified fan capacity.

C. On motors with drives with more than two belts, furnish nonadjustable sheaves, providing the specified fan capacity.

2.2 Machinery Accessories:

A. Lubricating Devices: Provide all oil level gauges, oil pressure gauges, grease cups, grease gun fittings, as required by the equipment. Extend all lubricating fittings to readily accessible locations.

B. Guards: Provide totally-enclosed OSHA type belt guards for all rotating equipment. Design guards to be readily removable for access to belt drives.

2.3 Equipment Design and Installation:

A. Uniformity: Unless otherwise specified, provide all equipment of same type or classification by the same manufacturer.

B. Design: Design all equipment in accordance with ASME, AGA, UL and other applicable technical standards as follows:

Electric appliances - UL labeled

Fans - AMCA rated and stamped

Cooling equipment - ARI certified

Fire dampers, smoke dampers, combination fire and smoke dampers - UL listed

PART 3 - EXECUTION

3.1 Verification of Dimensions:

A. Scaled and figured dimensions are approximate only. Before proceeding with work, carefully check and verify dimensions at site, and be responsible for properly fitting equipment and materials together and to the structure in spaces provided.

B. Drawings are essentially diagrammatic and many offsets, bends, special fittings and exact locations are not indicated. Carefully study drawings and premises in order to determine best methods, exact locations, routes, building obstructions, and install apparatus and equipment in available locations. Install apparatus and equipment in manner and in locations to avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.2 Cutting and Patching: Cut work and patch per Division 1 as necessary to properly install the new work. As the work progresses, coordinate necessary openings, holes, chases, etc., in their correct location. If the required openings, holes and chases are not in their correct locations, make the necessary corrections at no cost to the Owner. Avoid excessive cutting and do not cut structural members without the consent of the Architect. Patching by General Contractor at Mechanical, Plumbing or Fire Protection Contractor's expense. Include as a part of the work under this contract all structural framing required by penetrations through the roof and necessary steel to support ducts and pipes between structural steel unless shown on the structural drawings.

3.3 Closing-in of Unfinished Work: Cover no work until inspected, tested and approved. Where work is covered before inspection and test, uncover it, and when inspected, tested and approved, restore all work to original proper condition.

3.4 Accessibility:

A. Install valves, dampers, traps, control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement conveniently and accessibly throughout the finished building. Where any of these devices are shown on the contract drawings to be installed above any inaccessible ceiling, the Mechanical Contractor shall furnish access doors or panels as required.

B. All access doors or panels in walls and ceilings required for access to control devices, traps, valves and similar devices are to be furnished and installed as part of the work under this section. Provide type as specified under Division 8.

C. Provide ducts which pierce a fire separation with fire dampers of same fire rating as the separation.

D. Refer to drawings and "Finish Schedule" for type of wall and ceiling in each area and for rated construction.

E. Coordinate work of various sections to locate valves, traps, and dampers with others to avoid unnecessary duplication of access doors.

3.5 Roof Flashings: Flash and counterflash all piping, conduits and ductwork penetrating roofing membrane with flashing per roofing manufacturer's recommendations. Refer to architectural drawings for detailing of duct and pipe penetrations through roof.

3.6 Equipment Rough-in:

A. Rough in all equipment and fixtures as designated on the drawings and in the specifications. The drawings indicate only the approximate location of rough-ins. The exact rough-in locations must be determined from large-scale certified drawings. The Contractor shall obtain all certified rough-in information before progressing with any work for rough-in final connections.

B. Be responsible for providing all outlets and services of proper size at the required locations.

C. Minor changes in the contract drawings shall be anticipated and provided for under this division of the specifications.

D. Rough-in only (unless otherwise designated on the drawings) shall include the following:

1. Mechanical: Provide all services as indicated and required, including all ductwork, piping and valves. Cap all ductwork stub-outs in a manner suitable for future extension.

3.7 Owner-Furnished and Other Equipment:

A. Rough-in only for all Owner-furnished equipment (see Division 1) and all equipment furnished under other sections of the specifications, except as otherwise specified and/or noted on the drawings.

B. Rough-in requirements shall be as outlined in the preceding paragraph titled "Equipment Rough-In."

3.8 Equipment Final Connections:

A. Provide all piping and duct final connections for all equipment under Division 23 as required herein specified and indicated on the drawings.

B. Air Conditioning, Heating, and Ventilating: Provide final connections complete with necessary valves, drains, unions, flanges and duct connections for equipment furnished and installed under other sections of the specifications, except as otherwise designated. Included under the HVAC sections of the specifications are the final connections to the following:

1. Condensate piping from air conditioning equipment.

2. Supply, return, relief, outside air and exhaust duct connections for all equipment including exhaust fans.

3. Piping connections for all equipment.

3.9 Machinery Drives: After tests have been performed on the air conditioning and air handling systems, make without cost not more than two changes in the size of the nonadjustable sheaves to obtain the required air quantities.

3.10 Machinery Accessories:

A. Application: Do not install any equipment in an application not recommended by the manufacturer.

B. Installation: Align, level and adjust all equipment for proper operation. Install so connecting and disconnecting of piping and accessories can readily be done and so all parts are readily accessible for inspection, service and repair. Install equipment in accordance with manufacturer's recommendations.

3.11 Pipe and Equipment Supports:

A. Where supports, foundations, stands, suspended platforms for machinery, tanks, or other equipment are indicated or specified, perform the following:

1. Locate support members to avoid equipment strains and interference with piping connections, tube pulling or other maintenance operations.

2. Mount power-driven equipment on common base with driver.

B. Ceiling or Wall Supports: Use suspended platform, strap hangers, bracket or shelf, whichever is most suitable for equipment and location. Construct of structural steel members, steel plates, rods or pipe as required. Cross-brace and fasten to building structure or inserts in an approved manner.

C. Steel Work: Neatly fabricate and erect steel work with burrs and welding spatter ground off. Paint after fabrication with a rust-inhibitive primer.

D. Roof Mounted Equipment (Steel Supported): Provide curbs and flashings for metal support structures as shown in the latest SMACNA manual for roof supports.

3.12 Cleanup:

A. In addition to cleanup specified under Division 1, thoroughly clean all parts of the equipment. Where exposed parts are to be painted, thoroughly clean off any splattered construction materials and remove all oil and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

B. During the progress of the work, keep the premises clean and free of debris.

3.13 Painting:

A. Except as otherwise specified or indicated in the architectural drawings and/or specifications, paint all exposed unfinished metal with one coat of rust-inhibiting primer and a finish coat as directed by architects representative and as described in the contract documents. (Galvanized ductwork and factory painted equipment shall be considered as having primed surface.)

B. Finished painting is specified under Division 9.

3.14 Objectionable Noise and Vibration: Construct and brace the metal partitions, ducts and sheet metal housings to prevent vibration or rattling when systems are in operation. Install connections to equipment so noise and vibration will not reach the conditioned area through ducts, piping, conduit, sheet metal work, or the building structure. Provide power-driven equipment suspended from the structure with spring type isolation.

3.15 Welding:

A. Procedures:

1. All procedures and welders must be qualified in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code and ANSI code for power piping B31.1. Procedure qualification test records and acceptance shall be submitted with the welding procedure prior to the start of fabrication.

2. Architect's inspector or authorized representative will review performance qualification records of individual welders.

B. Welding Processes: The following welding processes are permitted, provided that the procedure is qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code.

1. Manual shielded metal-arc.

2. Gas tungsten-arc.

3. Other welding processes may be used providing they are qualified in accordance with Section IX, ASME Boiler and Pressure Vessel Code.

C. Restrictions: Weld bevel preparations shall be provided on all welding fittings and shall be machined or ground to remove all discoloration if flame or arc cut.

