SECTION 06 41 16
PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
2. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops."

1.03 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site**.**

1.04 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

C. Fire-Test-Response Characteristics: Provide decorative plastic laminate with the following subsurface burning characters as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas,

store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 08 71 00 "Door Hardware (Descriptive Specification)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.01 ARCHITECTURAL CABINET FABRICATORS

A. Fabricators: Coordinate with State of Alaska representative for list of approved fabricators.

2.02 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

D. Reveal Dimension: As indicated

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

a. Wilsonart International.

F. Laminate Cladding for Exposed Surfaces:

1. Vertical Surfaces: Grade VGS

2. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish. Doellken woodtape, 2240 Khaki Brown.
3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.
4. Color: 4936-38 Midway.

G. Materials for Semiexposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate.
a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.
b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
c. Retain first subparagraph below if required to provide balanced construction.
2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermoset decorative panels.

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.

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 selected by Designer from laminate manufacturer's full range in the following categories:
a. Solid colors, matte finish.
b. Patterns, matte finish.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced woodworking 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.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.

2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
2. Products: Subject to compliance with requirements, provide:
   a. Flakeboard Company Limited; Duraflake FR.

D. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.
1. Products: Subject to compliance with requirements, provide one of the following:
   a. Panel Source International, Inc.; Pyroblock Platinum.

2.04 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 (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: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.

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

E. Wire Pulls: Back mounted, solid metal 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081

G. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

H. Drawer Slides: BHMA A156.9.
1. Grade 1 and Grade 2: Side mounted full-extension type; zinc-plated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full extension type; zinc-plated-steel ball-bearing slides.

3. 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 1HD-100.
4. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.
5. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-200

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Door and Drawer Silencers: BHMA A156.16, L03011.

A. Grommets for Cable Passage through Countertops: 2-inch (51-mm) OD, gray, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide "TG series" by Doug Mockett & Company, Inc.

B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.

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

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: hardwood 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. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.06 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated.

C. 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.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

D. 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.

PART 3 - EXECUTION

3.01 PREPARATION

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

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

C. Verify mechanical, electrical and building items affecting work are placed and ready to receive work.

3.02 INSTALLATION

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

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

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

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly 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.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

2. 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 sheet metal screws through metal backing or metal framing behind wall finish.

3.03 ADJUSTING AND CLEANING

A. Adjust for maximum offset of true alignment with different adjacent materials to 1/32 inch (0.80 mm).

B. Adjust for true alignment of same materials to flush.

C. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

D. Clean, lubricate, and adjust hardware.

E. Clean cabinets on exposed and semiexposed surfaces.

F. Do not allow construction near unprotected surfaces.

END OF SECTION 06 41 16

SECTION 08 8700 – GLAZING SURFACE FILMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes decorative films on new glazing.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing film according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A single manufacturer with minimum ten years experience.

B. Installer Qualifications: An installer authorized by the film manufacturer.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace glazing film that deteriorates within specified warranty period. Deterioration of glazing film is defined as excessive or unusual loss of color, adhesive failure, bubbling, cracking, crazing, delamination, demetallization, or pealing. Warranty to cover labor for removal and reinstallation.

1. Warranty Period:

a. Building non-perimeter glazing: 5 years from date of Substantial Completion.

b. Building perimeter glazing: 3 years from date of Substantial Completion

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Glazing Film: Obtain glazing film from single source from single manufacturer.

2.02 GLAZING FILM

A. Film: Clear polyester film.

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

a. 3M – Fasara Glass Finish - Leise 70-0709-0263-3

B. Adhesive: Pressure-sensitive, removable

C. Properties (On 6mm clear flat glass):

1. Opacity: Translucent
2. Film size: 1.27 m x 30 m
3. Color: Clear
4. Warranty: 3 Years

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine glazing to receive film.

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

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer.

3.03 INSTALLATION

A. Film Installation:

1. Install in accordance with manufacturer's instructions.
2. Cut film edges neatly and tight to window sealant. Use new blade tips after 3 to 4 cuts.
3. Install in one continuous length free of air bubbles, blisters, or other defects.

3.04 CLEANING AND PROTECTION

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

B. Protect glazing film from contact with contaminating substances resulting from construction operations.

1. If, despite such protection, contaminating substances do come into contact with glazing film, remove substances immediately as recommended in writing by glazing film manufacturer. Remove and replace glazing film that cannot be cleaned without damage.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient stair accessories.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than [85 deg F (29 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.07 WARRANTY

A. Manufacturer's Materials Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner many have under Contract Documents.
   1. Warranty Period: 1 year limited warranty commencing on Date of Substantial Completion. Notice of any defect must be made in writing to manufacturer within thirty (30) days after buyer learns of the defect.
   2. Limited Wear Warranty: 3 year limited wear warranty.

PART 2 - PRODUCTS

2.01 **PERFORMANCE REQUIREMENTS**

A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.

2.02 RUBBER BASE – RB-1

A. Manufacturers: Subject to compliance with requirements, provide products by the following: provide::
   1. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (Vulcanized SBR Rubber)
   1. Group: I (solid, homogeneous)
   2. Style and Location:
      a. Cove: As scheduled in drawings

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 2-1/2 inches (64 mm)

E. Lengths: Cut lengths 48 inches (1219 mm) long

F. Outside Corners: Job formed

G. Inside Corners: Job formed

H. Colors and Patterns: TS RP194, #194 Burnt Umber.

2.03 RUBBER STAIR ACCESSORIES – RF-7

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

B. Manufacturers: Subject to compliance with requirements, provide products by:
   1. Roppe Corporation, USA.

C. Stair Treads: ASTM F 2169.
   1. Type: synthetic rubber compound
   2. Class: 1 (smooth, flat).
   3. Group: 1 (embedded abrasive strips)
   4. Nosing Style: Square
   5. Nosing Height: As scheduled in drawings.
   6. Thickness: 1/4 inch (6 mm) and tapered to back edge
   7. Size: Lengths and depths to fit each stair tread in one piece

8. Integral Risers: Smooth, flat; in height that fully covers substrate.

D. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads

E. Locations: Provide rubber stair accessories in areas indicated, as scheduled in dawings.

Colors and Patterns: #41 Heavy Duty, #194 Burnt Umber, with matching risers and black abrasive strip at edge of tread.

2.04 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. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

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

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. 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.

4. with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 60 percent relative humidity level.

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 resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

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

3.03 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. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

a. Form without producing discoloration (whitening) at bends. Shave back of base vertically at fold point and at two diagonal additional stress relief gouges on the vertical surface, approximately 1/2-inch (12mm) long, 1-inch (25mm) from the center gouge.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.

a. Miter or cope corners to minimize open joints.

3.04 RESILIENT ACCESSORY INSTALLATION

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

B. Resilient Stair Accessories:

1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.

2. Tightly adhere to substrates throughout length of each piece.

3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

3.05 CLEANING AND PROTECTION

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

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply one to two coat(s).

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

END OF SECTION 09 65 13

SECTION 09 65 16
RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes rubber sheet flooring.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 68 deg F (20 deg C), $\pm$ 5 deg F (3 deg C) and 50% RH $\pm$ 10% or more than 85 deg F (29 deg C , in spaces to receive resilient sheet flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C)

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

1.07 WARRANTY

A. Provide current, detailed manufacturer’s warranty for each flooring product as applicable, including limited wear, defect and conductivity.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, 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. FloorScore Compliance: Resilient sheet flooring shall comply with requirements of FloorScore certification.

2.02 UNBACKED RUBBER SHEET FLOORING – RF-6

A. Products: Subject to compliance with requirements, provide the following:

1. Nora Systems, Inc; Noraplan Envirocare

B. Product Standard: ASTM F 1859.

1. Type: Type I (homogeneous rubber sheet)
2. Thickness: 3MM.
3. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer per ASTM D 2240

C. Wearing Surface: Smooth.

D. Sheet Width: 4.0 feet (1.2 m)

E. Seamless-Installation Method: Heat welded

F. Colors and Patterns: Environcare 2930, Windflower.

2.03 INSTALLATION MATERIALS

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

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

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

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
   a. Color: Match flooring.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: Square metal, vinyl, or rubber cap provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

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

3.02 PREPARATION

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

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 resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring 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: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 60 percent relative humidity level.

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 resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

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

3.03 RESILIENT SHEET FLOORING INSTALLATION

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

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.

3. Double cut seams.
4. Match edges of flooring for color shading at seams.
5. Avoid cross seams.
6. Layout seams to avoid less than 1/3 of full roll width.

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

E. At movable and demountable partitions, install flooring under partitions without interruption in flooring or pattern.

F. Center seams and transitions under doors.

G. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

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

I. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

J. Adhere resilient sheet flooring 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.

K. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

L. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches (152 mm) up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.04 CLEANING AND PROTECTION

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

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 65 16

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.
2. Linoleum tile

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 68 deg F (21 deg C)] or more than 90 deg F (35 deg C) in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace resilient flooring that do not comply with requirements or that fail in materials within specified warranty period.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, 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. FloorScore Compliance: Resilient tile flooring shall comply with requirements of FloorScore certification.

2.02 LINOLEUM TILE RF-1, RF-2, RF-3

A. Products: Subject to compliance with requirements, provide the following:

1. Forbo

B. Tile Standard: EN-ISO 2436, EN-ISO 10874

C. Wearing Surface: Smooth.

D. Thickness: 2.0 mm

E. Size: 13 by 13 inches

F. Colors and Patterns: As selected by Architect from full range of industry colors, MCT 707 Barley, MCT 3048 Graphite, MCT 3235 Tobacco Leaf.

2.03 VINYL COMPOSITION FLOOR TILE RF-5

A. Products: Subject to compliance with requirements, provide the following:

1. Armstrong World Industries, Inc;

a. Standard Excelon

B. Tile Standard: ASTM F 1066, Class 1

C. Wearing Surface: Smooth

D. Thickness: 0.125 inch (3.2 mm)

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: RF-5 - 51877 Earth Green; 1/4 turn installation

2.04 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 comply with the following limits for VOC content:

a. Vinyl Composition Tile Adhesives: 50 g/L or less.

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

2.05 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

2.06 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: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 60 percent relative humidity level.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

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

E. Do not install floor tiles until they are the same temperature as the 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.

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

2.07 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 in pattern indicated per drawings.

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 in pattern of colors and sizes indicated per drawings.

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. Center transitions under doors.

G. 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.

H. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

I. Adhere floor tiles to flooring 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.

2.08 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply coat(s) as recommended by manufacturer.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 65 36
STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Static-dissipative, vinyl composition floor tile

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with static-control resilient flooring.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Nome State Office Building in Nome, Alaska.

1. Review methods and procedures related to static-control resilient flooring including, but not limited to, the following:

a. Examination and preparation of substrates to receive static-control resilient flooring.

b. Installation including seamless installation techniques.

1.04 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for static-control resilient flooring.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C).

1. Floor Tile: Store on flat surfaces.

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C), in spaces to receive static-control resilient flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C).

C. Close spaces to traffic during static-control resilient flooring installation.

D. Close spaces to traffic for 48 hours after static-control resilient flooring installation.

E. Install static-control resilient flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Static-Dissipative Properties: Provide static-control resilient flooring with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per ASTM F 150 with 100-V applied voltage and ESD-STM-7.1.
   a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
   b. Average greater than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.
2. Static Generation: Less than 10 V when tested per ESD STM 97.2 at 40 percent relative humidity and less than 100 V at 12 percent relative humidity in combination with conductive footwear and a person.
3. Static Decay: 5000 to zero V in less than .5 seconds when tested per FED-STD-101C/4046.1.

B. FloorScore Compliance: Static-control resilient flooring shall comply with requirements of FloorScore certification.

C. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 and ASTM E 662 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.02 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS

A. Static-Dissipative, Vinyl Composition Floor Tile RF-4: ASTM F 1066 (vinyl composition floor tile, non-asbestos formulated), Class 2 (through-pattern tile).

1. Products: Subject to compliance with requirements, provide the following:
   a. Armstrong World Industries, Inc; Static Dissipative SDT.
2. Thickness: 0.125 inch (3.2 mm).
3. Size: 12 by 12 inches (305 by 305 mm).
4. Colors and Patterns: 51951 Armor Gray, 1/4 turn installation

2.03 INSTALLATION MATERIALS

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

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor-covering system to ground connection.
   1. Adhesives shall comply with the following limits for VOC content:
      a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
      b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor-covering system to ground connection.

D. Maintenance Floor Tiles: Special floor tiles inscribed "Conductive floor. Do not wax."

E. Floor Polish: Provide protective, static-control liquid floor polish products as recommended by floor-covering manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion or static-control characteristics of floor coverings.

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

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions and with oversight by manufacturer's representative to ensure adhesion of static-control resilient flooring and electrical continuity of floor-covering systems.

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 floor-covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.

C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

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

E. Do not install static-control resilient flooring until it is same temperature as space where it is to be installed.

1. Move static-control resilient flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum substrates to be covered by static-control resilient flooring immediately before installation.

3.03 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor-covering surfaces to ground connections.

C. Scribe, cut, and fit static-control resilient flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend static-control resilient flooring into toe spaces, door reveals, closets, and similar openings. Extend static-control resilient flooring to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on static-control resilient flooring as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.

F. Install static-control resilient flooring on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of static-control resilient flooring installed on covers. Tightly adhere static-control resilient flooring edges to substrates that abut covers and to cover perimeters.