D. Welding Filler Material:

1. A filler material control procedure shall be submitted to Owner for review and acceptance prior to performing any welding.

2. All shielded metal-arc welding shall be performed using low-hydrogen type electrodes such as E 7018.

END OF SECTION 23 0501

SECTION 23 0593 - AIR SYSTEM BALANCING (Common Areas)

PART 1 - GENERAL

1.1 The Contractor shall include in his bid the services of a certified independent air balance and testing agency. The testing agency shall be one which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust and test air-moving equipment and air distributing or exhausting systems as herein specified. All work shall be done under direct supervision of a qualified heating and ventilating certified technician employed by the agency.

1.2 Perform all of the air system balancing specified in this section as part of the contract to be paid for by the Mechanical Contractor.

PART 2 - PRODUCTS

2.1 Materials: All instruments used by this agency shall be accurately calibrated and maintained in good working order. If requested, conduct the tests in the presence of the Architect and/or the Mechanical Engineer responsible for the project and/or his representative. Do not begin air balance and testing until system has been completed and is in full working order. Put all heating, ventilating and air conditioning systems and equipment into full operation and continue the operation of same during each working day of testing and balancing. Submit within 15 days after receipt of the contract, 7 copies of submittal data for the testing and balancing of the air conditioning, heating and ventilating systems. The air balance agency shall provide proof of having successfully completed at least five projects of similar size and scope and shall be a certified member of Associated Air Balance Council or NEBB. Submit the test and balance contract to the Architect for approval within 90 days after the Air Conditioning Contractor has received his contract to proceed with the air conditioning installation to allow the air balance agency to schedule this work in cooperation with other trades involved and comply with the completion date.

PART 3 - EXECUTION

3.1 Air Balancing: Upon completion of the air conditioning system, the air balance agency shall perform the following test, compile the test data, and submit five (5) copies of the complete test data to the Contractor for forwarding to the Owner, Architect and Engineer for review and approval.

3.2 Testing Procedure: The air balance agency shall perform the following tests, and balance system in accordance with the following requirements:

A. Test and adjust blower RPM to design requirements to within 10% of design.

B. Test and record motor full load amperes.

C. Make pitot tube traverse of main supply ducts and obtain design CFM at fans when deemed necessary by Engineer.

D. Test and record system static pressure, suction and discharge.

E. Test and adjust system for design CFM outside air.

F. Test and adjust system for design CFM recirculated air.

G. Test and record entering air temperatures (DB heating and cooling).

H. Test and record entering air temperatures (WB cooling).

I. Test and record leaving air temperatures (DB heating and cooling).

J. Test and record leaving air temperatures (WB cooling).

K. Adjust all main supply and return air ducts to proper design CFM.

L. Adjust all zones to proper design CFM supply and return.

M. Test and adjust each ceiling diffuser, grille and register to within 10% of design requirements.

N. Each grille, diffuser and register shall be identified as to location and area on a set of plans included with report.

O. Identify and list size, type and manufacture of diffusers, grilles, registers and all tested equipment. Use manufacturer's ratings on all equipment to make required calculations.

P. Reading and tests of diffusers, grilles and registers shall include required velocity, required CFM, and test resultant CFM after adjustments.

Q. In cooperation with the control manufacturer's representative, setting adjustments of automatically operated dampers to operate as specified, indicated and/or noted.

R. Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

S. As part of the work of this contract, the Air Conditioning Contractor shall make any changes in the pulleys, belts and dampers or the addition of dampers required for corrected balance as recommended by air balance agency, at no additional cost to Owner. The Contractor shall furnish the necessary labor to assist the testing agency to complete its work.

T. Test and balance agency shall include an extended warranty (in addition to the one year guarantee period) of 90 days after completion or resetting of any outlet, supply air fan or exhaust fans as listed in test report. The agency shall provide technicians to assist the Engineer in making any tests he may require during this period of time.

END OF SECTION 23 0593

SECTION 23 0594 – TESTING

PART 1 - GENERAL

1.1 This section describes the labor, materials and services required for the testing of all systems.

PART 2 - EXECUTION

2.1 Test Procedures

A. Make tests before the rough work is covered. The system may be tested in parts if approved. Coil Condensate Drain Piping: Fill to highest point of system for (4) hours.

2.2 Testing out

A. Check out and test operate all equipment installed under heating, ventilating and air conditioning sections of these specifications.

1. Check electrical work to see that the power is properly supplied to all electrical motors and that all electric controls are properly hooked up in the control circuits. Furnish a list of the voltage and current readings taken under load of all motors.

2. Check all work and see that all controls are in good working order and properly adjusted. After the equipment has been properly adjusted, start up and run all equipment enough to determine that the controls and equipment are all operating properly and that the installation is complete.

3. When the test or observations show that the work is in any way defective or at a variance with the specification requirements, immediately make all changes necessary to correct the work and remedy the defects to the satisfaction of the Architect. Remove any defective material or equipment from the premises. In the event the Contractor does not remedy all defects and make all changes demanded by the Architect within a reasonable time, the right is reserved to have the defects remedied or changes made and to charge the cost of the work against the account of the Contractor.

4. Furnish all appliances, equipment and labor for the tests and meet all expenses of the tests.

2.3 Final Tests

A. Before acceptance and at a time designated, make a complete test to demonstrate that the air quantities are balanced for even temperatures throughout, that all controls are adjusted and that, in general, the system is placed into proper operation. Furnish a skilled operating engineer for a period of at least eight hours, at time or times designated by the Owner, to instruct the Owner's representative in the operation and maintenance of the equipment.

END OF SECTION 23 0594

SECTION 23 0933 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 Scope

A. The work included in this section shall consist of all labor, transportation, materials and equipment necessary for the installation of a complete system of automatic temperature control for this project in accordance with the drawings and as specified herein.

B. Thermostat used shall be capable of controlling air conditioning and heating equipment shown on the mechanical plans.

C. Temperature control components shall be compatible with the existing control system.

PART 1 - PRODUCTS

1.1 Miscellaneous Control Devices

A. Damper Motors: On all damper motors provide flexible, nonmetallic diaphragm operators with sufficient power to position the dampers accurately in response to the controller. Damper motors on modulating outside air shall have a pilot positioner.

B. Automatic Dampers: Parallel or opposed blade control dampers as required, equal to Johnson Proportion/Aire low leakage dampers; 13 gauge galvanized steel formed damper frames for extra strength with mounting holes for flange and enclosed duct mountings. Dampers over 48" wide shall be standard modules with interconnecting hardware. Blade bearings of oil-impregnated sintered bronze with 1/2" zinc-plated steel shafts. All blade linkage hardware or corrosion-resistant finish and readily accessible for maintenance after installation. Provide synthetic elastomer seals.

C. Wall Mounted Wall Thermostats: Mount all room thermostats where shown on the plans. UFAS height will apply. All thermostats used shall be checked for compatibility with the associated equipment prior to installation.

PART 2 - EXECUTION

2.1 Work Included in Other Sections of the Specifications

A. All electrical wiring (by ETC).

B. Mounting of dampers in ductwork, including the furnishing of required blank-off plates to reconcile modular damper sizes to duct sizes (by MTC).

Abbreviations:

ATC = Automatic Temperature Controls Trades Contractor

MTC = Mechanical Trades Contractor

ETC = Electrical Trades Contractor

2.2 Temperature Control Raceways - Division 26

A. Low voltage wiring will not be required to be in a raceway. All temperature control raceways will be provided and installed by Division 26 Contractor. (Exterior locations as indicated on Mechanical Plans). Raceway system shall be complete and include but not be limited to all required conduit, boxes, connectors etc.

END OF SECTION 23 0933

SECTION 23 2300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 Furnish and install refrigerant piping between condensing unit and evaporator coil. Make final connections to all equipment.

1.2 Piping shall be factory manufactured line sets with brazed joints.

PART 2 - PRODUCTS

2.1 Copper line sets with insulation as indicated below.

PART 3 - EXECUTION

3.1 Refrigerant lines shall be installed by workmen skilled in the installation and testing of refrigerant piping and refrigerant equipment.

3.2 All work shall conform to standard engineering practice as recognized by ARI and the American Society of Heating, Refrigerating and Air Conditioning Engineers, and all piping, installation and testing shall conform to the applicable requirements of ANSI B9.2.

3.3 All refrigerant lines shall be properly pitched and shall have oil traps properly sized, located and installed, complete with properly sized double suction risers, to ensure that oil in any part of the system will be able to return to the compressor under minimum system operating conditions. Manufacturer installation directives shall be followed for each piece of equipment.

3.4 All field fabricated pipe shall be cut smooth and square with an approved type of pipe cutter. Pipe shall be reamed, cuttings carefully removed and piping thoroughly cleaned of all dirt and oil before brazing.

3.5 All piping shall be thoroughly tested for leaks and proved tight before charging. Evacuate system to not less than 500 microns with oil submerged vacuum pump and special vacuum hoses. Hold for two hours. Charge shall be calculated and a volume charging cylinder or electronic scale shall be utilized. Affix a tag to each system showing type of refrigerant and total pounds in the system.

3.6 Provide boot at each refrigerant wall penetration. See detail for model number and additional information.

3.7 Cleaning: Clean all fittings before installation.

3.8 Insulation:

A. Insulate all refrigerant suction piping with 1/2" thick flexible foamed plastic closed cell pipe insulation. Insulation shall have a "K" factor of not more than .26 at 70°F and a water vapor transmission rate of 0.1 perm-inch or less in conformance with ASTM C-177 and ASTM C-355 water method. When insulation is exposed to sunlight, wrap with polytape with one-third overlap.

B. Install insulation by slitting tubular sections and applying over piping.

C. Paint all insulation and/or tape exposed to the exterior with ultraviolet resisting paint.

END OF SECTION 23 2300

SECTION 23 3114 - SHEET METAL DUCTWORK (LOW PRESSURE)

PART 1 - GENERAL

1.1 Scope: Furnish all labor, materials, equipment and services necessary for the installation of all low pressure sheet metal duct systems as herein described and as indicated on the drawings. Each system shall be complete with all accessories, etc., as described herein and in other sections of these specifications.

1.2 Galvanized Sheet Metal: For all ductwork except as otherwise specified.

PART 2 - PRODUCTS

2.1 Galvanized Ductwork: Galvanized, prime-grade, lock-forming, quality steel (LFQ) having galvanized coating of 1-1/4 ounces total for both sides of 1 square foot of a sheet. Cross-break all sides of ducts.

2.2 Longitudinal Seams: Pittsburgh lock groove, hammered flat. Tape all transverse joints of supply, return and exhaust ducts with open weave fiberglass, canvas and Arabol, or reinforced Hardcast.

2.3 Turning Vanes:

A. Sheet Metal Vanes: Factory fabricated, single thickness, galvanized sheet metal with airfoil contour. Shop fabricated duct turns must be submitted for approval prior to processing any work on project.

2.4 Flexible Duct: Flexible, preinsulated, vinyl coated fiberglass with corrosion-resistant, steel spiral reinforcing, designed for low velocity application. All duct, insulation and adhesives shall be fire and smoke resistant in conformance with NFPA 90A and UL 181 for Class 1 duct. Duct shall be Thermaflex Type M-KC as manufactured by Flexible Tubing Co. or approved.

2.5 Flexible Connections: 24-ounce glass fabric that is flameproof, airtight, ozone resistant, and a minimum of 3" wide with 3" of metal on each side of 3" of fabric using a grip lock seam, Duro-Dyne "Durolon".

2.6 Manual Dampers: Minimum of 16 gauge galvanized steel, maximum of 8" blade, opposed blade type, with manual quadrant.

2.7 Manual Quadrants: On all low pressure dampers Ventlock #641 in uninsulated ducts.

2.8 Access Doors:

A. Uninsulated Ducts: Construct access doors of galvanized sheet metal gauges heavier than duct with rolled edges, hinges, and Ventfabrics, Inc. "Ventlock" #260 latch. Make airtight with felt strips or neoprene gasketing and provide 1" x 1" x 1/8" galvanized iron frame for installation in ductwork.

2.9 Access Panels and Access Openings in Ductwork: Galvanized, sheet steel, 2 gauges heavier than the duct with rolled edges, felt strips or neoprene gasketing and attached to duct with sheet metal screws a maximum of 6" on center.

2.10 Fire Dampers: Furnish and install access panels as hereinbefore described to meet the requirements of the code. All fire dampers must be constructed in accordance with Underwriters' Laboratories and city code requirements. Dampers shall be of the type with the open damper out of the airstream for 90% free area.

2.11 Duct Supports:

A. Ducts 47" and Smaller: 14 gauge steel hanger straps 1" wide riveted to seams of ducts, maximum of 6'-0" on center. Alternate support for horizontal ducts must be by (2) 1/4" bolts or 2 or more #14 sheet metal screws.

B. Ducts over 48" in Width: Support from trapeze hanger consisting of vertical steel rods and angle iron frames.

2.12 Duct Construction: All duct construction must conform to local code or to the SMACNA Duct Construction Standards Manual, whichever is more stringent.

PART 3 - EXECUTION

3.1 Fabrication: Fabricate all ductwork and install using skilled mechanics in strict conformance with the SMACNA Manual. Provide supplemental stiffening as required to prevent drumming and provide a structurally sound assembly.

3.2 Construction: Construct all fittings, elbows, and transitions to provide a minimum of noise and resistance. Where space permits, use elbows with a minimum radius of 1-1/2 times the width (or depth). Where space conditions necessitate abrupt changes in direction (or as otherwise indicated), use square elbows with double radius turning vanes. Transitions increasing in the direction of airflow shall not change greater than 1" in 7" and transitions decreasing in the direction of airflow shall not change greater than 1" in 5".

A. Ductmate and Ward duct connectors are allowed when fabricated and installed in strict compliance with manufacturer's instructions.

3.3 Turning Vanes: (Common Areas) Provide single thickness turning vanes in all 90° square elbows and elsewhere as indicated. Use acoustical turning vanes where indicated.

3.4 Taping: Tape all cross-joints in concealed or insulated sheet metal ductwork with Arabol and canvas or reinforced Hardcast.

3.5 Weatherproofing: Make all ductwork exposed to weather weathertight, seal all joints with a minimum of 2 coats of asphalt-based roofing compound painted with aluminum paint.

3.6 Duct Openings: Construct duct openings at grilles or registers so that the plaster will not crack when the registers are attached.

3.7 Painting: (Common Areas) Paint the inside of all supply, return and exhaust ducts and dampers one coat of dead black paint whenever visible through the openings.

3.8 Manual Dampers: Provide manual dampers in each supply duct to outlet/inlet and elsewhere as indicated. Provide locking quadrants with memory stop.

3.9 Measurements: Before fabrication, check all ductwork with the building construction for dimensions, locations, clearances, etc. Make up duct with any necessary variations to conform to the details of the construction of the building, to suit the space available, and to fit the equipment furnished. The entire duct system must be substantially constructed, rigidly erected and free of any duct vibration or noises.

3.10 Flashing: Flash all ducts passing through the roof, floor or through exterior walls.

3.11 Testing and Balancing: See Testing and Air Systems Balancing.

END OF SECTION 23 3114

SECTION 23 3300 - DUCT SPECIALTIES

PART 1 - GENERAL

1.1 Scope: Grilles, registers, and diffusers shall be furnished and installed where shown. They shall be of the size and model indicated. Carnes, J&J, Krueger, Metal*Aire, Nailor, Titus, Tuttle & Bailey, Manufactured Air Products.