G. Adhere static-control resilient flooring to substrates using a full spread of static-control 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.

3.04 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 floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.

1. Lay floor tiles square with room axis in pattern indicated per drawing set.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

3.05 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to test electrical resistance of static-control resilient flooring for compliance with requirements.

1. Arrange for testing after static-control adhesives have fully cured and static-control resilient flooring has stabilized to ambient conditions and after ground connections are completed.

2. Arrange for testing of static-control resilient flooring before and after performing floor polish procedures.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of static-control resilient flooring.

B. Perform the following operations immediately after completing static-control resilient flooring:

1. Remove static-control adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect static-control resilient flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Do not wax static-control resilient flooring.

2. If recommended in writing by manufacturer, apply protective static-control floor polish formulated to maintain or enhance floor covering's electrical properties; ensure static-control resilient flooring surfaces are free from soil, static-control adhesive, and surface blemishes.

a. Verify that both floor polish and its application method are approved by manufacturer and that floor polish will not leave an insulating film that reduces static-control resilient flooring's effectiveness for static control.

D. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION 096536

SECTION 09 65 43
LINOLEUM FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes linoleum floor tile

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).

1. Floor Tile: Store on flat surfaces.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than [70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive flooring during the following time periods:

1. Seven days prior to installation.
2. During installation.
3. Seven days after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, 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. FloorScore Compliance: Flooring shall comply with requirements of FloorScore certification.

2.02 LINOLEUM FLOOR TILE RF-1 and RF-2

A. Product: Subject to compliance with requirements, provide product indicated on Drawings by the following:

1. Forbo Industries, Inc.

B. Linoleum Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing.

1. Nominal Floor Tile Size: 13 by 13 inches (330 by 330 mm).

C. Thickness: 0.08 inch (2.0 mm)

D. Colors and Patterns:
1. RF-1 – MCT, 707 Barley, Installation pattern per plans
2. RF-2 – MCT, 3048 Graphite, Installation pattern per plans
3. RF-3 – MCT, 3235 Tobacco Leaf, Installation pattern per plans

2.03 INSTALLATION MATERIALS

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

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit 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 linoleum flooring manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

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

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

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

3.02 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

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 flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring 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 recommended by linoleum flooring manufacturer, but not less stringent than the following:
    a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

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 flooring until it is the same temperature as space where it is to be installed.
1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.03 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

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

E. Install flooring on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of low VOC 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.

G. Heat-Welded Seams: For seamless installation, comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.04 LINOLEUM FLOOR TILE INSTALLATION

A. Lay out linoleum floor tiles from center marks established with principal walls, discounting minor offsets, so floor 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 floor tiles square with room axis in pattern indicated in Drawings.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from linoleum flooring before applying liquid floor polish.

1. Apply two to three coat(s) or as recommended by manufacturer.

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 09 68 13
TILE CARPETING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes modular, tufted carpet tile.

B. Related Requirements:

1. Section 02 41 19 "Selective Demolition" for removing existing floor coverings.
2. Section 09 65 13 "Resilient Base and Accessories" and Section 09 65 19 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.03 DEFINITIONS

A. Pile Thickness: Yarn Tuft heights above top surface of backing.

1.04 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Nome State Office Building in Nome, Alaska.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
   a. Review delivery, storage, and handling procedures.
   b. Review ambient conditions and ventilation procedures.
   c. Review subfloor preparation procedures.

1.05 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.08 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.09 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 does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 CARPET TILE CPT-1 and CPT-2

A. Products: Subject to compliance with requirements, provide the following:

1. Mannington Commercial
   a. CPT-1: Palma Collection – Scena
2. Mohawk Group, The
   a. CPT-2: First Step Modular, L8513

B. Color:

1. CPT-1: TBD by tenant. Standard color options are: Fiji, Aruba, Montego, Turks & Caicos
2. CPT-2: 524 Stepping Stone

C. Pattern:

1. CPT-1: Monolitic
2. CPT-2: Quarter Turn

D. Fiber Content:

1. CPT-1: Solution Dyed
2. CPT-2: Yarn Dyed

E. Fiber Type:

1. CPT-1: 100% Antron Legacy Type 6,6 Nylon
2. CPT-2: Fortis™ Nylon

F. Pile Characteristic:

1. CPT-1: Textured Patterned Loop
2. CPT-2:Performance Loop Pile

G. Yarn Twist:

1. CPT-1: Per manufacturer specifications

2. CPT-2: Per manufacturer specifications

H. Yarn Count:
1. CPT-1: Per manufacturer specifications
2. CPT-2: Per manufacturer specifications

I. Density:
1. CPT-1: 6,406
2. CPT-2: 5,494

J. Finished Pile Thickness:
1. CPT-1: 0.118” (3.0 mm)
2. CPT-2: 0.249” (6.3 mm)

K. Stitches:
1. CPT-1: 9.8 per inch (38.58/10cm)
2. CPT-2: 8.5 per inch (33.46/10cm)

L. Gage:
1. CPT-1: 5/64 (50.39 rows per 10 cm)
2. CPT-2: 5/32 (25.2 rows per 10 cm)

M. Surface Pile Weight:
1. CPT-1: 22.0 oz. per sq. yd. (746.02 g/m2)
2. CPT-2: 38.0 oz. per sq. yd. (1288 g/m2)

N. Total Weight:
1. CPT-1: Per manufacturer specifications
2. CPT2: Per manufacturer specifications

O. Primary Backing/Backcoating:
1. CPT-1: Manufacturer’s standard material
2. CPT-2: Manufacturer’s standard material

P. Secondary Backing:
1. CPT-1: Manufacturer’s standard material
2. CPT-2 Manufacturer’s standard material

Q. Backing System:
1. CPT-1: Infinity Modular
2. CPT-2: EcoFlex ICT

R. Size:
1. CPT-1: 24 by 24 inches (610 by 610 mm)
2. CPT-2: 24 by 24 inches (610 by 610 mm)

S. Applied Soil-Resistance Treatment:
1. CPT-1: Manufacturer's standard material (Sentry Plus)
2. CPT-2: Manufacturer’s standard material

T. Antimicrobial Treatment:
1. CPT-1: Manufacturer's standard material
2. CPT-2: Manufacturer’s standard material

2.02 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 complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.

2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet tile.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 06 10 00 "Rough Carpentry."

2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. For metal subfloors, verify the following:

1. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

E. For painted subfloors, verify the following:

1. Perform bond test recommended in writing by adhesive manufacturer.

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

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

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 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. 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 carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

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

3.03 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer; adhesives to be low VOC.

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

D. 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.

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

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

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. 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 8433 - SOUND-ABSORBING WALL UNITS

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 shop-fabricated, fabric-wrapped panel units tested for acoustical performance, including:

1. Sound-absorbing wall panels.

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

B. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install sound-absorbing wall units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify locations of sound-absorbing wall units and actual dimensions of openings and penetrations by field measurements before fabrication.

1.8 WARRANTY

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

1. Failures include, but are not limited to the following:

a. Acoustical performance.
b. Fabric sagging, distorting, or releasing from panel edge.
c. Warping of core.

2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

A. Unika Vaev – Ecoustic Wall Panels

B. Sound-Absorbing Wall Panel **WP-2.** Manufacturer's standard panel construction consisting of pressed layers of 100% polyester sheets.

1. Unika Vaev – Ecoustic wall panels
2. Mounting: Edge mounted with splines secured to substrate.

a. Finish Color at Exposed Edges: Black

3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.
4. Edge Profile: Square

5. Corner Detail in Elevation: Square
6. Reveals between Panels: as indicated on Drawings.
7. Facing Color: 95 Natural Felt
8. Acoustical Performance: Sound absorption NRCof 0.80 according to ASTM C 423 for direct wall mount installations. NRC of 0.85 with a 0.98” airgap.
9. Nominal Thickness: 1 inch (25 mm)
10. Panel Size: 8’-11” x 3’-11”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated units, substrates, areas, and conditions, for compliance with requirements, installation tolerances, and other conditions affecting performance of sound-absorbing wall units.

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

3.2 INSTALLATION

A. Install sound-absorbing wall units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with sound-absorbing wall unit manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Align and level fabric pattern and grain among adjacent units.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm)

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8433

SECTION 099123
INTERIOR PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:
   1. Concrete.
   2. Concrete masonry units (CMU).
   3. Steel.
   4. Aluminum (not anodized or otherwise coated).
   5. Gypsum board.

B. Related Requirements:
   1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.

1.03 DEFINITIONS

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

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

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

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

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

1.04 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C) per manufacturer instructions.
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

3. Dispose of solvent-based materials, and materials used with solvent-based materials; in accordance with requirements of local authorities having jurisdiction.

1.06 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C), within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's absolute limits.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, provide product listed in other Part 2 articles for the paint category indicated.

2.02 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, must meet the limitations and restrictions on chemical components set by the following standards.

1. Topcoat Paints: Green Sea Standards GS-11, Paints, First Edition, May 20 1993

2. All other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #113, Architectural Coatings, Rules in Effect on January 1, 2004

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

1. SW 7042; Shoji White; R-230, G-224, B-211

2. SW 7074; Software; R-127, G-132, B-134

3. SW 2851; Sage Green Light; R-112, G-112, B-92

4. SW 6661; Papaya; R-239, G-190, B-112

2.03 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior

1. Sherwin Williams; ProMar 200 Zero VOC Interior Latex Primer; BW28W02600

2.04 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1)

1. Sherwin Williams; ProMar 200 Zero VOC Interior Latex Paint

B. Latex, Interior, Egg-Shel, (Gloss Level 2)

1. Sherwin Williams; ProMar 200 Zero VOC Interior Latex Paint

C. Latex, Interior, Semi-Gloss, (Gloss Level 5):

1. Sherwin Williams; ProMar 200 Zero VOC Interior Latex Paint

2.05 WATER-BASED WOOD STAINS

A. Acrylic, Interior, Semi-Gloss (Gloss Level 5)
Sherwin Williams Minwax Water Based Wood Stain, Low VOC

2.06 WATER-BASED PROTECTIVE SEALERS

A. Acrylic, Interior, Semi-Gloss (Gloss Level 5)

1. Sherwin Wiliams Minwax Polycrylic Protective Finish Semi-Gloss, Low VOC

2.07 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.01 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. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

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

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

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

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Aluminum Substrates: Remove loose surface oxidation.

H. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.03 APPLICATION

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

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. 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.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces. Reference drawings for paint finish:
    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    h. Other items as directed by Architect.
2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

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

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex over Alkyd Primer System:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
b. Prime Coat: Primer, alkyd, quick dry, for metal.
c. Prime Coat: Primer, alkyd, anti-corrosive, for metal or primer, alkyd, quick dry, for metal.
d. Prime Coat: Shop primer specified in Section where substrate is specified.
e. Intermediate Coat: Latex, interior, matching topcoat.
f. Topcoat: Latex, interior, flat, (Gloss Level 1).
g. Topcoat: Latex, interior, (Gloss Level 2).
h. Topcoat: Latex, interior, (Gloss Level 3).
i. Topcoat: Latex, interior, (Gloss Level 4).
j. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
k. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

2. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, rust-inhibitive, water based.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1).
d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2).
e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3).
f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5).

B. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex System:

a. Prime Coat: Primer, quick dry, for aluminum
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1)
d. Topcoat: Latex, interior, (Gloss Level 2)
e. Topcoat: Latex, interior, (Gloss Level 3)
f. Topcoat: Latex, interior, (Gloss Level 4)
g. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5)
h. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees)

C. Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior.
b. Prime Coat: Latex, interior, matching topcoat.
c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat: Latex, interior, flat, (Gloss Level 1).
e. Topcoat: Latex, interior, (Gloss Level 2).
f. Topcoat: Latex, interior, (Gloss Level 3).
g. Topcoat: Latex, interior, (Gloss Level 4).
h. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
i. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

D. Wood Substrates: Including **wood trim, architectural woodwork, doors, windows**, **wood-based panel products, glued-laminated construction,** "Latex System" Subparagraph **below corr**esp**onds to MPI INT 6.1M, M**PI **INT 6.**2D, **MPI IN**T 6.**3T, and MPI INT 6.4R.**

1. **Acry**lic **System:**

a. **Prime Coat: Stain, A**cry**lic for interi**or **wood**
b. Intermediate Coat: Acrylic, interior, matching topcoat.
c. Topcoat: Acrylic, interior, semi-gloss

END OF SECTION 099123

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Corner guards.
2. Impact-resistant wall coverings.
3. Door protection systems.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for angle corner guards.
2. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot- (2.4-m-) long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.05 QUALITY ASSURANCE

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

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."

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

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

E. Regulatory Requirements: Comply with applicable provisions in [the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines] [and] [ICC/ANSI A117.1].

F. Pre-installation Conference: Conduct conference at Nome State Office Building in Nome, Alaska.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at temperature range per manufacturer guidelines not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of per manufacturer guidelines at 68 deg F (21 deg C).
    a. Store corner-guard covers in a vertical position.
    b. Store wall-guard covers in a horizontal position.
4. Storage of Materials: Store rigid panels flat and elevated of floors in a dry place at the project site.
5. Handling: Remove foreign matter from face of panels by use of a soft bristle brush, avoiding abrasive action.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature per manufacturer guidelines at 68 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.08 WARRANTY

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

1. Failures include, but are not limited to, the following:
    a. Structural failures.
    b. Deterioration of plastic and other materials beyond normal use.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.

1. Impact Resistance: Minimum 30.4 ft-lbf/in. of notch when tested according to ASTM D 256-90b, Impact Resistance of Plastics

2. Self-extinguishing when tested according to ASTM D 635-74
3. Flame-Spread Index: 25 or less.
4. Smoke-Developed Index: 450 or less.

B. Stainless-Steel Sheet: ASTM A 240/A 240M.

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

D. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.02 CORNER GUARDS

A. Surface-Mounted, Stainless Steel Corner Guards, fabricated with 90- or 135-degree turn to match wall condition;

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
   a. WallGuard.com.
2. Fabrication: Corner guars shall be factory formed from stainless steel sheet.
   a. Lengthwise perimeter edges to include nominal 10 degree return bend
   b. Edge burrs shall be removed
   c. Satin finish grain oriented parallel with length
   d. Single piece fabrication to 144” length.
3. Mechanical fasteners
   a. For optional pre-drilled holes: stainless steel #6 c 1-1/2” Philips oval head sheet metal screw with stainless steel cup washer
   b. For optional pre-frilled and countersunk holes: stainless steel #6 x 1-1/2” Philips oval head sheet metal screw.
   c. Tamper resistant fasteners available.

2.03 IMPACT-RESISTANT WALL COVERINGS

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by the following:
   a. IPC Door and Wall Protection Systems; Division of InPro Corporation.
2. Size: 48 by 120 inches for sheet.
3. Sheet Thickness: 0.040 inch (1.0 mm).
4. Color and Texture: As selected by Architect from manufacturer's full range, #5E005.
5. Height: Wainscot to 4’-0” A.F.F.
6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
7. Mounting: Adhesive.

2.04 DOOR PROTECTION SYSTEMS

A. General: Comply with BHMA A156.6.

1. For fire-rated doors, provide door protection systems that are UL listed and labeled.

B. Protection Plates: Fabricated from stainless steel, .05 inches thick.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:
   a. Rockwood Manufacturing

C. Armor Plates: Minimum .05 inches thick, beveled four sides.
1. Size: 36 inches (914 mm) high by door width, with allowance for frame stops.
2. Color and Texture: As selected by Architect from manufacturer's full range, satin stainless steel.
3. Mounting: Countersunk screws through factory-drilled mounting holes

D. Kick/Mop Plates: Minimum .05 inches thick, beveled four sides.
1. Size: 8 inches (203 mm) high by door width, with allowance for frame stops.
2. Color and Texture: As selected by Architect from manufacturer's full range, satin stainless steel.
3. Mounting: Countersunk screws through factory-drilled mounting holes

2.05 ACCESSORIES

A. Division Bars, Corner Trim: Panel manufacturer's standard length, non staining, extruded vinyl pieces; longest length possible to eliminate end joints.

B. Caulks and Adhesives: Clear silicone sealant and construction adhesive as recommended by the panel manufacturer.

2.06 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Preform curved semirigid, impact-resistant sheet wall covering in factory for radius and sheet thickness as follows:
1. Sheet Thickness of 0.040 Inch (1.0 mm): 24-inch (610-mm) radius.

C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.07 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
3. Run grain of directional finishes with long dimension of each piece.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.

2. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.02 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.

b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).

c. Adjust end and top caps as required to ensure tight seams.

3.04 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

C. Wash the panel faces with warm soapy water.

D. Provide final protection and maintain conditions in a manner acceptable to Installer that ensures panel assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 26 00

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Horizontal louver blinds with aluminum slats.

B. Related Requirements:

1. Section 06 1000 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting horizontal louver blinds and accessories.

1.03 ALLOWANCES

A. Horizontal louver blinds are part of construction budget.

1.04 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver horizontal louver blinds in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain horizontal louver blinds from single source from single manufacturer.

2.02 HORIZONTAL LOUVER BLINDS, ALUMINUM SLATS

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

1. Bali Blinds

B. Slats: Aluminum; alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
   1. Width: 1 inch (25 mm)
   2. Thickness: Manufacturer's standard
   3. Spacing: Manufacturer's standard
   4. Finish: Snowcap White #386

C. Headrail: Formed steel or extruded aluminum; long edges returned or rolled. Headrails fully enclose operating mechanisms on three sides.
   1. Capacity: Two blinds per headrail unless otherwise indicated.
   2. Ends: Capped or plugged
   3. Manual Lift Mechanism:
      a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range
      b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
   4. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
      a. Tilt: Full.
      b. Operator: Corrosion-resistant steel rod
   5. Manual Lift-Operator and Tilt-Operator Locations: Right side and left side of headrail, respectively unless otherwise indicated.
   6. Integrated Headrail/Valance:

D. Bottom Rail: Formed-steel or extruded-aluminum tube that secures and protects ends of ladders and lift cords and has plastic- or metal-capped ends.

E. Lift Cords: Manufacturer's standard braided cord.

F. Ladders: Evenly spaced across headrail at spacing that prevents long-term slat sag.

G. Valance: Manufacturer's standard

H. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
   1. Type: Wall
   2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

J. Side Channels and Perimeter Light Gap Seals: Manufacturer's standard.

K. Colors, Textures, Patterns, and Gloss:
   1. Slats: Snowcap White #386
   2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated

L. Colors, Finishes, and Gloss:
   1. Slats: As indicated on Drawings
   2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color unless otherwise indicated

2.03 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lift-and-Tilt Mechanisms: With permanently lubricated moving parts.

D. Mounting and Intermediate Brackets: Designed for removal and reinstallation of blind without damaging blind and adjacent surfaces, for supporting blind components, and for bracket positions and blind placement indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish:

1. Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.

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

3.02 INSTALLATION

A. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior slat edges are not closer than 1 inch (25 mm) from interior faces of glass and not closer than 1/2 inch (13 mm)]from interior faces of glazing frames through full operating ranges of blinds.

2. Install mounting and intermediate brackets to prevent deflection of headrails.

3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.03 ADJUSTING

A. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

3.04 CLEANING AND PROTECTION

A. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer and that ensures that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged horizontal louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.

END OF SECTION 122113

SECTION 12 36 16
METAL COUNTERTOPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes stainless-steel countertops and integral sinks.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal countertops & sinks only after casework has been completed in installation areas.

B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.05 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction to receive metal countertops by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316L.

B. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that complies with applicable requirements in Section 079200 "Joint Sealants."

1. Mildew-Resistant Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, silicone
2. Color: Clear.
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 STAINLESS-STEEL COUNTERTOPS & SINKS

A. Countertops: Fabricate from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet. Provide smooth, clean exposed tops and edges in uniform plane, free of defects. Provide front and end overhang of 1 inch (25 mm) over the base cabinets.

1. Joints: Fabricate countertops in sections for joining in field, with joints at locations indicated.
2. Sound deaden the undersurface with heavy-build mastic coating.
3. Extend the top down to provide a 1-inch- (25-mm-) thick edge with a 1/2-inch (12.7-mm) return flange.

4. Form the backsplash coved to and integral with top surface, with a 1/2-inch- (12.7-mm) thick top edge and 1/2-inch (12.7-mm) return flange.
5. Provide raised (marine) edge around perimeter of tops containing sinks; pitch tops containing sinks two ways to provide drainage without channeling or grooving.
6. Where stainless-steel sinks occur in stainless-steel tops, factory weld into one integral unit.

B. Stainless-Steel Sinks: Fabricate from stainless-steel sheet, not less than 0.050-inch (1.27-mm) nominal thickness. Fabricate with corners rounded and coved to at least 5/8-inch (16-mm) radius. Slope the sink bottoms to outlet without channeling or grooving. Provide continuous butt-welded joints.

1. Provide sizes indicated or manufacturer's closest standard size of equal or greater volume, as approved by Architect.
2. Provide double-wall construction for sink partitions with top edge rounded to at least 1/2-inch (13-mm) diameter.
3. Factory punch holes for fittings.
4. Provide sinks with stainless-steel strainers and tailpieces.
5. Provide sinks with integral rims except where located in stainless-steel countertops.
6. Apply 1/8-inch- (3-mm-) thick coating of heat-resistant, sound-deadening mastic to undersink surfaces.

2.03 STAINLESS-STEEL FINISH

A. Grind and polish surfaces to produce uniform, directional satin finish matching No. 4 finish, with no evidence of welds and free of cross scratches. Run grain with long dimension of each piece. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of metal countertops.

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

3.02 INSTALLATION

A. Install metal countertops level, plumb, and true; shim as required, using concealed shims.

B. Field Jointing: Where possible, make field jointing in the same manner as shop jointing; use fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

C. Secure tops to cabinets with Z- or L-type fasteners or equivalent; use two or more fasteners at each front, end, and back.

D. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.

E. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.03 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil (0.15-mm) plastic or other suitable water-resistant covering over the countertop surfaces. Tape to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 12 36 16

SECTION 12 36 61
SIMULATED STONE TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Solid-surface-material trim.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 QUALITY ASSURANCE

A. Qualifications: Shop that 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

B. Fabricator/Installer Qualifications:
   1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer

C. Applicable Standards:
   1. American National Standards Institute (ANSI)
      a. American Society for Testing Materials (ASTM)
      b. National Electrical Manufacturers Association (NEMA)
      c. NSF International
   2. Fire test response characteristics:
      a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
         1) Flame Spread Index: 25 or less
         2) Smoke Developed Index: 450 or less

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
   1. Provide protective coverings to prevent physical damage or staining following installation for duration of project

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements.

1.07 WARRANTY

A. Provide manufacturer's warranty against defects in materials
   1. Warranty shall provide material and labor to repair or replace defective materials
   2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

B. Manufacturer's Warranty period:
   1. Per specified manufacturer, from date of substantial completion

PART 2 - PRODUCTS

2.01 SOLID-SURFACE-MATERIAL TRIM (SST-1)

A. Configuration: Provide trim at inside of exterior windows with the following style:
   1. Edges: Eased

B. Trim**:** 1-1/2-inch thick x 1-1/2-inch thick, solid surface material trim with straight edge in same material at inside of exterior windows. See Architectural Details and Opening Schedule for additional information.

C. Fabrication: Fabricate trim in one piece unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

2.02 TRIM MATERIALS

A. Adhesives: Adhesives shall not contain urea formaldehyde.

B. Adhesives: Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. LG Hausys Hi Macs
   2. Type: Provide Standard Type unless Special Purpose Type is indicated.
   3. Colors and Patterns: As selected by Architect from manufacturer's full range and as follows:
      a. LG Hi-Macs Classic, Ivory White S29, Polished finish

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data
   1. Provide product in largest pieces available

2. Form field joints using manufacturer’s recommended adhesive, with joints inconspicuous in finished work.
3. Exposed joints/seams shall not be allowed.
4. Cut and finish component edges with clean, sharp returns.
5. Anchor securely
6. Align adjacent trim and form seams to comply with manufacturer’s written recommendations using adhesive in color to match trim.
7. Carefully dress joints smooth, remove surface scratches and clean entire surface.

B. See architectural detail for trim fastening and additional attachment information. Use adhesive in color to match trim, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.02 **CLEANING AND PROTECTION**

A. Keep components clean during installation

B. Remove adhesives, sealants and other stains

END OF SECTION 12 36 61

SECTION 12 36 23.13
PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes plastic-laminate countertops.

1.03 SUBMITTALS

A. See Section 01 3300 – submittal procedures.

1.04 INFORMATIONAL SUBMITTALS

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

B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that 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.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install countertops 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.

B. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate

measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE COUNTERTOPS

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

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGL

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

a. Formica Corporation.

D. 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 manufacturer's designations.
2. Match Architect's sample.
3. As selected by Designer from client standards:

a. 5880-50 Earthen Warp (PL-2)

4. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: 3-mm PVC edging. Doellken Woodtape, 2428 Shadow.

F. Core Material: Particleboard or medium-density fiberboard; formaldehyde-free

G. Core Material at Sinks: exterior-grade plywood

H. Core Thickness: 3/4 inch (19 mm)

1. Build up countertop thickness to 1-1/2 inches (38 mm) at front, back, and ends with additional layers of core material laminated to top.

I. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

J. Paper Backing: Provide paper backing on underside of countertop substrate.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, made with binder containing no urea formaldehyde
2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde

3. Softwood Plywood: DOC PS 1.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced woodworking 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.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

1. For panels 3/4 inch (19 mm) thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi (11 MPa); modulus of elasticity, 300,000 psi (2070 MPa); internal bond, 80 psi (550 kPa); and screw-holding capacity on face and edge, 250 and 225 lbf (1100 and 1000 N), respectively.
2. For panels 13/16 to 1-1/4 inches (20 to 32 mm) thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi (9 MPa); modulus of elasticity, 250,000 psi (1720 MPa); linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf (1100 and 780 N), respectively.

2.04 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 1-1/4-inch (32-mm) OD, gray molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, by Doug Mockett & Company, Inc.

2.05 MISCELLANEOUS MATERIALS

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

B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

C. VOC Limits for Installation Adhesives and Sealants: Use products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Wood Glues: 30 g/L.
2. Multipurpose Construction Adhesives: 70 g/L.
3. Structural Wood Member Adhesive: 140 g/L.
4. Architectural Sealants: 250 g/L.

2.06 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated for the following:

C. Complete fabrication, including assembly, 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.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, 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.

1. Seal edges of openings in countertops with a coat of varnish.

PART 3 - EXECUTION

3.01 PREPARATION

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

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

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

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

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

E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

F. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 12 36 23.13

SECTION 23 09 23

BUILDING AUTOMATION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

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

B. Furnish a totally native BACnet-based Building Automation System (BAS), including an operator's workstation using Microsoft as the operating system and shall be based on a distributed control system in accordance with this specification. The operator's workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2001, BACnet.

C. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

D. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

E. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

F. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

G. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

H. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

I. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

J. Provide supervisory specialists and technicians at the job site to assist in system startup, and commissioning.

K. Provide a comprehensive operator and technician training program as described herein.

L. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

M. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.

1.02 SYSTEM DESCRIPTION

A. Distributed logic control systems complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as pumps, air handlers, heat exchangers, etc. and any other listed equipment using native BACnet-compliant components.

B. Operator's workstation software shall be Microsoft as the computer operating system. The Building Management System (BAS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, full suite of field engineering tools including graphical programming and applications.

C. Building controllers shall include complete energy management software, including scheduling

building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage. All application controllers all equipment and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.

D. Room sensors shall allow room setpoint adjustment within preset limits. Initial settings 68-76 Degree F.

E. Provide all alarms, manual control, and status indication functions as indicated under the sequence of operation, Specification Section 23 09 93.

F. The system shall be Web Enabled and shall be accessible through any computer connected to the internet using a standard web browser and appropriate password protection. Contractor shall include costs for all network wiring and coordination with the owner for IP Address connection.

G. The system shall include remote notification services to allow messaging of critical alarms to owners' designated personnel.

1.03 RELATED SECTIONS

A. Section 23 05 00 – Basic Mechanical Materials and Methods.

B. Section 23 05 93 – Balancing and Testing.

C. Section 23 09 93 - Sequence of Operation.

D. Section 23 21 13 – Plumbing and Hydronic Piping.

E. Section 23 21 16 – Hydronic Specialties.

F. Section 23 33 00 – Ductwork Accessories.

G. Section 23 36 00 – Air Terminal Units.

H. Section 23 08 00 – Commissioning of HVAC.

I. Division 26 – Electrical Specifications.

1.04 REFERENCES

A. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning

B. ANSI/ASHRAE 135-2004 Data Communication Protocol for Building Automation and Control Systems (BACnet)

C. ASME MC8S.1 - Terminology for Automatic Control

D. NEMA EMCI - Energy Management Systems Definitions

1.05 QUALITY ASSURANCE

A. The direct digital control system provided shall be designed, furnished, installed, tested, certified and placed into service by a Control Contractor who is regularly engaged in the installation of direct digital control systems in Alaska. The Control Contractor shall maintain an office in Alaska with parts and maintenance personnel to ensure prompt response (24 hour maximum) to an emergency call during the one year correction period.

B. The Control Contractor shall be able to demonstrate that he has had experience designing and installing direct digital control systems of comparable type and size to that called for in these Specifications.

C. The Control Contractor, if other than the manufacturer, shall hold a manufacturer's franchise or license to design and install control systems for that manufacturer.

D. Within two weeks after award of contract submit to the Project Manager the following items for Contractor qualification:

1. Name of manufacturer and proof that the Control Contractor holds a manufacturer's franchise or license to design and install the proposed control system.
2. Proof of Alaskan Office, with full time service representative.
3. List of Alaskan buildings with names, addresses, and phone numbers of Owners which are representative of direct digital control systems that have been installed by the Control Contractor. Include a brief description and approximate control system construction cost of each system submitted.
4. Provide verification that each and every controller, sensor, and all other BAS components shall be individually tested and listed by the BACnet Testing Laboratories (BTL).
5. Verify compatibility of system with BACnet controls provided for Boilers in accordance with Section 23 52 00.

1.06 EQUIPMENT AND SHOP DRAWING REVIEW SUBMITTALS

A. Provide electronic submittals in accordance with Section 23 05 00 and Division 01 General Requirements.

B. Prior to programming, ordering of equipment, or installation of any portion of the system submit the following in a single tabbed and indexed PDF package for review by the Project Manager.
   1. System architecture diagram showing power supply to each component; interconnection of direct digital controllers, building management station, and peripherals; and indication of proposed location of direct digital controllers.
   2. Sequence of operations. Print sequence of operations on the schematic control diagrams so that the relevant sequence is on the same diagram with the control schematic it describes. The Sequence of Operations provided in the Contract Documents is written in directive language. Rewrite the sequence of operations to be submitted to the Owner in language that explains the sequences of operation. Remove all directives to the Contractor.
   3. Schematic control diagrams 11 inches by 17 inches minimum paper size with upper case lettering, minimum 1/16 inch high plotted from digitized files in AutoCAD format. Clearly indicate wire and terminal labels, set points, reset schedules, switch over points, signal ranges, and other points required to completely describe the system. Show interface with any existing control systems. Depict circuitry on schematic control diagrams to allow circuits to be traced from connection to connection using one of the following methods:
      a. Diagram each wire or tube depicting full length of circuit from connection to connection.
      b. Reference each wire to a uniquely labeled terminal. Depict terminals on a sequentially labeled terminal strip showing attached wires and the device labels of the components attached at the other end. If the wiring label used is different than the terminal label indicate the wire label. In addition provide ladder diagrams indicating current or air flow through circuitry components.
      c. Construct digitized schematic control diagrams using a symbol library so that symbols for similar equipment are common. Use separate layers or line type designations for the following items:
         1) Device Symbols
         2) Equipment Symbols
         3) Ductwork
         4) Piping
         5) Wiring
   4. Valve schedules
   5. Subpanel and panel face layouts.
   6. Control components data sheets, installation, operation, and adjustment instructions. Further index and tab this section of the submittal by item number.
      a. Each control component shall be identified with a separate item number. Separate each item with a divider sheet with plastic index tabs.

b. Provide two alphabetical listings of all items included in the binder in an index at the front of the binder. One index shall list items by functional name. The other index shall list items by symbol used in the control diagrams.
c. Each sheet or page shall indicate the specific item(s) proposed for this project. Delete or cross out all other items.
d. For all system elements operator's workstation(s), building controller(s), application controllers, routers, and repeaters, provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.
e. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.

7. Orientation and training instruction schedule and course outlines.
8. Printed copies of graphic screens and tabular screens.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Provide electronic operations and maintenance manuals in accordance with Section 23 05 00 and Division 01 General Requirements.

B. Operation and Maintenance Manuals must be submitted for review, reviewed by the Project Manager, corrected in accordance with review comments, and accepted by the Project Manager before a request for final or substantial completion inspection will be considered by the Project Manager.

C. The Operation and Maintenance Manual shall include the information required for the equipment review submittal, updated as required to reflect current as-built conditions, plus the following:

1. A brief customized guide to system operation prepared for the proprietary programming and interfacing software. Include copies of the guide in the Operation and Maintenance Manual, laminated between two plastic sheets for use away from the workstations. The guide shall include:
   a. Log on procedure.
   b. Custom commands with examples.
   c. Procedure for accessing interactive video display screens, changing set points, acknowledging alarms, creating history logs, and reviewing history logs.
   d. List of history logs.
   e. List of interactive video display screens.
   f. List of commands required to back up the building management system and start up the system after a computer failure.
   g. List of commands required to back up individual direct digital controllers and start them up after a controller failure.
2. Maintenance information and parts lists for control components.
3. Complete system as-built wiring diagrams indicating the following:
   a. Wiring for all control and power circuits indicating the voltage and breaker location for each circuit.
   b. Wiring for direct digital controllers and interface panels.
   c. Terminal number or code name for terminals in direct digital controllers and interface panels with unused terminals marked "spare".
   d. Assigned name, address, and engineering units for direct digital controller input and output terminals.
   e. Location, identification tag, type, function, and wiring for sensors, switches, relays, damper and valve operators, and other control system components.
4. List of software with current revision numbers, vendor name and support telephone numbers.
5. Indicate on the Record Drawings the location of control devices and panels that are not physically attached to mechanical equipment and that are not already indicated on the construction documents.

6. Include copies of programming and variable printouts for the direct digital control computers created to fulfill the sequence of operation requirements. Include the following information:
   a. Print date and time on each page with the sequence of operation corresponding to the program listing on that page.
   b. List and describe variables used. Where applicable, variable names referring to system components shall also be referenced to names used on system Shop Drawings.
   c. Block Programming diagrams if block programming is used.
7. Provide reloadable backup copy of programming and variable printouts for the direct digital control computers created to fulfill the sequence of operation requirements. Provide on CD-ROM disk.
8. Provide digitized copies of as built schematic control diagrams, wiring diagrams, and graphic screens recorded on CD-ROM disk in AutoCad or PDF drawing format.
9. Provide a print out of the configuration files for each controller. Place controller specific print out in specific controller cabinet.
10. Provide other information required for the Owner to properly troubleshoot and maintain the control system.

D. Submit index table of histories to be provided as part of final inspection for review concurrently with Operation and Maintenance Manual.

E. Published and bound building management system software or hardware manuals are not required to be included in the three ring “Operation and Maintenance Manual”. Provide one copy of each published and bound building management system software or hardware manual required for the maintenance and operation of building management system to the Project Manager one week prior to request for substantial completion. Provide a separate index sheet describing each separately provided bound manual as part of the “Operation and Maintenance Manual”.

F. Provide editing facilities used in the developing of the building management system so that any custom programming required to apply the building management system to this project is accessible to a trained operator for viewing, editing, or creating similar software structures. List software that cannot be changed by the operator with model and version number. Any custom software is considered the property of the owner with full right to copy. This software is required to work across the BACNET/IP network.

G. After the final inspection and subsequent punch list inspections update each copy of the Operation and Maintenance Manual to reflect final as-built conditions.

1.08 SYSTEMS DEMONSTRATION

A. The Contractor will completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operation.

B. Provide complete demonstration of system operation to the owners representative at the project substantial completion inspection. The Contactor will demonstrate to the Owner's satisfaction that all equipment and systems operate in accordance with the sequence of operation as outlined under Section 23 09 93. Demonstration will include all equipment controlled by the Direct Digital Control System.

C. Building management station demonstration will consist of:
   1. Running sample point log and system configuration reports as requested.
   2. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
   3. Step through penetration tree, display all graphics, demonstrate dynamic update and direct access to graphics.
   4. Execute system commands in graphic mode including operation of control system set points, schedules, valves, dampers and control relays. Commands shall be executed as

necessary to demonstrate the system is controlling in accordance with the sequence of operations.

5. Demonstrate update, and alarm responsiveness.
6. Demonstrate digital system configuration graphics with interactive upload and download, and demonstrate specified diagnostics.
7. Demonstrate programming with point options of beep duration, beep rate, alarm archiving and color banding.

1.09 WARRANTY

A. Under provisions of Division 01 General Requirements.

B. All components, system software, parts and assemblies will be guaranteed against defects in materials and workmanship for one year from acceptance date.

C. Labor to troubleshoot, repair, reprogram, or replace system components will be furnished by the Contractor at no charge to the owner during the warranty period.

D. All corrective software modifications made during warranty service periods will be updated on all user documentation and on user and manufacturer archived software disks.

1.10 SUBSTANTIAL INSPECTION SUPPLEMENTAL DATA

A. Substantial inspection supplemental data must be submitted for review, reviewed by the Project Manager, corrected in accordance with review comments, and accepted by the Project Manager before a request for substantial completion inspection will be considered by the Project Manager.

PART 2 PRODUCTS

2.01 APPROVED BUILDING AUTOMATION SYSTEMS

A. Alerton Technologies, Inc.

B. Distech Controls.

C. Trane.

D. Automated Logic.

E. Siemens Industry Inc.

F. Delta Controls.

G. Substitutions: Under provisions of Division 01 General Requirements.

2.02 OPERATOR'S WORKSTATION

A. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive.

B. BACnet Conformance:
   1. Operator's workstation shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator's terminal shall comply with the requirements of a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
      a. Clock Functional Group.
      b. Event Response Functional Group.
      c. Time Master Functional Group.
      d. Device Communications.
   2. Please refer BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
4. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.
5. Displays:
    a. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD™ or Visio™ drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
    b. All displays and programming shall be generated and customized by the local EMCS supplier and installer.
    c. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse a graphic of a switch or light, for example, which then displays a different graphic (such as an "ON" switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example: when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object's status is toggled and the graphic of the pump's impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.
    d. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Each analog input object may be assigned a minimum of five graphic files, each with high/low limits for automatic selection and

display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.

e. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area changes based on the analog object's value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.

f. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.

g. A mouse shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.

6. Password Protection:

a. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.

b. Each operator's terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0-8 characters, User Name shall be 0-29 characters, and Password shall be 4-8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

c. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.

7. Operator Activity Log:

a. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date and time of system activity and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation.

b. Log shall be gathered and archived to hard drive on operator workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.

c. Any displayed data, that is changeable by the operator, may be selected using the right mouse button and the operator activity log shall then be selectable on the

screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

8. Scheduling:
   a. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
   b. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
   c. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.
   d. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
9. Alarm Indication and Handling:
   a. Operator's workstation shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running. Printout of alarms shall be sent to the assigned terminal and port.
   b. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
   c. Alarm messages shall be in user-definable text (English or other specified language) and shall be entered either at the operator's terminal or via remote communication.
   d. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting alarm setup.
10. Trendlog Information:
   a. System server shall periodically gather historically recorded data stored in the building controllers and archive the information Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trendlog information shall be displayed in standard engineering units.
   b. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x,y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.
   c. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.

d. System shall include a trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.