A. Shall be rated for air flow indicated on plan.

B. Shall be compatible with ceiling materials.

C. Sidewall grilles shall be compatible with wall materials.

D. Match existing supply air and return air grilles.

1.2 Installation: All grilles, registers and diffusers shall be set flush and true to the wall or ceilings to prevent air leakage around the edges.

1.3 Provide plaster frames for outlets in plaster or gypsum board.

1.4 Finish: All units must be factory finished. Provide finish and color as indicated on the drawings or as otherwise directed by Architect.

PART 2 - PRODUCTS

2.1 Fire Dampers

A. Construct all fire dampers, smoke dampers, and combination smoke and fire dampers in accordance with code requirements. Dampers shall be low leakage rated, welded construction, sized with open damper out of airstream for a minimum of 90% free area. Install in all fire-rated and smoke separations as shown on the plans. Installation shall be in accordance with manufacturer's and UL requirement

B. Fire Dampers shall be provided on all combustion air grilles from mechanical closets into the breezeway. Coordinate final location and approach with general contractor before ordering supplies or beginning installation.

END OF SECTION 23 3300

SECTION 23 5417 - AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install air conditioning systems complete with remote air-cooled condensing units, of the type, size and capacities indicated. Each system shall be complete with all equipment, filters, piping, insulation, controls, relays, interlocks and connections as required.

B. Furnish heat pumps with outdoor units, indoor fan coils, etc as indicated in the Mechanical Plans, Schedules and Details. Manufacturer requirements will need to be strictly followed.

C. Verify proper operation of existing Air Handler / VAV unit system. Make adjustments and modifications as indicated on the plans.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide Heat Pump Systems as indicated in the Mechanical Plans, Schedules and Details.

B. Provide Condensing Units, Furnaces and Cooling Coils.

C. Mechanical Contractor shall provide pads that provide a level mounting location that meets manufacturer requirements for all equipment installations. Equipment shall be attached to the pads.

D. Controls

1. See Section 23 0933.

E. Refrigerant Piping

1. See Section 23 2300.

F. Pipe Insulation

1. See Section 23 2300.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cooling Coil and Fan Coils

1. Install in conformance with manufacturer's recommendations.

B. Refrigerant Piping

1. See Section 23 2300.

END OF SECTION 23 5417

TABLE OF CONTENTS

SECTION 26 05 00 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide labor, materials, and equipment necessary for completion of work of this Division as described in Contract Documents.

1.2 RELATED SECTIONS

A. General Conditions and Division 01 apply to this Section

1.3 SUBMITTALS

A. As-Built Drawings

1. Provide complete set with all changes made to original drawings. Provide CADD files. Hand-drawn changes are not acceptable.

B. Product Data

1. Submit for the following:

a. Wiring devices
b. Disconnects
c. Lighting fixtures
d. Fire alarm & detection equipment
e. Voice & data cabling & termination equipment

2. Provide the following information for each item of equipment:

a. Catalog sheets
b. Assembly details of dimension drawings
c. Installation instructions
d. Manufacturer's name and catalog number
e. Name of local supplier
f. Name of electrical contractor

C. Operation & Maintenance Manual

1. Provide two copies of Operation and Maintenance Manuals.

a. Binder - Loose-leaf type with hard cover. Title on outside of front cover and on spine.
b. Title Page - List the following information
   1) Name of Project
   2) Date Project Completed
   3) Name and Address of Architect, Electrical Engineer, General Contractor, Electrical Contractor, and Suppliers.
c. Table of Contents -
   1) List equipment in order that it appears in Binder.
d. Dividers -
   1) Provide one divider with tab for each type of equipment listed in Table of Contents. Properly label tabs.
e. Equipment Information - Provide following information for each item of equipment
   1) Catalog Sheets.

2) Assembly details or dimension drawings.

3) Installation, operating, and maintenance instructions.

4) Manufacturer's name and catalog number

5) Name of local supplier.

f. Furnish such information for following equipment and arrange as listed -

1) Disconnect switches

2) Wiring devices

3) Lighting fixtures

4) Fire alarm and detection system

5) Communications systems equipment

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Furnish UL listed equipment where such label is available. Install in conformance with UL standards where applicable.

B. Install electrical work in accordance with Drawings and Specifications, edition of NEC in effect at project location, recommendations of NFPA, state and local electrical and building codes, and special codes having jurisdiction over specific portions of work. This includes, but is not limited to the latest adopted version of the following

1. National Electrical Code with applicable local amendments

2. International Fire Code with applicable state or local amendments

3. Life Safety Code, NFPA 101

4. International Building Code

C. In the event of conflict between Drawings, Specifications and such codes, notify Architect in writing prior to bid. A ruling will then be made by Architect in writing.

D. Obtain permits and certificates of approval from all authorities having jurisdiction over the installation and pay all fees required for scope of work being done including connection fees, impact fees, power company installation costs, etc.

1.5 WARRANTY

A. Guarantee work to be free from defects of materials and workmanship for a period of one year from date of final acceptance of building by authorities having jurisdiction.

B. Furnish owner with three written copies of Guarantee-Warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Substitutions:

1. Where Manufacturer's names appear, other Manufacturers may be substituted upon obtaining written approval of Architect at least 10 days prior to opening of bids

2. Any prior approval of alternate equipment does not automatically exempt the supplier from meeting the intent of these specifications. Failure to comply with the operational and functional intent of these specifications may result in the total removal of the alternate system at the expense of the contractor.

3. If submittals of alternate equipment require more than two reviews by the engineer, a fee of $250 will be charged to the contractor and payable to the engineer before submittals will be approved.

PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections. Coordinate electrical equipment locations with other trades to maintain required working clearances and prevent encroachment into such working spaces.

B. Confirm and verify electrical power specifications (i.e., voltage, phase, amperage, etc.) and electrical equipment and material requirements for all HVAC equipment, water heaters, water coolers, appliances, pumps, and other powered equipment provided by others, before beginning rough-in. All coordination shall be done with approved shop drawings or submittals.

3.2 INSTALLATION

A. Electrical drawings are diagrammatic. Do not scale for exact sizes or locations. Drawings are not intended to disclose absolute or unconditional knowledge of actual field conditions. Some equipment may need to be relocated from the locations indicated on the drawings to maintain working spaces around equipment. Any such coordination and relocation shall be the responsibility of the electrical contractor.

B. Be prepared to relocate any outlet or device 6 feet in any direction without additional charge to the owner prior to wall, ceiling, or floor finish materials being installed.

C. Install equipment according to manufacturer's recommendations.

D. In the event of conflict between specifications and drawings, or between various areas on drawings or specifications, notify Engineer in writing in sufficient time prior to bid to prepare the supplementary drawings and specification addenda required to resolve the conflict. In the event of a conflict, the most stringent requirement shall govern.

E. Provide electrical equipment and materials for, and make all connections to equipment furnished by others, including but not limited to items such as kitchen equipment, building and pole-mounted signs, fountain pumps, etc. as required for a complete and operable system.

3.3 FIELD QUALITY CONTROL

A. Test systems and demonstrate equipment as working and operating properly. Rectify defects at no additional cost to Owner.

B. All work under this division shall be executed in a thorough workmanlike manner, as determined by the Engineer, by competent and experienced journeyman electricians.

C. All work shall be installed in strict conformance with all manufacturers' requirements and recommendations.

3.4 FIRE STOPPING AND SEALING

A. Seal around conduits or other wiring materials passing through fire rated walls in accordance with Architectural details and/or specifications using U.L. listed fire caulk.

3.5 TEMPORARY LIGHTING AND POWER

A. Provide, maintain and remove after construction is completed, temporary lighting adequate for workman safety and temporary power for all trades including any 3-phase power required.