11. Energy Log Information:
    a. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.
    b. All data shall be stored in data base file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
    c. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
    d. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.
12. Demand Limiting:
    a. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
    b. Binary shedding shall include minimum of 5 priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one the loads shall be shed/restored in a "first off-first on" mode and in the other the loads are just shed/restored in a linear fashion.
    c. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
    d. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.
13. Configuration/Setup:
    a. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.
14. Field Engineering Tools:
    a. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.

b. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
c. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.
d. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
e. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computers hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.
f. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.

15. Workstation Hardware:
a. Provide an operator's workstation adjacent to control panels in the Boiler Room. Mount laptop in a wall mounted computer station.
b. Workstation/Server Computer Minimum Requirements:
c. Intel, 4.0 Ghz or better.
d. 4 GB RAM or better.
e. 500 GB hard disk or better.
f. High-performance graphics adapter.
g. Ethernet 10/100 network interface card.
h. Keyboard, mouse, and read-write DVD.
i. Windows.
j. Monitor, 15” minimum.
k. Black and White Printer (Inkjet or Bubblejet).
l. Wall Mount Station: 14 guage steel, powder coat finish, VersaTables UFWM or approved equal.

C. At the conclusion of project, contractor shall leave with owner a DVD that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the owner to completely restore the system in the case of a computer malfunction.

2.03 BUILDING CONTROLLER

A. General:
1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), master slave token passing (MS/TP) LANs, a point-to-point (PTP - RS-232) connection and modem.
a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly

monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.

3. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.
4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.
5. Building controller shall provide battery-backed real-time (hardware) clock functions.
6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).
7. Global control algorithms and automated control functions should execute via 32-bit processor.
8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

B. BACnet Conformance:
   1. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
      a. Clock Functional Group.
      b. Files Functional Group.
      c. Reinitialize Functional Group.
      d. Device Communications Functional Group.
      e. Event Initiation Functional Group.
   2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
   3. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
   4. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Schedules:
   1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.

D. Logging Capabilities:
   1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.

2. Logs may be viewed both on-site or off-site via remote communication.
3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.
4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

E. Alarm Generation:
1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Each alarm may be dialed out as noted in paragraph 2 above.
3. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
4. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects - system destination and actions individually configurable.

2.04 APPLICATION CONTROLLERS

A. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

B. BACnet Conformance
1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
2. Files Functional Group.
3. Reinitialize Functional Group.
4. Device Communications Functional Group.
5. Please refer to BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
6. Standard BACnet object types supported shall include as a minimum-Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
7. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0-10VDC, 0-5 VDC, 4-20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0-10VDC or 0-20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.
8. All program sequences shall be stored on board application controller in EEPROMnonvolatile flash memory. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point

nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.

9. Application controller shall include support for intelligent room sensor. Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.05 EXPANDABLE APPLICATION CONTROLLERS

A. General:

1. Expandable application controller shall be capable of providing control strategies for the system based on information from any or all connected inputs. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site via simple download are not acceptable. Changing global strategies via firmware changes is also unacceptable. Program execution of controller shall be a minimum of once per second.
2. Programming shall be object-oriented using control program blocks. Controller shall support a minimum of 500 Analog Values and 500 Binary Values. Each and every analog and binary value shall support standard BACnet priority arrays. Programming tool shall be provided with system and shall be the same tool that is used to program the Building Controller. All flowcharts shall be generated and automatically downloaded to controller. No re-entry of database information shall be necessary.
3. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's terminal or field computer.
4. Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. Unused battery life shall be 10 years.
5. The onboard, battery-backed real time clock must support schedule operations and trend logs.
6. Global control algorithms and automated control functions should execute via 32-bit processor.
7. Controller shall include both on-board 10BASE-T/100BASE-TX Ethernet BACnet communication over twisted pair cable (UTP) and shall include BACnet IP communication. In addition, controller shall include BACnet PTP connection port.
8. The base unit of the controller shall host up to 8 expansion modules with various I/O combinations. These inputs and outputs shall include universal 12-bit inputs, binary triac outputs, and 8-bit switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support 3K and 10K thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.
9. All outputs must have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position.
10. The position of each and every HOA switch shall be available system wide as a BACnet object. Expandable Controller shall provide up to 176 discreet inputs/outputs per base unit.

B. BACnet Conformance:

1. Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet

device and shall support simultaneous routing functions between all supported LAN types. Building controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:

a. Clock Functional Group.
b. Files Functional Group.
c. Reinitialize Functional Group.
d. Device Communications Functional Group.
e. Event Initiation Functional Group.

2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.
4. The Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internet work, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Schedules:
1. Each controller shall support a minimum of 50 BACnet Schedule Objects.

D. Logging Capabilities:
1. Each controller shall support a minimum of 200 trend logs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
2. Controller shall periodically upload trended data to system server for long term archiving if desired.
3. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

E. Alarm Generation:
1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
3. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects - system destination and actions individually configurable.

2.06 TERMINAL UNIT APPLICATION CONTROLLERS

A. Provide one native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

B. BACnet Conformance:
1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
a. Files Functional Group.
b. Reinitialize Functional Group.
c. Device Communications Functional Group.

d. Please refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

e. Standard BACnet object types supported shall include as a minimum-Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0-10 VDC, 4-20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.

D. All program sequences shall be stored on board controller in EEPROMnonvolatile flash memory. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.

E. Application controller shall include support for intelligent room sensor Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

2.07 SENSORS

A. General:
1. Provide sensors with specified output type for remote sensing of temperature, humidity pressure, and flow rate. Factory calibrate for the specific application.
2. Provide two wire sensors and transmitters. Whenever transmitters are indicated or are required as part of sensor provide transmitters with 4-20ma signal output.

B. Space Temperature:
1. Thermistor or RTD with minimum 32-150 deg F range, accuracy of plus or minus 0.4 deg F over full range, and maximum drift of 0.1 deg F/year. Removable covers with tamper proof fasteners.
2. When temperature sensor is connected to an application specific controller provide with an RJ-11 jack so that a portable operators terminal can be connected at the temperature sensor.
3. Provide sensor with temperature indication and setpoint adjustment.

C. Space Temperature - Tamper Resistant
1. Where tamper resistant sensors are indicated provide temperature sensor bonded to a stainless steel handy box cover plate.
2. Provide sensor with logo decal and insulated back.
3. Precon ST-S3 or equal.

D. Duct Air Temperature, Probe Type:
1. Thermistor or RTD with minimum 32 deg F to 150 deg F range, accuracy of plus or minus 0.4 deg F over full range, and maximum drift of 0.1 deg F/year.
2. Handy box enclosure, with probe length suitable for duct size.

E. Duct Air Temperature, Averaging Type:
   1. RTD continuous sensing element inside copper tube with minimum 32 deg F150 deg F range, accuracy of plus or minus 0.75 deg F over full range, and maximum drift of 0.1F/year. Provide Sensor element length suitable for complete duct coverage. Hy - Cal RTS-4205-P or equal.

F. Fluid Temperature:
   1. Thermistor or RTD with minimum 30 deg F to 230 deg F range, accuracy of plus or minus 1.0 deg F over full range, and maximum drift of 0.5 deg F per year.
   2. Insertion bulb type including well to allow removal of element without draining system.

G. Outside Air Temperature:
   1. Platinum RTD with minimum minus 58 deg F to 110 deg F range, Accuracy of plus or minus 1.0 deg F over full range, and maximum drift of 1 deg F per year. Hy-Cal TS-P-OS or equal.
   2. Remote bulb sensing element with ventilated sun shield and weather proof box.

H. Fluid Pressure:
   1. Semi-conductor strain gauge pressure transducer with range 150 percent of operating pressure and over pressure tolerance of 200 percent of range pressure, plus or minus 2 percent accuracy over full range, and maximum drift of 1 percent full range per year. Kele PTX1E or equal.
   2. Watertight enclosure.
   3. Provide with brass or stainless steel snubber and pigtail on steam applications.
   4. Provide with gate or ball valve isolation.

I. Duct Static or Air Differential Pressure:
   1. Semi-conductor strain gauge pressure transducer with range 150 percent of operating pressure and over pressure tolerance of 200 percent of range pressure, plus or minus 2 percent accuracy over full range, and maximum drift of 1 percent full range per year. Dwyer Series 600 or equal.
   2. Provide static pressure tips with integral compression fittings for reference tubing at duct penetrations.

J. Current Sensor:
   1. Current transformer and conditioning circuitry to convert 0-20 amps AC line current to 0-5 VDC input directly, and 20 to 5,000 amps AC using an auxiliary current transformer. Veris Hawkeye or equal.

K. Carbon Dioxide Sensors:
   1. Provide carbon dioxide sensors for sensing indoor air quality in rooms or air ducts. Unit shall consist of a microprocessor-based selective photo-acoustic CO2 sensor and a VOC (Volatile Organic Compound) sensor with a heated stannic dioxide semiconductor. Sensor shall have a LED indicating the intensity of the CO2 level on the sensor itself.
   2. Power Supply: 24VAC, 50-60Hz, max 6VA.
   3. Range of Use: 0-2000ppm.
   4. Tolerance: +/- 100ppm.
   5. Voltage Output: 0-10Vdc.
   6. Operating Temperature: 14-113 deg F.
   7. Humidity: 0-95% RH.

L. Airflow Sensor Measurement Devices
   1. Acceptable Manufacturers
      a. EBTRON, Inc. Model GTx116-P
      b. No Substitutions.
   2. Provide airflow sensor measurement devices as indicated in the sequence of operations. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.

3. Each measurement device shall consist of one or more sensor probe assemblies and a single microprocessor-based transmitter. Each sensor probe assembly will contain one or more independently wired sensor housings. Multiple sensor housings shall be equally weighted and averaged by the transmitter prior to output. Pitot tubes and arrays are not acceptable. Vortex shedding flow meters are not acceptable.
4. All Sensor Probe Assemblies
   a. Each sensor housing shall be manufactured of a U.L. listed engineered thermoplastic.
   b. Each sensor housing shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine airflow rate and ambient temperature. Devices that use “chip” type thermistors are unacceptable. Devices that do not have 2 thermistors in each sensor housing are not acceptable.
   c. Each sensor housing shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range. Each sensor assembly shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
   d. Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
   e. Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to a remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
   f. Each sensor assembly shall not require matching to the transmitter in the field.
   g. A single manufacturer shall provide both the airflow measuring probe(s) and transmitter at a given measurement location.
5. Duct and Plenum Sensor Probe Assemblies
   a. Sensor housings shall be mounted in an extruded, gold anodized, 6063 aluminum tube probe assembly.
   b. The number of sensor housings provided for each location shall be as follows:

1) Area (sq. ft.)	Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=12	16

   c. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
      1) Insertion mounted through the side or top of the duct
      2) Internally mounted inside the duct or plenum
      3) Standoff mounted inside the plenum
   d. The operating airflow range shall be 0 to 5,000 CFM unless otherwise indicated on the plans.
6. Fan Inlet Sensor Probe Assemblies (Allowed only at roof mounted relief fans upon written permission from the ASD field representative).
   a. Sensor housings shall be mounted on 304 stainless steel blocks.
   b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
   c. Mounting feet shall be constructed of 304 stainless steel.
   d. The operating airflow range shall be 0 to 10,000 CFM unless otherwise indicated on the plans.
7. Transmitters

a. The transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or a volumetric rate.
b. The transmitter shall be capable of displaying the individual airflow and temperature readings of each sensor on the LCD display.
c. The transmitter shall operate on 24 VAC. The transmitter shall not require an isolated power source.
d. The transmitter shall be protected from weather and water.
e. The transmitter shall be capable of communicating with the host controls using one of the following interface options:
    1) Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)
    2) RS-485: Field selectable BACnet-MS/TP, ModBus-RTU and Johnson Controls N2 Bus
    3) 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, ModBus-TCP and TCP/IP

8. The measuring device shall be UL listed as an entire assembly.
9. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans. A written report shall be submitted to the mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.
10. Install in accordance with manufacturer's instructions at the locations indicated on the contract drawings. Duct and plenum devices shall not be adjusted without approval from the mechanical engineer.

2.08 SWITCHES

A. Bypass timer/timer switch:
    1. Instant close, timed open, spring wound timer switch, Mark-Time or equal.

B. Push Button Switch:
    1. Momentary contact, stackable contact blocks, 30.5 mm operator.
    2. Square D class 9001 or equal.

C. Key Operated Switch:
    1. Key operated, momentary contact, stackable contact blocks, 30.5 mm operator.
    2. Square D class 9001 or equal.

D. Low Voltage Thermostats – Space Temperature
    1. Adjustable setpoint, adjustable calibration of setpoint, room temperature indication, setpoint index, adjustable heat anticipator.
    2. Switching through SPDT mercury switch with coiled bimetal temperature sensing.
    3. Heating thermostats: 55 deg F to 75 deg F minimum setpoint adjustment range.
    4. Combination heating and cooling thermostats: 55 deg F to 85 deg F minimum setpoint adjustment range. Dual setpoint. Adjustable deadband, 0 deg F to 10 deg F.
    5. Covers: Removable and without temperature or setpoint indication unless specifically indicated otherwise. Setpoint adjustment shall require cover removal.

E. Line Voltage Thermostat - Space Temperature
    1. Provide where non-DDC space temperature control is indicated.
    2. Adjustable setpoint, room temperature, and setpoint indication.
    3. Switching through SPDT contacts rated 16 amp inductive current at 120V.
    4. Setpoint range: 50 deg F to 80 deg F minimum setpoint adjustment range.
    5. Removable setpoint adjustment knob.
    6. Covers: Removable and without temperature or setpoint indication unless specifically indicated otherwise.
    7. Mount covers to bases with tamper proof fasteners.
    8. Honeywell T6051A or equal.

F. Current Operated Switches:
   1. Provide current sensing relays for status of fans or pumps as called out in sequence of operation. Provide with field adjustable current setpoint range suitable for application. Adjust sensor for equipment current draw. Veris or equal.
   2. Internal circuits powered by induced line current.

2.09 TRANSMITTERS

A. Temperature Transmitter
   1. Two wire, 4-20ma loop powered 1000 ohm platinum RTD temperature transmitter, with adjustable setpoint, and selectable range. Kele Model T91 or equal.
   2. Select range with mid range at setpoint.
   3. Accuracy, 0.1F or 0.2 percent of span.
   4. Enclosure with LED display.

2.10 CONTROL RELAYS

A. General: Provide relays rated for current and voltage requirements of controlled equipment.

B. Panel Mounted Relays:
   1. Plug in type, with DIN rail mountable plug in sockets. IDEC RH series or equal.
   2. UL listed.

C. Field Mounted Relays:
   1. Solid state packaged relay including relay, LED indicator, provisions for mounting, transient protection and housing. Functional Devices RIB T series or equal.
   2. Provide with a Hand-Off-Auto switch.
   3. Provide internal separation between class 1 and class 2 wiring including separate wire ways or nipples.
   4. UL listed.

2.11 CONTROL VALVES

A. Two-way valves: All 2-Way valves shall be provided as specified in section 23 21 16. The contractor is responsible to coordinate actuators signal and power requirements for all valves will the valve supplier. Provide field testing and wiring connections to all control valve to perform in accordance with the sequence of operations.

B. Three-way mixing hot water control valves: Polished stainless steel stem, spring loaded teflon packing, constant total flow over full plug travel characteristics, and fully rated for 125 PSIG with 240 deg F fluid temperature.

C. Sizing: Modulating control valves shall be correctly selected for service and flow of system served. A pressure drop of 3 psi shall be used as a sizing guideline unless specifically noted otherwise in project documents. Two position shutoff valves shall be line size. Valves shall be constructed for tight shutoff and shall have minimum close of pressure rating greater than maximum system pump head pressure.

D. Provide valves that do not require removal of valve body from pipe to replace packing.

2.12 DAMPER AND VALVE ACTUATORS

A. General:
   1. Where exposed to outdoor air or air temperatures lower than 50 deg F provide completely weatherproof actuators with internal heaters to allow normal operation at minus 50 deg F.
   2. Provide spring return to normal position type actuators except at fin tube radiation valves and variable air volume terminal units where fail to last position actuators are acceptable.
   3. Provide actuators of the following signal types:
      a. Modulating Electronic Actuators. Actuator to convert electronic 1-10VDC or 4-20mA analog signal to a linear, positive positioning stroke. Provide actuators that utilize less than 8VDC or 14ma signal range with linear potentiometer feedback to controller, incorporated into control loop programming. Provide modulating electronic actuators for modulating control except as indicated. Belimo or equal.

b. Tri-State Reversing Electric Actuators. Actuator to reverse or hold position depending on contact closure state. Provide with linear potentiometer feedback to controller, incorporated in control loop programming. Tri-state reversing electric actuators may be used for terminal unit and fin tube radiation control. Belimo or equal.

c. Two Position Electric Actuator. Direct mounting actuator to open or close depending on contact closure state. Belimo or equal.

2.13 UNITERRUPTABLE POWER SUPPLIES (UPS)

A. Provide UPS sized for minimum 4 minutes of back-up. UPS to include overload capability, battery testing, replaceable batteries, power factor correction, internal bypass capability, circuit breaker, lightning and surge protection.

B. Emerson Model GXT3 or approved equal.

2.14 EMERGENCY BOILER SHUT OFF

A. Momentary contact pushbutton with 60 mm diameter red mushroom head, mounted on stainless steel 1-gang plate in recessed box. Mount a red engraved nameplate with white letters that reads "Boiler Emergency Stop" on faceplate or wall above button. Provide NO or NC contact blocks as required to perform the specified sequence of operation.

2.15 VARIABLE FREQUENCY DRIVES

A. Scope: Furnish Variable Speed Drives as specified on the drawings and schedules. Standard and optional features shall be included within the VFD enclosure as specified.

B. General: The VFD shall convert three-phase, 60 Hz utility power to adjustable voltage and frequency, three-phase, AC power for stepless motor speed control from 10% to 100% of the motor's 60 Hz speed. Input voltage shall be as specified on the drawing schedule. The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to variable DC voltage. VFD's that use silicon controlled rectifiers in the converter bridge shall also include an input power isolation transformer. The isolation transformer shall be housed in a separate NEMA 1 enclosure and shall include a copper electrostatic shield. The VFD shall utilize IGBT, PWM or 6-step waveform technology. The VFD maximum output current rating shall be 110% of the motor nameplate full load current. The VFD and options shall be listed by a nationally recognized testing agency such as UL or ETL. The VFD and options shall comply with the applicable requirements of the latest standards of ANSI, IEEE, and the National Electric Code. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The VFD shall not emit either conducted or radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15, Subpart J.

C. Construction: The VFD shall include the following basic features:

1. The VFD shall be housed in a NEMA 1 enclosure.
2. The following operator controls shall be located on the front of the enclosure:
   a. Run/stop selector switch to start and stop the motor
   b. Auto/manual selector switch
   c. Manual speed potentiometer
   d. Power on pilot light to indicate that the VFD is being supplied by the power line.
   e. Fault pilot light to indicate that the VFD has tripped on a fault condition
   f. Digital meter with selector switch to indicate percent speed and percent load.
   g. Volt meter and amp meter.
3. Two sets of Form C, dry contacts to indicate when the VFD is in the run mode.
4. Two sets of Form C, dry contacts to indicate when the VFD is in the fault mode.

5. When input power returns to normal following a fault trip for undervoltage, overvoltage, or phase loss, the VFD shall automatically restart. The VFD shall not automatically restart following fault trips due to overload or overcurrent.
6. Factory minimum-level spare fuse kit.
7. Relay for RED signal from motor.
8. Input circuit breaker.

D. Protective Requirements: The VFD shall include the following protective features:
1. Current limiting semiconductor fused for the power input.
2. Separate overload relay for each motor controlled.
3. Protection against input power undervoltage, overvoltage and phase loss.
4. Protection against output current overload and overcurrent.
5. Protection against overtemperature within the VFD.
6. Protection against overvoltage on the DC bus.
7. Any disconnect switches between VFD and the motor shall include an auxiliary contact interlocked to the VFD fault trip circuit.
8. DC bus discharge circuit for protection of service personnel.

E. Adjustments: The VFD shall include the following adjustments available via potentiometers inside the enclosure:
1. Maximum speed, adjustable 50-100% base speed.
2. Minimum speed, adjustable 0-50% base speed.
3. Acceleration time, adjustable 2-60 seconds.
4. Deceleration time, adjustable 2-60 seconds with override circuit to prevent nuisance trips if deceleration time is set too short.
5. Current limit, adjustable 1-110%.

F. Special Requirements: The following special features shall be included in the VFD enclosure.
1. Manual bypass shall provide all the circuitry necessary to transfer the motor from the VFD to the power line, or from the line to the controller while the motor is at zero speed. The bypass circuitry shall be mounted in a separate section of the VFD enclosure. Two motor contactors, electrically interlocked, shall be utilized. One contactor is to be between the controller and the motor. The other contactor is to be between the bypass power one and the motor providing across-the-line starting. Motor protection is to be provided in both the controller mode and the bypass mode. The bypass section door shall include a "drive/line" switch, "on/off-reset" and a "load transferred to line" pilot line. The bypass circuitry shall include a fused disconnect switch or circuit breaker to provide a means of disconnecting all power to both the bypass circuitry and the controller. The disconnect switch or circuit breaker shall be door interlocked and lockable. The fused or circuit breaker shall be sized to provide short circuit protection for the motor when in the bypass mode per NEC.

G. Start-up Service: The manufacturer shall provide start-up service in the form of a factory trained service technician. The service technician shall verify correct installation, start-up the drive and check for proper operation

H. VFD Warranty: The VFD shall be warranted by the manufacturer for a period of 24 months from the date of shipment. The warranty shall include parts, labor, travel costs, and living expenses incurred by the manufacturer to provide factory-authorized service

I. Approved Manufacturer: ABB, Model ACH-550, or approved equal.

2.16 WIRING AND RACEWAYS

A. Provide wiring and raceway complying with the National Electrical Code, Division 16, and State and Local Codes and Ordinances.

B. Provide wiring and raceway complying with the National Electrical Code, and State and Local Codes and Ordinances.

C. Raceways:

1. EMT, metal duct, IMC, surface metal raceways, or totally enclosed metal trough with flexible metal tubing unless otherwise noted.
2. Provide rigid steel conduit raceways when raceway is buried or embedded in concrete.
3. Provide 18 inches minimum to 36 inches maximum flexible metal conduit of galvanized steel construction for final connection to control devices. For connections to pipe mounted devices, and to devices in damp, wet, or exterior locations, or in mechanical rooms containing boilers or steam converters, provide oil-resistant liquid-tight flexible metal conduit.
4. Provide EMT connectors with rain tight compression fittings and insulated throats.
5. Wire mould is generally not allowed except as approved on a case-by-case basis with the owner's representative.

D. Wiring:
1. Provide wire with copper stranded conductors. Provide color or number coded jackets.
2. Low voltage wiring from control components to input/output modules: 20 gauge minimum foil-shielded cable rated 100 VDC at 80 deg C.
3. Provide plenum rated cable whenever wire is run without conduit.
4. Provide communications network wiring meeting the gauge, impedance, capacitance, resistance and shielding requirements specified by the manufacturer of the connected devices.
5. Identify wires and cables with permanent self-laminating machine print labeling system. Provide labels capable of receiving 8 characters of type written text, with minimum print on area of 1 inch by 1/2 inch, and protected by a clear sheath. Thomas & Betts E-Z Code or equal.
6. Support or bundle wire with self locking, UL listed cable ties. Provide 40 lb rated cable ties incorporating a stainless steel locking insert. Provide UL 94V-0 flammability rated, halar cable ties when installed without panel enclosure. Thomas & Betts Ty-Rap or equal.
7. Provide cable tie anchors designed for mechanical anchoring, allowing removal of cable tie without removal of anchor, capable of accepting at a minimum a number 8 screw. Adhesive cable tie anchors are allowed only on the interior surface of panel doors. Panduit TM series or equal.

2.17 PANELS

A. General:
1. UL listed, not over 24 inches wide by 42 inches high, constructed of 14 U.S.S gauge steel except that enclosures less than 20 inches in both dimensions may be 16 gauge. Provide multi-section or multiple individual panels as required. Hoffman or equal.
2. Equipped with subpanels.
3. Punched or stamped to receive front mounted switches, gauges, indicating lights and alarms.
4. Secure to the front of every control panel that has more than one source of power the following warning label: The word "WARNING" shall be in 1 inch high letters. Other letters shall be 1/4 inch high.
   a. WARNING Complete de-energization of this control panel requires that circuit breakers supplying all equipment controlled by this panel be opened.
5. Provide track mounted terminals with integral permanent labeling system. Integral screws for securing connected wires. Voltage and amperage ratings to match terminated wire ratings. Marathon or equal.
6. Provide nylon insulated crimp connectors with voltage and amperage rating matching connected wire ratings unless terminal strip is designed to connect to connected wire type without using a crimp connector. Thomas & Betts STA-KON connectors or equal.
7. Indicating lamps on panel shall be long life type, rated for a minimum life of 10,000 hours.

B. Interior Enclosures:
1. Piano hinged front with latch and lock.
2. Baked enamel finish
3. Concealed enclosures may be standard electrical boxes.

2.18 FIRESTOPPING

A. Capable of maintaining an effective barrier against flame, heat, and smoke. Metalines, Dow, 3M, or equal.

B. Provide installations classified in Underwriter's Laboratories (UL) Building Materials Directory or listed in the Warnock Hersey International Directory.

C. Paintable where exposed to view.

D. Waterproof in plumbing chases.

E. Provide the product of more than one manufacturer if required to provide listed installations throughout.

PART 3 – EXECUTION

3.01 GENERAL

A. Modify existing control system devices as indicated. Extend and modify the existing wiring and control system power source to accommodate indicated direct digital control system devices.

B. Before beginning installation of new system components, test the existing system devices that are being reused in modified control systems for proper operation and report any devices in need of replacement or repair to the Project Manager. At the option of the Project Manager, he will issue a contract amendment to replace or repair the defective devices or he will have Owner maintenance personnel replace or repair the defective devices. The Contractor shall be responsible for providing new devices to replace existing devices that are not brought to the Project Manager’s attention before beginning installation of new system components.

C. Work must comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards. Perform work by persons qualified to produce workmanship of specified quality. If required by the State of Alaska workers shall be licensed. If requested provide copy of license.

D. Do not install control devices in locations where they are subject to damage or malfunction due to normally encountered ambient temperatures.

E. Mount damper operators and other control devices secured to insulated ductwork on brackets such that the device is external of the insulation.

F. Schematics and diagrams, when indicated on the Drawings, show approximate functional relationships and sequences only. All required devices are not shown. Contractor is responsible for providing all components required for a complete functioning system selected to meet the specific functional requirements of each application.