B. Provide and maintain barricade lighting where required to adequately protect owner against liability for damage to public or personnel.

3.6 CUTTING AND PATCHING

A. Cut all openings required to install the work of this Division or to repair any defective work. Cost for all cutting and patching required by the work of this Division shall be included, however, the actual cutting and patching shall be under the Prime Contractor's direction. Exercise due diligence to avoid cutting openings larger than required or openings that are in the wrong locations.

B. It is the intent to minimize the amount of exposed conduit on the roof and penetrations through the roof. Install conduit below roof and up through the inside of the equipment where possible. In the event roof penetrations must be made, the conduit shall be installed through waterproof sheetmetal housings or water proof pitch pans as detailed on the drawings.

END OF SECTION 26 05 00

SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor shall be responsible to examine the site & check all field conditions. Notify the Architect of any condition which differs from that indicated on the plan.

B. Verify field measurements and circuiting arrangements are as indicated.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

D. Demolition drawings are based on casual field observation and existing record documents.

E. Report discrepancies to Architect before disturbing existing installation.

F. Beginning of demolition means installer accepts existing conditions. No subsequent allowance for time or money will be allowed for work or changes resulting from contractor's failure to examine site conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Coordinate all field routing with existing equipment. Provide all necessary offsets to avoid conflicts with existing equipment or other obstructions.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring to source of supply.

D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Conceal all raceway & wiring in existing walls, ceilings, floors, etc.

K. Measure steady state load currents at each panelboard feeder for all altered panelboards. Should the difference between phases exceed 20 percent at any panel board, rearrange circuits in panelboard to balance the phase load within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits. Update directories accordingly.

L. Existing raceways may be reused if location is in compliance with the contract documents. Upgrade and/or provide new conduit supports for all raceways being reused as required. Insure integrity of existing raceways before re-use.

3.4 CLEANING AND REPAIR

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

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 05 05

SECTION 26 05 19 - POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wire and cable for 600 volts and less.

D. Wiring connectors.

E. Electrical tape.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).

E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

J. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

K. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

L. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

M. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

O. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

P. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

Q. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

R. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

S. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

T. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

U. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
1) Maximum Length: 6 feet.

b. Where concealed in hollow stud walls and above accessible ceilings for branch circuits.
1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.

2. In addition to other applicable restrictions, may not be used:

a. Where exposed to view.
b. Where exposed to damage.
c. For damp, wet, or corrosive locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.

H. Conductor Material:

1. Provide copper conductors except where aluminum conductors are specifically indicated. Substitution of aluminum conductors for copper is not permitted. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.

3. Tinned Copper Conductors: Comply with ASTM B33.

4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

I. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:
1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

2. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

a. Conductors size 6 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.

3. Color Code:

a. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral/Grounded: White.

b. Equipment Ground, All Systems: Green.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2.

2.4 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.

2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Provide oversized neutral conductors.

F. Provide dedicated neutral conductor for each phase conductor.

G. Grounding: Full-size integral equipment grounding conductor.

1. Provide additional isolated/insulated grounding conductor.

H. Armor: Steel, interlocked tape.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

3. Connectors for Aluminum Conductors: Use compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.

5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:

a. 3M: www.3m.com
b. Ideal Industries, Inc: www.idealindustries.com
c. NSI Industries LLC: www.nsiindustries.com

G. Mechanical Connectors: Provide bolted type or set-screw type.

1. Manufacturers:

    a. Ilsco: www.ilsco.com
    b. Thomas & Betts Corporation: www.tnb.com

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

1. Manufacturers:

    a. Ilsco: www.ilsco.com
    b. Thomas & Betts Corporation: www.tnb.com

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.6 ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

1. Manufacturers:

    a. Ideal Industries, Inc: www.idealindustries.com
    b. Ilsco: www.ilsco.com

C. Wire Pulling Lubricant:

1. Manufacturers:

    a. 3M: www.3m.com/
    b. American Polywater Corporation: www.polywater.com
    c. Ideal Industries, Inc: www.idealindustries.com

2. Listed and labeled as complying with UL 267.

3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.

4. Suitable for use at installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as indicated.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:

   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

I. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):

a. Use listed fittings.
b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

J. Install conductors with a minimum of 12 inches of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.

6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 26 05 53.

R. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipmentwhen premises has feeders or branch circuits served by more than one nominal voltage system.

S. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

T. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

U. Conductors shall be continuous from outlet to outlet.

V. Protect exposed cable from damage.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Grounding and bonding components.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

C. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.

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

E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Raceways may be used as sole equipment grounding conductor where permitted by NFPA 70. Provide insulated equipment grounding conductor where indicated or required, including but not limited to:

a. In each nonmetallic feeder and branch circuit raceway.
b. In each flexible conduit.
c. In outdoor portions of each metallic feeder and branch circuit raceway utilizing non-threaded fittings (where permitted) supplying rooftop multimotor and combination-load air-conditioning and refrigerating equipment.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

E. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.

a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections or compression connectors for underground, concealed and other inaccessible connections.

    a. Exceptions:
        1) Use mechanical connectors for connections to electrodes at ground access wells.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

D. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2 RELATED REQUIREMENTS

A. Section 26 05 34 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 05 37 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

E. Conduit and equipment supports.

F. Anchors and fasteners.

1.3 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

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

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.

2. Coordinate work to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.

4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.

2. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.

3. Do not use products for applications other than as permitted by NFPA 70 and product listing.

4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

5. Steel Components: Use corrosion-resistant materials suitable for environment where installed.

a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel.

2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:

1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.

2. Comply with MFMA-4.

3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.

4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.

5. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are permitted only as follows:
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction.
    b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.

2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: See Section 26 05 34 for additional requirements.

J. Box Support and Attachment: See Section 26 05 37 for additional requirements.

K. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

L. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

D. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

2. Obtain permission from Architect before drilling or cutting structural members.

E. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

F. Install surface-mounted cabinets and panelboards with minimum of four anchors.

G. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.

H. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION 26 05 29

SECTION 26 05 34 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Liquidtight flexible metal conduit (LFMC).

B. Aluminum electrical metallic tubing (EMT).

C. Liquidtight flexible nonmetallic conduit (LFNC).

D. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding.

1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 05 29 - Hangers and Supports.

D. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

E. Section 26 27 01 - Electrical Service Entrance: Additional requirements for electrical service conduits.

F. Section 27 05 33.13 - Conduit for Communications Systems.

1.3 REFERENCE STANDARDS

A. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

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

F. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

G. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

H. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

I. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

J. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.

4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use electrical metallic tubing (EMT).

F. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

G. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

H. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).

3. Maximum Length: 6 feet unless otherwise indicated.

2.2 CONDUIT - GENERAL REQUIREMENTS

A. Electrical Service Conduits: See Section 26 21 00 for additional requirements.

B. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.

C. Provide conduit, fittings, supports, and accessories required for complete raceway system.

D. Provide products listed, classified, and labeled as suitable for purpose intended.

E. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4-inch trade size.

2. Branch Circuit Homeruns: 3/4-inch trade size.

3. Control Circuits: 1/2-inch trade size.

4. Flexible Connections to Luminaires: 3/8-inch trade size.

5. Underground, Interior: 3/4-inch trade size.

6. Underground, Exterior: 1-inch trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction.

D. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction with PVC jacket.

D. Fittings: NEMA FB 1.

2.5 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.

2. Material: Use aluminum.

3. Connectors and Couplings: Use compression/gland or set-screw type.

a. Do not use indenter type connectors and couplings.

2.6 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.7 ACCESSORIES

A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

B. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

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

B. Install conduit in accordance with NECA 1.

C. Liquidtight Flexible Nonmetallic Conduit (LFNC): Install in accordance with NECA 111.

D. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.