G. Hard wire control devices. Do not use power line carriers.

H. Ensure that the direct digital controller network, N2, and power wiring will support both a 10 percent increase in network length, and a 10 percent increase in controllers similar to those installed without having to add additional network repeaters, increase power wire size or circuit breaker capacity.

I. Unless indicated otherwise, connect the primary sensing input and the associated output for each control loop to the same controller. A secondary or resetting input may be attached to any controller and communicated over the network.

J. After the final inspection and subsequent punch list inspections provide wiring schematic and Control Drawings with written sequence of operations, 11 inches by 17 inches in size, reduced from the as-built Control Drawings. Provide one copy in each Operation and Maintenance Manual, and one copy laminated in heavy clear plastic, at its applicable control panel. Provide one set of backup tapes and disks necessary to restart and reload all programmable devices used in the control system.

K. Tune control loops to respond quickly to control fluctuations without hunting.

L. Label control devices mounted in the field and within control cabinets with 1/4 inch high white embossed letters and black tape background. Dymo or equal. Symbol to match symbol used on Control Drawings.

M. Additional work under this contract may be required due to oversights by the owner's specification. This additional work may be requested and authorized by the project manager based on informal estimates in writing, email or otherwise. The contractor shall be requested to breakout hourly rates on the bid schedule for this work by craft and/or discipline.

N. Provide digital (.txt, .csv) file of complete tag/block name dictionary of all physical and virtual points used under the physical point list and control logic referenced in Sequence of Operation. This will be used for owner developed graphics.

3.02 WIRING AND RACEWAYS

A. Permanently label electrical or electronic wiring at each end indicating location and the device at opposite end. At the direct digital controller end use either the I/O address, if it describes the connected device, or the unique control device tag used on the control schematics. At the device end indicate both the terminal number and the controller connected at the other end. For color coded multi-conductor cable, label cable sheath not individual conductors.

B. At field devices where conductors are not wired to terminal strips wire using a unique color for each conductor connected to that device.

C. Install wiring in a neat and orderly manner generally running along building lines.

D. Support low voltage wiring run without conduit at a maximum of 4 feet between anchors.

E. Seal conduit penetrations at floor and wall penetrations with firestopping installed as indicated. Note that this applies to all floor and wall penetrations, not just fire barrier penetrations. At all mechanical rooms or other rooms containing floor drains, except those with slab on grade floors, make penetration watertight and extend sleeve 3 inches above the floor.

F. Wire all electrical controls and switches furnished under this Section of the Specifications.

G. Make wire connections using factory fabricated jack assemblies, terminal strips, or solder connections. Use crimp connectors on stranded wire unless connecting to terminal strips approved for direct stranded wire connection. Insulate solder connections with heat shrink tubing. Field connections in control power wiring circuits may be made using wire nuts.

H. Avoid splices in signal wire, where unavoidable connect with solder connections and label on each side of splice. Use identical wire type and color on each side of splice.

I. Connect each direct digital controller diagnostic port to an RJ-11 jack on the room sensors. If there are more than one room sensor per controller, connect to one and indicate that sensor on As-builts Drawings.

J. Conceal wiring in finished areas. Unless otherwise noted, install wiring inside conduit or fully enclosed metallic raceway.

K. Low voltage wiring installed in concealed accessible locations may be run without conduit. Sleeve wiring at wall penetrations.

L. Metal raceways crossing expansion joints make provision for 3 way movement. For conduits 1 & 1/2 inch and larger use O-Z type DX fittings, or equal.

M. At raceway penetrations of the vapor barrier provide a double splice patch (one on each side of vapor barrier) by cutting a square piece of vapor barrier 12 inches larger on all sides than the pipe. Cut a round hole in the center of the square splice patch, smaller than the pipe, to form a stretched fit. Force the pipe through the splice patch and tape all sides to the vapor barrier and seal the vapor barrier to the pipe at the penetration with an adhesive compatible with the vapor barrier material.

N. Securely seal at the warm end, raceways running from a warm area to a cold area. Seal with a silicone not harmful to wire insulation. Ductseal or equal.

O. Install all wiring in accordance with National Electrical Code, and State and Local Codes and Ordinances.

3.03 PANELS

A. Provide UL listed panel assemblies.

B. Mount control devices other than sensors and operators in panels on the panel face and the subpanel surface. Removal of devices shall not require removal of subpanel. Do not mount devices on panel sides.

C. Wire control devices mounted in control panels through permanently and sequentially labeled terminal strips.

D. Arrange panels and junction boxes in a clear, logical manner, installed to allow easy servicing and labeling.

E. Arrange control devices such that inadvertent operation of push-buttons, switches, etc. will not result in a jammed or inoperable system caused by component or device failure.

F. Label panels, control switches, and panel mounted gauges with minimum 1/2 inch high by 1/16 inch thick, black, laminated plastic with white core. "Setonply" by Seton Nameplate Corp. or equal. Engrave with 1/4 inch high characters identifying the switch or gauge by the description indicated on the Control Drawings. Attach labels to panels with mechanical fasteners with a maximum head size of 3/16 inch. Adhesive backing is not sufficient to provide secure mounting.

3.04 SENSORS AND SWITCHES

A. Mount room sensors and fan control switches in offices 48 inches above finished floor, with any operable portion no higher than 48 inches, unless otherwise indicated. Where adjacent to light switches mount at same height as switches to provide a clean horizontally aligned installation unless doing so requires the operable portion to be above 48 inches. For sensors with tamper proof guards, sensors may be mounted between 48 inches and 60 inches above finished floors.

B. Liquid or air flow across pumps, and fans, etc. shall be sensed using current sensor unless indicated otherwise.

C. Differential pressure transducers shall be used to sense differential pressure unless indicated otherwise. Unless indicated otherwise mount differential pressure transducers in panel adjacent to associated direct digital controller. At each differential pressure transducer provide with a differential pressure gauge piped in parallel with the transducer, mounted on panel face.

D. Connect low temperature limit switches directly to the controlled equipment's motor starter control coil or, for equipment with no motor starter, to contacts of a relay in the equipment's power circuit.

E. Fill immersion fluid temperature sensor wells with heat conducting compound. At 1-1/2 inches and smaller piping install wells in pipe tees one size larger than line size.

F. Provide sensors and thermostats installed on exterior surfaces with insulated bases such that actual room temperature not wall surface temperature is sensed.

G. Provide cast aluminum ventilating, nonbreakable shields and mounting brackets for sensors which are indicated to have protective covers.

H. Provide averaging sensors in air handling unit casings or in areas where stratification is likely to occur. Provide averaging element of sufficient length to accurately indicate the average duct temperature.

I. Protect averaging or capillary tubes where they penetrate duct with rubber grommet and seal with clear silicon. Support averaging or capillary tubes with copper capillary clips which maintain a minimum tubing bend radius of 1 inch.

3.05 CONTROL POWER SUPPLY

A. Provide uniterruptible power supply (UPS) on power supply to all control panels and control transformers. UPS shall have an auto reset feature to automatically resume operation.

B. Provide electric power to control devices from control system power circuit or from device or equipment being controlled.

C. Carry a dedicated ground wire to controllers from the associated breaker panel. Do not use the conduit system for grounding purposes.

3.06 PRE-FUNCTIONAL TESTING AND ADJUSTING

A. Upon completion of the installation, the contractor shall initiate operation of the control system and perform all necessary testing and diagnostics to ensure proper operation. A formal commissioning procedure shall be utilized to insure complete system integrity and conformance to these specifications. This procedure shall consist of two separate steps incorporating point verification and program verification. Commissioning forms shall address all field devices, field controllers, software statements, and software points. Submit for approval a written testing procedure indicating how each of these steps will be accomplished in accordance with Section 23 08 00.

B. Verify correct installation and wiring of all points.

C. Confirm that all devices are installed correctly. Verify that terminations are tight and of correct polarity. Document and signoff the results on Point Verification form.

D. Coordinate the final adjustments and "fine tuning" of control functions and devices so that the building, the mechanical systems, and the control systems operate and respond as an integrated comfortable and energy efficient component of this facility.

E. Upon completion of start up test existing smoke detectors to ensure fan shutdown. Note that test of circuitry is sufficient.

F. Verify that all points are wired to the correct termination block at the control panel by verifying continuity between the device and the panel termination. Document and signoff results on Pre-Functional test forms. Verify that each sequence performs as specified in contract documents. Tune each loop as required for proper operation.

G. Document and signoff the results on Program Pre-Functional Test forms.

H. Command all digital output points on and off and confirm proper operation of the associated output device. Command all analog output points to various levels within their range and confirm proper operation of the associated output device. Activate all digital input sensors and confirm proper point status at the panel. Measure conditions at all analog input sensors with an independent reference device, calibrate as required, and confirm proper point status at the panel. Document and signoff the results on Pre=Functional Test forms.

I. Deficiencies revealed by failed test(s) shall be repaired and corrected and the test(s) repeated until successful.

J. Verify interface to Boiler control system, including control and monitoring of all points in Sequence of Operation.

K. Provide completed pre-functional testing forms to commissioning agent prior to functional testing.

3.07 FUNCTIONAL TESTING

A. Perform funcational testing of all systems in accordance with Section 01 91 00, Section 23 08 00 and Section 26 08 00.

B. Support commissioning agent in testing as required to provide verification of control system operation.

3.08 SPECIAL TOOLS AND SPARE PARTS

A. Provide three sets of special tools required to adjust control devices. This includes allen wrenches and other special tools. This does not include common tools such as pliers, adjustable wrenches, flat blade or Phillips screwdrivers. This set shall be provided during Owner instruction period and proper use shall be demonstrated to Owner personnel during said period.

3.09 DATABASE ARCHIVAL AND UPGRADE

A. Provide a complete database backup CD for the building management system and each direct digital controller to the Owner at final inspection. If software modifications are required during the warranty period update CD.

3.10 ORIENTATION AND TRAINING

A. Provide 40 hours of on-site orientation and training to Owner personnel designated by the Project Manager. Orientation and training sessions shall be conducted by a factory trained manufacturers representative familiar with the systems software, hardware, and accessories. Limit training time per day to 6 hours. Complete training and orientation according to the following schedule:
   1. 24 hours (3 days) of instruction after acceptable performance of the system hardware and software has been established and prior to final inspection.
   2. 16 hours (2 days) of instruction six months after final inspection.

B. Submit proposed training dates and instruction session course outlines for acceptance by Project Manager.

C. Provide instructions on all the operations listed in the initial course outline during the first training session. On subsequent sessions communicate in advance with facility supervisor to determine which operations require additional instruction.

D. Initial course outline:
   1. Determine the control strategies that have been defined for a specific piece of equipment.
   2. Utilize X-Y graphing and histories as an aid for control loop tuning.
   3. Enable or disable control strategies.
   4. Assign sensors and/or actuators to a control strategy.
   5. Simulate control strategies with substituted inputs or outputs.
   6. Define appropriate control loop algorithms and choose optimum loop parameters for loop control.
   7. Add/delete control loops to the system.
   8. Add/delete points to the system.
   9. Label parameters and variables with names or acronyms of a minimum of eight letters.
   10. Select points to be alarmable and define the alarm state(s).
   11. Download programming to the system after all direct digital controllers and building management station program memory has been lost.
   12. Process stored historical data and display and printout data in tabular and graphical formats.
   13. Diagnose system malfunctions.
   14. Change system operating sequences

3.11 SUBSTANTIAL INSPECTION REQUIREMENTS

A. Substantial inspection data must be submitted for review, reviewed by the Project Manager, corrected in accordance with review comments, and accepted by the Project Manager before a request for final or substantial completion inspection will be considered by the Project Manager.

B. Prior to the substantial inspection, review and test entire installation for conformance with contract documents. Test shall include thorough field check of sequence of operations for each system and piece of equipment including simulation of all possible modes of operation. With the call for inspection, verify in writing that this system review and test has been performed and anything not conforming to contract documents shall be so noted.

C. During the Substantial inspection Contractor personnel shall provide on-site assistance to inspection personnel required for a complete and thorough inspection.

D. During the Substantial inspection Contractor personnel shall demonstrate that the control system performs in accordance with the contract documents. Provide material and personnel required to perform the demonstration.

END OF SECTION

SECTION 260926
LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. A new low voltage lighting control system shall be provided to control the Multipurpose Building Lighting as noted on the Plans. The system shall have the capability to be controlled locally via intelligent lighting control switches.

B. Contractor's work to include all labor, materials, tools, appliances, hardware, lighting control panels, relays, sensors, wire, junction boxes, switches and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational lighting control system, as described herein.

1.02 RELATED WORK

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

B. Section 26 05 19 – Low Voltage Electrical Conductors and Cable.

C. Section 26 51 00 – Interior Lighting.

1.03 SUBMITTALS

A. Submit product data under provisions of Division 01.

B. Manufacturer shall substantiate conformance of this specification by supplying the necessary catalog literature, documents, performance data and wiring diagrams. Any deviations to this specification shall be clearly stated by letter and submitted.

C. Submit a single line riser diagram of the control system showing interconnect wiring between panels and devices including conductor type, quantity and size. Submit panel diagrams or panel schedules indicating load controlled, circuit controlled, and connected switches.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site, store and protect under provisions of Division 01.

B. All lighting control equipment, wiring, etc. shall be stored in an enclosed area, maintained at a minimum of 55° F and shall be protected from weather.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in lighting control systems for a minimum of three (3) years documented experience in Alaska.

B. All components and panels shall be UL listed, shall be manufactured by a UL listed panel shop, offer a minimum three (3) year warranty and meet all state and local code requirements.