2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal conduits unless specifically indicated to be exposed.

4. Conduits in the following areas may be exposed, unless otherwise indicated:

a. Electrical rooms.
b. Mechanical equipment rooms.
c. Within joists in areas with no ceiling.

5. Unless otherwise approved, do not route exposed conduits:
    a. Across floors.
    b. Across roofs.
    c. Across top of parapet walls.
    d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in same area on common rack.

E. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is permitted only as follows:

a. Support of electrical metallic tubing (EMT) up to 1-inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.

10. Use of wire for support of conduits is not permitted.

11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

F. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.

7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.

8. Secure joints and connections to provide mechanical strength and electrical continuity.

G. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Provide suitable sealing system where conduits penetrate exterior wall below grade.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.

8. Provide metal escutcheon plates for conduit penetrations exposed to public view.

9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

H. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where conduits are subject to earth movement by settlement or frost.

I. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.
b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

J. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

K. Provide grounding and bonding; see Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. Correct deficiencies and replace damaged or defective conduits.

3.4 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

END OF SECTION 26 05 34

SECTION 26 05 37 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 26 05 29 - Hangers and Supports.

C. Section 26 05 34 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.

2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

E. Section 26 27 26 - Wiring Devices:

1. Wall plates.

2. Additional requirements for locating boxes for wiring devices.

F. Section 27 10 00 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

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

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes or nonmetallic boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.

4. Use suitable masonry type boxes where flush-mounted in masonry walls.

5. Use raised covers suitable for the type of wall construction and device configuration where required.

6. Use shallow boxes where required by the type of wall construction.

7. Do not use "through-wall" boxes designed for access from both sides of wall.

8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.

12. Minimum Box Size, Unless Otherwise Indicated:

    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.

13. Wall Plates: Comply with Section 26 27 26.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. NEMA 250 Environment Type, Unless Otherwise Indicated:

    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.

3. Junction and Pull Boxes Larger Than 100 cubic inches:

    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

   a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
   b. Communications Systems Outlets: Comply with Section 27 10 00.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 34.

10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:

    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

H. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Install firestopping to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

M. Close unused box openings.

N. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

O. Provide grounding and bonding in accordance with Section 26 05 26.

P. Identify boxes in accordance with Section 26 05 53.

Q. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

R. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

S. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

T. Maintain headroom and present neat mechanical appearance.

3.3 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.5 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

B. Clean exposed surfaces and restore finish.

END OF SECTION 26 05 37

SECTION 26 05 53 - ELECTRICAL SYSTEMS IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 27 26 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

C. Section 27 10 00 - Structured Cabling: Identification for communications cabling and devices.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.

2. Do not install identification products until final surface finishes and painting are complete.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.6 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Panelboards:

1) Identify power source and circuit number. Include location when not within sight of equipment.

2) Identify main overcurrent protective device. Use identification nameplate for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

4) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

5) Use identification nameplate at each panelboard to identify the available fault current and the date calculations were performed.

b. Enclosed switches and circuit breakers:
1) Identify power source and circuit number. Include location when not within sight of equipment.

2) Identify load(s) served. Include location when not within sight of equipment.

c. Enclosed Contactors:
1) Identify load(s) and associated circuits controlled. Include location.

2. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.

3. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.

4. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.

5. Use identification label on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.

2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.

3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

4. Use underground warning tape to identify direct buried cables.

C. Identification for Boxes:

1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

a. For exposed boxes in public areas, use only identification labels.

D. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 27 10 00.

2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.

3. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.

4. Use identification label to identify fire alarm system devices.

   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.

5. Use identification label to identify serving branch circuit for all receptacles.

   a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.

6. Use identification label to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

E. Identification for Luminaires:

1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

   a. Use only for indoor locations.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

a. Equipment designation or other approved description.
b. Other information as indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

a. Equipment Designation: 1/2 inch.
b. Other Information: 1/4 inch.
c. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.

5. Color:

a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.

D. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Power source and circuit number or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background.

E. Format for Control Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Load controlled or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background.

F. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Designation indicated and device zone or address.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Red text on white background.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

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

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.

5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.

7. Boxes: Outside face of cover.

8. Conductors and Cables: Legible from the point of access.

9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws or self-adhesive backing and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 05 53

SECTION 26 05 83 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Power Conductors and Cables.

B. Section 26 05 34 - Conduit for Electrical Systems.

C. Section 26 05 37 - Boxes for Electrical Systems.

D. Section 26 27 26 - Wiring Devices.

E. Section 26 28 16 - Enclosed Switches.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.

2. Make electrical connections before required start-up of equipment.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.6 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 28 16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 27 26.

D. Flexible Conduit: As specified in Section 26 05 34.

E. Wire and Cable: As specified in Section 26 05 19.

F. Boxes: As specified in Section 26 05 37.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 26 05 83

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy sensors.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Power Conductors and Cables.

B. Section 26 05 26 - Grounding and Bonding.

C. Section 26 05 29 - Hangers and Supports

D. Section 26 05 37 - Boxes for Electrical Systems.

E. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

F. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

G. Section 26 51 00 - Interior Lighting.

H. Section 26 56 00 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

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

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.

2. Coordinate placement of wall switch occupancy sensors with installed door swings.

3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.

4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.

5. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.

6. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

B. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C. Field quality control reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

1.6 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

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

B. Provide five year manufacturer warranty for occupancy sensors.

PART 2 PRODUCTS

2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.2 OCCUPANCY SENSORS

A. Manufacturers:

1. Hubbell Building Automation, Inc: www.hubbellautomation.com

2. Lutron Electronics Company, Inc; _____: www.lutron.com

3. Leviton: www.leviton.com

4. Cooper Controls: www.cooperlighting.com

5. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

B. General Requirements:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.

2. Sensor Technology:

a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection.

4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.

5. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.

6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.

7. Sensitivity: Field adjustable.

8. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.

9. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:

1. General Requirements:

a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.
c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
e. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
f. Provide vandal resistant lenses for passive infrared (PIR) wall switch occupancy sensors.

2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.

3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within area of 400 square feet.

4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.

D. Ceiling Mounted Occupancy Sensors:

1. General Requirements:

a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Finish: White unless otherwise indicated.

2. Ultrasonic Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within area of 500 square feet at mounting height of 9 feet, with field of view of 360 degrees.

3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.

E. Power Packs for Low-Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.

2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.

3. Input Supply Voltage: Dual rated for 120/277 V ac.

4. Load Rating: As required to control load indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1

C. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 05 37.

1. Mounting Heights: Unless otherwise indicated, as follows:

a. Wall Switch Occupancy Sensors: 48 inches above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Maintain separation of remote-control, signaling, and power-limited circuits.

1. See manufacturer instructions and Section 26 05 19 for control wiring conductors, wiring methods, and identification requirements.

E. Install lighting control devices in accordance with manufacturer's instructions.

F. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Install lighting control devices plumb and level, and held securely in place.

H. Where required and not furnished with lighting control device, provide wall plate; see Section 26 27 26.

I. Provide required supports; see Section 26 05 29.

J. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

K. Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.

N. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

P. Where indicated or required, provide cabinet or enclosure for mounting of lighting control device system components; see Section 26 05 37.

3.4 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Location: At project site.

END OF SECTION 26 09 23

SECTION 26 27 26 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates and covers.

1.2 RELATED REQUIREMENTS

A. Section 26 05 37 - Boxes for Electrical Systems.

B. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

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

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

B. Products: Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.

2. Receptacles Installed in Dwelling Units: Use tamper-resistant receptacles.

3. Provide GFCI protection for:

a. Receptacles installed within 6 feet of sinks.
b. Receptacles installed in kitchens.
c. Receptacles serving electric drinking fountains.

4. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.

2.2 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Finishes:

1. All Wiring Devices: Verify color with Architect before ordering devices.

2.3 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20and where applicable FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.

B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.4 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

B. Convenience Receptacles:

1. Standard Convenience Receptacles: Commercial specification grade, 15A 125V NEMA 5-15R; single or duplex as indicated on the drawings.

2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

C. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.5 WALL PLATES AND COVERS

A. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard.

3. Screws: Metal with slotted heads finished to match wall plate finish.

B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.

1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

4. Locate receptacles for electric drinking fountains so they are readily accessible per NEC 210.8.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Provide low-voltage control wiring between all 0-10V dimmers and their associated luminaires.

K. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 26 05 53.

O. Use jumbo size plates for outlets installed in masonry walls.

P. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonfusible switches.

1.2 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding.

B. Section 26 05 29 - Hangers and Supports.

C. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

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

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.5 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.2 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; general duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. General Duty Switches:

1. Conductor Terminations:
    a. Provide mechanical lugs.
    b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
2. Provide externally operable handle with means for locking in the OFF position, capable of accepting two padlocks.

N. Provide the following features and accessories where indicated or where required to complete installation:

1. Hubs: As required for environment type; sized to accept conduits to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

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

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 05 29.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Identify enclosed switches in accordance with Section 26 05 53.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 28 16

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports.

B. Section 26 05 37 - Boxes for Electrical Systems.

C. Section 26 05 53 - Electrical Systems Identification: Identification products and requirements.

D. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 56 00 - Exterior Lighting.

1.3 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

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

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

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.
b. Include IES LM-79 test report upon request.

B. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Conform to requirements of NFPA 70 and NFPA 101.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. Provide 5-year manufacturer warranty for LED luminaires, including drivers.

B. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.10 EXTRA MATERIALS

A. Furnish 10% of the total of each plastic lens type used on the project, minimum two of each type. Deliver to owner in protected, factory packaging.

B. Furnish 10% replacement lamps of the total of each lamp type, minimum two of each type. Deliver to owner in protected, factory packaging.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Sealed maintenance-free nickel cadmium unless otherwise indicated.

2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.

3. Provide compatible accessory wire guards where indicated.

G. Provide accessories and fittings as recommended by manufacturer to properly and completely install and wire fixtures.

2.4 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.

2. Directional Arrows: As indicated or as required for installed location.

2.5 BALLASTS AND DRIVERS

A. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.

a. Wall Dimmers: See Section 26 27 26.

2.6 LED EMERGENCY POWER SUPPLY UNITS

A. Description: Self-contained LED emergency power supply units suitable for use with indicated luminaires, complying with NFPA 101and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source, solid-state control automatically switches luminaire to the emergency power supply for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery: Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated.

D. Emergency Illumination Output: Approximately 1400 lumins initially and not less than 1000 lumens after 90 minutes.

E. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.

F. Operating Temperature: From 32 degrees F to 122 degrees F unless otherwise indicated or required for the installed location. Provide 0 degrees F ballasts for all exterior fixtures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

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

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.

2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.

4. Secure pendant-mounted luminaires to building structure.

5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.

2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

J. Mount fixtures as called for on drawings. Determine type of ceiling being installed in each space and furnish fixtures suitable for exact type, including roof/floor or ceiling/floor fire rated design with fire tenting required by Architect. All coordination and materials to be provided without additional cost to owner.

K. Provide all necessary supports, brackets, adapters and miscellaneous equipment for mounting and installation of fixtures.

L. Surface Mounted Fixtures: Install plumb and square and aligned with building lines and with each other; secure to prevent movement.

M. Install accessories furnished with each luminaire.

N. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within fixture; use flexible conduit.

O. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

P. Bond products and metal accessories to branch circuit equipment grounding conductor.

Q. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

2. Install lock-on device on branch circuit breaker serving units.

R. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

S. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

T. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting units to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean finishes and touch up damage.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.9 SCHEDULE - SEE DRAWINGS

END OF SECTION 26 51 00

SECTION 27 10 00 - STRUCTURED CABLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications equipment room fittings.

E. Communications outlets.

F. Communications grounding and bonding.

G. Communications identification.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 26 05 26 - Grounding and Bonding.

C. Section 26 05 37 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

C. ICEA S-90-661 - Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communication Wiring Systems; 2021.

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

E. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2023.

F. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

G. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

H. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

I. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

J. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A 2002.

K. UL 444 - Communications Cables; Current Edition, Including All Revisions.

L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

M. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.

2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.

3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1. Storage and handling requirements and recommendations.

2. Installation methods.

B. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding.

C. Manufacturer Qualifications.

D. Evidence of qualifications for installer.

E. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

F. Field Test Reports.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 5 Years experience in the installation and testing of the type of system specified, and:

1. Supervisors and installers factory certified by manufacturers of products to be installed.

1.7 DELIVERY, STORAGE, AND HANDLING

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

B. Keep stored products clean and dry.

1.8 WARRANTY

A. A Lifetime Performance Warranty covering all components, equipment and workmanship shall be submitted in writing with system documentation. The warranty period shall begin on the system's first use by the owner.

B. The project must be pre-registered with Manufacturer before installation has begun.

C. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 SYSTEM DESIGN

A. Provide a complete, warrentied, end-to-end, permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, patch panels, enclosures, racks and cabinets, and outlets.

1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).

2. Comply with Communications Service Provider requirements.

3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.

4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.

5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:

C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.2 PATHWAYS

A. Conduit: As specified in Section 26 05 34; provide pull cords in all conduit; minimum size 1".

2.3 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.

2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.

3. Cable Capacity: 4-pair.

4. Cable Applications:

a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
c. General Purpose Applications: Use listed NFPA 70 Type CM/CMG general purpose cable, Type CMR riser cable, or Type CMP plenum cable.

5. Cable Jacket Color - Voice and Data Cable: Blue.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.

1. Performance: 500 mating cycles.

2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

D. Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.

2. Patch Cords for Patch Panels:

a. Quantity: One for each pair of patch panel ports.
b. Length: 3 feet.

3. Patch Cords for Work Areas:

a. Quantity: One for each work area outlet port.
b. Length: 6 feet.

2.4 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:

1. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.

2. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.

a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
d. Provide incoming cable strain relief and routing guides on back of panel.

2.5 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 26 05 37.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

2. Minimum Size, Unless Otherwise Indicated:

a. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

B. Wall Plates:

1. Comply with system design standards and UL 514C.

2. Accepts modular jacks/inserts.

3. Capacity:

    a. Data or Combination Voice/Data Outlets: 2 ports.
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified on the drawings.

2.6 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

2.7 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

2.8 SOURCE QUALITY CONTROL

A. Factory test cables according to TIA-568 (SET).

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

3.2 INSTALLATION OF PATHWAYS

A. Underground Service Entrance: Install conduit at least 24 inches below finish grade; encase in at least 3 inches thick concrete for at least 60 inches out from the building line.

B. Install pathways with the following minimum clearances:

1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.

2. 12 inches from power conduits and cables and panelboards.

3. 5 inches from fluorescent and high frequency lighting fixtures.

4. 6 inches from flues, hot water pipes, and steam pipes.

C. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of telecommunications outlets provided under this section.

    a. Mounting Heights: Unless otherwise indicated, as follows:
    b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
    c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
    d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
    e. Locate outlet boxes so that wall plate does not span different building finishes.

f. Locate outlet boxes so that wall plate does not cross masonry joints.

D. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

3.3 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Terminate cables at each outlet with specified modular jack assembly.

2. Terminate cables at all patch panels and connector blocks.

3. Patch appropriate computer outlet locations to network switches as directed by the owner.

4. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.

5. Do not over-cinch or crush cables.

6. Do not exceed manufacturer's recommended cable pull tension.

7. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches.