C. Lighting control panels, components and assemblies shall be assembled and fully factory tested prior to shipment and installation. Site assembled panels or components shall not be allowed.

1.06 EXTRA MATERIALS

A. Furnish to the Owner the following extra materials for the lighting control system:

1. Ten (10) relays of each type.

1.07 WARRANTY

A. Warrant all materials and equipment to be new and free from defects in material and workmanship for a period of one (1) year under provisions of Division 01.

1.08 PROJECT RECORD DRAWINGS

A. Submit documents under provisions of Division 01.

B. Provide contract size reproducible documents showing the as-built location of all new control panels, existing momentary contact switches, any new conduit routing, and all new junction box locations.

1.09 OPERATION AND MAINTENANCE MANUALS

A. Submit data under provisions of Division 01.

B. Provide operation and maintenance instructions including detail electronic schematic drawings, detailed parts list and exploded view of all equipment, detailed troubleshooting instructions and a reduced set of the project record drawings.

C. Provide lighting control operational summary sheet.

D. Provide programming record sheet.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Watt Stopper, 'LI Series

B. Lighting Controls GR 2400 Series.

C. Lutron Softswitch

D. Hubbell CX Series

E. Substitutions: Under provisions of Division 01.

2.02 PROGRAMMABLE LIGHTING CONTROLLER

A. Enclosure

1. UL listed NEMA 1 enclosure designed for wall mounting. Backbox must be capable of being shipped ahead of controller chassis insert to allow for rough-in of all electrical connections prior to receipt of the controller chassis insert.
2. Each programmable lighting controller shall be provided with a factory or field installable controller chassis insert. Controller chassis insert shall contain all controller electronics, power supplies, relays, contactors and other required components. Controller chassis inserts shall arrive at the project site completely pre-wired and requiring only the connection of lighting circuits and control devices.
3. Each programmable lighting controller shall be provided with a mechanical barrier that separates all line voltage components and wiring from all control voltage components and wiring. An additional barrier may be installed within the line voltage section that shall provide isolation between normal and emergency circuits where required.
4. Each programmable lighting controller shall be provided with a dead front screw-held or hinged locking cover that is designed for either surface or flush mounting.
5. Controllers shall be available in sizes to accommodate up to 48 low voltage switch inputs and 8 relay outputs. Controllers shall be available in either the standard configuration in which the electronics are to the left of the voltage barrier with the line voltage compartment on the right or with the electronics in the center and two line/low voltage dividers with the lighting relays on the right and left sides.

B. Electrical:

1. Controller Power Supply: Each programmable lighting controller shall be provided with two dual-rated, UL listed Class 2 transformers capable of either 120 or 277 VAC primary (50 to 60 Hz).
2. Connections: All connections shall be made to clearly and permanently labeled termination points.

C. Controller Electronics:

1. Controller CPU: Each programmable controller shall be provided with a CPU (Central Processing Unit) that shall provide all the programming and control functions for the entire controller. CPU shall be protected against loss of memory during a power outage through nonvolatile RAM for a period of up to 10 years without power of any type.
2. Real-Time Clock: Real-Time Clock shall be used to perform all time-controlled functions. Clock accuracy shall be displayed to the second. Real-Time Clock functions shall include time of day, day of week, date and automatic daylight savings and leap year adjustments. Time clock shall be protected against loss of time during a power outage for a period of up to 45 days without power of any type.

3. I/O Controller: I/O (input/output) cards shall be provided to expand the controller capability from 8 to 48 switch inputs and relay outputs in groups of 8. Electronics shall feature surge protection and opto-isolation.
4. Switch Input Characteristics: Each switch input shall be designed to be actuated by dry contact from 2 or 3 wire momentary or maintained switches or their logical equivalents (photo cell contacts, Building Automation System Outputs, Time clocks etc.)
5. Input LEDs: For each input there shall be three LEDs: ON input contact status (hardwired), OFF input contact status (hardwired) and Programmable Pilot Output. The LEDs reflect the true status of the relay controlled by the switch input. Normally this Pilot LEDs track with the status LED(s) of the affected relays. (If the switch turns on relay output 5 for example, relay 5 output LED will light.) However the user has the option of programming the LED to indicate the status of any relay, group or preset.
6. Relay Output Characteristics: Each Relay Output shall control either a latching lighting relay rated for 120 or 277 VAC @ 20 full load amps. or a dry contact output that shall provide pulsed or maintained switching of the Class 2 circuits of other devices such as two pole relays, contactors etc. Each output is equipped with manual ON and OFF buttons that may be used to control the output regardless of programming. In addition, each output has a status LED that indicates the current status of the output.
7. Communications: The controller shall be equipped with a serial (RS232) port, modem, and infrared transceiver for monitoring and programming purposes.

F. Programming: Programmable controllers shall be capable of being programmed, monitored or controlled through any or all of the below methods. All programming changes shall take effect

Immediately as they are programmed and shall not suspend or disable switches or other system functions. The same functions shall be available for any of the connection types.

1. Local Key Pad and Display: The system user shall be able to program, monitor and control any of the controller features and functions through the use of simple menu-driven self-prompting user interface consisting of a 4-line 20-character backlit LCD display and 6 selection keys that change function based on the current operating mode.

G. Diagnostic Aids: Each programmable lighting controller shall be provided with an LED that shall indicate that the main power supply is present and operational. Each relay output shall have an LED pilot to indicate the current status of all controlled relay outputs. In addition, the system user shall be able to monitor and control any programmable lighting controller directly and in real time through any of the programming methods listed above. System users shall be able to view the current status of any or all relay outputs, force any relay output ON or OFF, and view the current status of any or all switch inputs.

H. Data Protection and Storage: All programmed data shall be stored in nonvolatile RAM that shall protect all stored programming data from loss during a power outage for a minimum period of 10 years without power of any type.

I. Power Failure and Power-Up Options: Each programmable lighting controller shall be provided with circuitry that shall automatically shut down the controller whenever the incoming power fails to be delivered to the controller within required limits. When power is returned to the controller, one of the following power-up modes will be implemented (user selectable) for each controlled relay output in the system.

1. No Action: Upon restoration of incoming control power, the controller electronics shall be restarted and resume normal operations, and all circuits will be maintained in the condition they were last in.
2. Forced ON: Controller will force the selected relay output to the ON state after power-up. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.
3. Forced OFF: Controller will force the selected relay output to the OFF state after power-up. Time-scheduled events that were to take place during the power outage will be ignored; however, all future scheduled events will be activated.

J. Manual Push Buttons: Each relay output shall be supplied with an ON and OFF manual push-button with LED pilot that shall allow the system user to view the current status and/or manually turn any relay output to the ON or OFF state.

K. True Relay Status Feedback: Each controller shall be provided with circuitry that shall monitor the actual current status of each relay via a set of pilot contacts mechanically linked to the relay main contacts.

L. Staggered or Instant Relay ON/OFF Activation: Programmable lighting controller shall be support user selectable instantaneous or staggered (17 or 50 ms pulse duration) relay activation.

M. Input Flexibility: Each switch input shall accept the logical equivalent of a dry contact 2- or 3-wire maintained or momentary switch.

N. Input to Output Programmability: Any switch input may be programmed to control any or all of the controllers relay output(s) without limitations. Any switch input anywhere in a control network can control any or all relay output(s).

O. Relay Groups: The controller also shall support the grouping of individual relay outputs into 8 relay groups. These groups may be controlled by switch, or time based signals.

P. Switch Input Types: Each of the programmable lighting controller switch inputs shall be programmable for one of the below listed switch types.

1. Momentary ON/OFF: When momentary contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM, relay outputs controlled by this input are turned OFF.
2. Momentary Push-Button: When momentary contact is made between the ON and COM, relay outputs controlled by this input are turned ON and OFF alternately, based on current state, each time contact is made.
3. Maintained ON/OFF: When contact is made between the ON and COM, relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.
4. Set Preset: When momentary contact is made between the ON and COM, the selected preset scene will be activated. Controller shall provide 48 user definable presets that can be activated by switch input or timer.
5. Two-Step Alternating Sequence: The first time the switch is activated, relay outputs programmed as “Group A” are turned ON and relay outputs programmed as “Group B” are turned OFF. The second time the switch is activated, “Group A” relay outputs are turned OFF and “Group B” relay outputs are turned ON. The third time the switch is activated, the pattern begins again at step one.
2. Timed ON: The timed ON input shall operate either from the input closure or open. If programmed to operate from the closure, the relays turn ON when the input closes and turn OFF after the timed duration. The relays do nothing when the input opens. If programmed to operate from the open, the relays turn ON when the input closes and remain ON. When the input opens, the relays turn OFF after the timed ON duration.
3. Input Disable: When maintained contact is made between the ON and COM, inputs programmed for disable from this switch input will be ignored.
4. Timer Disable: When maintained contact is made between the ON and COM, timers programmed for disable from this switch input will be ignored.
5. Network Disable: When maintained contact is made between the ON and COM, network commands sent to the controller via the control network are ignored.
6. Output Override: When maintained contact is made between the ON and COM, relay outputs controlled by this input are either turned ON, OFF or HELD in their current state until the input is released. All inputs, timers and network commands are ignored for controlled relay outputs.

Q. Photo / Motion Sensor Inputs: Programmable lighting controllers shall be designed to accept dry contact control inputs from photo or motion sensors and program them to perform any of the available switch input functions.

R. Switch Enable/Disable: The system shall support the ability to enable/disable switch inputs according to a user-defined set of times.

T. Blink Alert: Each relay output within the programmable lighting controller can be individually programmable to blink prior to being turned OFF. The blink alert function shall blink each relay twice prior to turning OFF with a timer Off sweep to warn occupants of the upcoming OFF event. If an ON command is received during the blink alert time, relay output will be overridden and left ON for the override time. Override times shall be adjustable from 5 to 999 minutes in 1-minute increments.

U. Astronomical Clock: Each controller shall contain an astronomical time clock that shall calculate sunrise and sunset times based on the geographical positioning information provided during the programming of the system. Sunrise and sunset times may be used as activation times for any system timer. In addition to sunrise and sunset time activation, the control shall be capable of programming activation time for the system timer for before and after these times based on an offset of 1-999 minutes either before or after the calculated sunrise or sunset event.

V. Open/Closed Time Control: The user shall also have the option of controlling relay outputs in relation to the OPEN/CLOSED times of the facility. The open/closed times may vary for different days per day of the week and may be programmed for each day of the year.

W. Time-of-Day Scheduling: Each programmable lighting controller shall be provided with a minimum of 48 available timers (scheduled events) for use in developing time-of-day automated schedules. Each timer shall have the ability to turn any or all relay outputs ON, OFF at any standard time in 1-minute increments or at times calculated by the astronomical clock for sunrise and sunset with offset. Timers shall be day-of-week selectable timers and may be programmed to activate on any combination of days of the week (Sunday through Saturday), on all days, or to activate on a specific date only (“Holiday Schedule”). Each non-holiday timer shall be capable of being programmed to either halt operation on holidays or to ignore holidays and continue normal operations on holidays.

X. OFF Sweeps: The system shall also support after hours OFF sweeps of selected relay outputs at user defined one, two, or three hour intervals

Y. Pre-Sets: The lighting controller shall support up to 48 user-defined presets (ON/OFF relay patterns). The presets may be invoked by switch or timer actuation.

Z. Descriptive Names: The system shall support the optional assignment of descriptive names (up to 10 characters) to the lighting controller, relay outputs, relay groups, inputs, timers, and presets.

AA. Password Protection: Each Programmable controller shall have a user definable 6-number password, which will lock out the keypad programming functions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The contractor shall locate, install, wire and program all lighting control panels as directed in the contract drawings, specifications and in accordance with the manufacturer’s installation and operation instructions.

B. The contractor shall provide, install and terminate interconnecting wiring between main control panels, expansions panels, photocells, switches and other interconnecting devices. Line voltage and class 2 (low voltage) wiring shall only be installed in the respective section of the lighting control panels and devices.

C. The contractor shall arrange a pre-installation meeting with the manufacturer’s factory authorized representative and Owner’s Representative, to review lighting schedules, application, placement and installation criteria.

D. The contractor shall provide, at the Owner’s facility, the training necessary to familiarize the Owner’s personnel with the operation, use, adjustment, programming, and problem solving diagnosis of the lighting control system.

E. Lighting control system manufacturer shall provide all necessary technical phone assistance to the contractor during installation of the lighting control system.

F. A wiring schedule directory card shall be installed on the back of the front cover of each relay panel which identifies all circuits/relays/loads controlled.

3.02 INSTRUCTION OF OPERATION PERSONNEL

A. Provide the Owner's authorized personnel with operation and maintenance instructions for the lighting control system as specified in Section 26 05 00.

B. Conduct walking tour of project and briefly describe function, operation, and maintenance of each component.

3.03 FIELD QUALITY CONTROL

A. The final connections, start-up, check-out and Owner instruction on the system shall be done by a manufacturer's certified and authorized technician.

B. Under provisions of Division 1 and Section 26 05 00, the manufacturer's certified technician shall make a thorough inspection of the complete installation including all components to ensure the following:

1. The system is complete and functional and complies with all requirements of the specifications.
2. All equipment meets Underwriter's Laboratories requirements.
3. The system is installed in accordance with the manufacturer's instructions.
4. Project record drawings are complete and up to date.
5. Make changes necessary to conform to Items 1, 2, 3 and 4 with technical assistance from the manufacturer as required.

END OF SECTION