2. At Outlets - Copper: 12 inches.

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.

2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

3. Use T568B wiring configuration.

4. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.

5. Cables shall be dressed and terminated in accordance with ANSI/TIA-568-C.0, Manufacturer's recommendations, and best industry practices.

6. Cable jacket shall be maintained to within one inch of termination point.

7. A pull cord (nylon; 1/8 inch minimum) shall be co-installed with all cable installed in any conduit.

8. Cable raceways shall not be filled greater than required by ANSI/TIA-569-B maximum fill for particular raceway type.

9. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

10. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for purpose.

11. Cable's minimum bend radius and maximum pulling tension shall not be exceeded.

12. If J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at 48 inch to 60 inches maximum intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

13. Horizontal distribution cables shall be bundled in groups of no more than 25 cables. Cable bundle quantities in excess of 25 cables may cause deformation of bottom cables within bundle and degrade cable performance.

14. Cable shall be installed above fire-sprinkler systems and shall not be attached to system or any ancillary equipment or hardware. Cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

15. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support cabling.

16. Cables shall be identified by self-adhesive label and meet requirements of ANSI/TIA-606-A-1. Cable label shall be applied to cable behind faceplate on section of cable that can be accessed by removing cover plate.

D. Identification:

1. Use wire and cable markers to identify cables at each end.

2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.

3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

E. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.

1. Cables: Install color coded labels on both ends.

2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.

3.4 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:

1. Inspect cable jackets for certification markings.

2. Inspect cable terminations for color coded labels of proper type.

3. Inspect outlet plates and patch panels for complete labels.

C. Testing - Copper Cabling and Associated Equipment:

1. Test operation of shorting bars in connection blocks.

2. Category 5e and Above Links: Perform the following tests:

a. Wire map
b. Length
c. Attenuation
d. NEXT
e. Propagation delay

D. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 10 00

SECTION 28 46 00 - FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.2 SYSTEM DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The system shall be an active/interrogative type system where each device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the associated initiating device and notification appliance circuit wiring is functional. Loss of such a signal at the main FACP shall result in a trouble indication as specified hereinafter for the particular input.

C. Operation of manual station or automatic activation of any smoke detector or heat detector shall -

1. Cause system evacuation horns to sound and lamps to flash.

2. The LCD display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises.

3. All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.

4. Initiate off-site alarm notification.

5. Release magnetic door holders.

6. Initiate shut down of mechanical units with air flow in excess of 2000cfm.

7. Initiate closure of all fire/smoke dampers.

1.3 RELATED REQUIREMENTS

A. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

1.4 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

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

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

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

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

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

G. UL 1635 - Digital Alarm Communicator System Units

H. UL 1971 - Signaling Devices for the Hearing-Impaired.

I. UL 864 - Control Units for Fire Protective Signaling Systems.

J. UL 268 - Smoke Detectors for Fire Protective Signaling Systems.

K. UL 38 - Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems

L. UL 346 - Waterflow Indicators for Fire Protective Signaling Systems.

1.5 SUBMITTALS

A. See General Conditions - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:

1. Copy (if any) of list of data required by authority having jurisdiction.

2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.

4. System zone boundaries and interfaces to fire safety systems.

5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.

6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.

7. List of all devices on each signaling line circuit, with spare capacity indicated.

8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.

9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.

10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.

12. Certification by Contractor that the system design complies with Contract Documents.

13. Do not show existing components to be removed.

D. Inspection and Test Reports:

1. Submit inspection and test plan prior to closeout demonstration.

2. Submit documentation of satisfactory inspections and tests.

3. Submit NFPA 72 "Inspection and Test Form," filled out.

E. Operating and Maintenance Data: Revise and resubmit until acceptable; have one set available during closeout demonstration:

1. Complete set of specified design documents, as approved by authority having jurisdiction.

2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.

3. Contact information for firm that will be providing contract maintenance and trouble call-back service.

4. List of recommended spare parts, tools, and instruments for testing.

5. Replacement parts list with current prices, and source of supply.

6. Detailed troubleshooting guide and large scale input/output matrix.

7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.

8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

F. Project Record Documents: Have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.

2. "As installed" wiring and schematic diagrams, with final terminal identifications.

3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

G. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

3. Maintenance contract.

H. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

2. In addition to the items in quantities indicated in PART 2, furnish the following:

a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
b. One copy, on CD-ROM, of all software not resident in read-only-memory.

1.6 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.

3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

a. ADA Standards.
b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction .
d. Applicable local codes.
e. Contract Documents (drawings and specifications).
f. NFPA 101.
g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.

5. Master Control Unit (Panel): Existing, located as shown on drawings.

B. Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By remote supervising station.

2. Means of Transmission to Remote Supervising Station: Any method complying with NFPA 72, 26.6.3. Provide UPS battery backup on associated network switches and all pathway devices as applicable.

C. Circuits:

1. Initiating Device Circuits (IDC): Class A.

2. Signaling Line Circuits (SLC): Class A.

3. Notification Appliance Circuits (NAC): Class A.

2.2 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.3 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.

2.4 COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.

2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Notification Appliances:

1. Low Profile Horn-Strobes

a. Audible output of 92 dBA at 10 ft. when measured in reverberation room per UL-464.
b. Integrally mounted flashing light unit with block letters 'FIRE'. Multi-candela with field-selectable settings of 15cd, 30cd, 60cd, 75cd & 110cd, and flash rate between one and three Hertz. Strobe output shall be determined as required by its specific location and application.
c. Selectable steady or synchronized temporal output.
d. In and out screw terminals shall be provided for wiring.
e. Shall mount in a North American 1-gang box.
f. All units shall flash in synchronization with each other.

2. Low Profile Strobes

a. Integrally mounted flashing light unit with block letters 'FIRE'. Multi-candela with field-selectable settings of 15cd, 30cd, 60cd, 75cd & 110cd, and flash rate between one and three Hertz. Strobe output shall be determined as required by its specific location and application.
b. Selectable steady or synchronized temporal output.
c. In and out screw terminals shall be provided for wiring.
d. Shall mount in a North American 1-gang box.
e. All units shall flash in synchronization with each other.

3. Low Frequency Horns

a. Shall comply with NFPA 72 18.4.5.3
b. 520 Hz (+/- 10%) square wave tone
c. Audible output of 76 dBA at 10 ft. when measured in reverberation room per UL-464.

D. Accessory Devices:

1. Notification Appliance Protective Devices: Provide polycarbonate protective covers for appliances installed in areas subject to damage and vandalism such as gymnasiums, multi-purpose rooms, detention areas, etc.

E. Initiation & Control Modules

1. Relay Module

a. Provide addressable control relay circuit modules as required. The module shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware.

F. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Install wiring in raceway. Minimum raceway size shall be 3/4 inch. Fire alarm system conductors from different zones may be combined in common conduit. Make certain that raceway size and wire quantity, size, and type is suitable for equipment supplied and is within NEC standards.

D. Label pull and junction boxes "FIRE ALARM" with red indelible ink.

E. Loop wires through each device on zone for proper supervision. Tee-taps not permitted.

F. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy.

G. Protect conductors from cuts, abrasion and other damage during construction.

H. Minimum conductor size shall be 14 AWG unless otherwise specified.

I. Post copy of wire identification list inside fire alarm panel door or other area accessible to fire alarm service personnel.

J. Obtain Owner's approval of locations of devices, before installation.

K. Install instruction cards and labels.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.

3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.

5. Repeat demonstration until successful.

3.4 MAINTENANCE

A. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

B. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:

1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.

2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.

3. Record keeping required by NFPA 72 and authorities having jurisdiction.

C. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within 2 hours of notification.

2. Include allowance for call-back service at no extra cost to Owner.

D. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

E. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

F. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 46 00