MSE of Kentucky, Inc.

Engineers/Architects/Planners

624 Wellington Way
Lexington,
Kentucky 40503
859-223-5694
FAX 859-223-2607
E-Mail: mseinc@mselex.com

Addendum No. 1
Montgomery County Fiscal Court
Montgomery County Senior Center Project
Bid Date: January 8, 2025
Addendum Issue Date: December 26, 2024

The Contractor shall conform to the following changes, as same shall become binding upon the Contract to be issued in response to this invitation.

Specifications

Item 1: Add attached Section 07400 – Vinyl Siding, Soffits and Trim spec.

Item 2: Replace Spe Section 07631 - Flashing, Sheet Metal, Gutters, Downspouts and Roofing Specialties with the attached revised Section 07631 spec.

Item 3: Replace Spec Section 09300 - Ceramic Tile with the attached revised Section 09300 spec.

Item 4: Replace Spec Section 09650 – Resilient Flooring with the attached revised Section 09650 Spec.

Item 5: Replace Spec Section 10800 – Toilet Room Accessories with the attached revised Section 10800 spec.

Item 6: Add attached M/E/P specifications.

Plan Sheets

Item 7: Replace Plan Sheet A-6 with attached revised Plan Sheet A-6.

Other

Item 8: The cost estimate for construction is $1.8 million.

END OF ADDENDUM NO. 1

SECTION 07400 - VINYL SIDING, SOFFITS AND TRIM

PART 1 - SCOPE

A. This Section includes all labor, materials, equipment, and related items required for vinyl soffits, and trim as shown on the Drawings and as specified.

PART 2 - SUBMITTALS

A. Color Samples. The Contractor shall submit to the Architect, in duplicate, for approval and color selection prior to furnishing any materials at the job site, color samples of available colors for each item proposed to be furnished.

PART 3 - MATERIALS

A. Manufacturers. Vinyl siding, soffits and trim as manufactured by Alside.

B. Vinyl siding shall be double, horizontal, wood grain texture siding, made of polyvinyl chloride compound as defined in the NBS Voluntary Product Standard PS 55-72 for "Rigid poly (vinyl chloride) (PVC) plastic siding. See elevation for size. Siding and accessories shall be as manufactured by Certainteed, Alcoa, Owens-Corning, or approved equal. Siding panels shall have a nominal thickness of .042"

1. Product Design - Vinyl double horizontal siding panels shall be 12'-6" in length with interlocking horizontal edges, a one-half-inch (½") butt or shadow leg, a drip bead in the butt to direct the flow of water from the surface of the panel and triangular weep holes in the shadow leg of the bottom panel, thus allowing the wall to "breathe" and also permit condensation and water vapor to escape from the wall.

2. Elongated nailing slots 1" long shall be provided in the nail hem of the panels to permit proper expansion and contraction on the wall. The nail hem and the bottom lock of all panels shall be notched on both ends to provide for the proper overlapping of adjacent panels. A notch shall also be provided at the center butt of the double four panel for positive engagement, thus providing a quality appearance in overlap.

3. Vinyl siding shall be produced from PVC compound containing quality color pigments to provide color throughout thickness of siding.

C. Vinyl soffit panels shall be by same manufacturer as vinyl siding material, shall be standard 12" wide double V-groove or 6" wide single V-groove style, and shall be furnished in both ventilated and non-ventilated types as required for the completed installations.

1. Furnish ventilating sections in sufficient quantities to provide minimum free ventilating area at overhangs equal to or exceeding 1/300 of building roof area. Provide manufacturer's technical product data confirming ventilating area and consult with the Architect as to spacing of ventilating sections prior to proceeding with the installations.

D. Trim and Accessories

1. Vinyl trim, including starter stripe, inside and outside corner posts, general purpose trim, etc. shall be by same manufacturer as vinyl siding and soffit materials, shall be minimum of .040" thick, and shall be as shown or required for the completed installations. Furnish trim in longest available lengths for single-piece applications where not exceeding manufacturer's standards.

2. Coil stock for covering exterior wood trim shall be vinyl (PVC) coated aluminum .019 gauge with a wood grain texture. Field break coil stock as necessary for smooth application.

3. Nails, fasteners, etc., shall be those specifically recommended by the siding and soffit manufacturer for applications shown.

PART 4 - INSTALLATIONS

A. General. Inspect all supporting construction, openings, etc., in connection with vinyl siding, soffits, trim, etc., and report in writing to the Architect any defects or improper conditions affecting the installations. Proceeding with installations shall be construed as acceptance of the supporting construction, and the Contractor shall be held responsible for any defects in the work of this Section resulting therefrom.

B. Install all vinyl siding and soffits, and trim, etc., furnished in connection therewith in strict accordance with manufacturer's specific installation instructions and as shown or detailed on the Drawings. Items shall be neatly cut and fitted, and securely attached. Joints where necessary shall be neatly made. Take care in the installations not to damage adjacent collateral work. Contractor shall provide under work of this Section each and every component, device, accessory, sealant, etc., necessary for the satisfactory completion of the vinyl siding and soffit work, whether or not such items are specifically mentioned hereinbefore.

C. At completion, vinyl siding, soffits, trim, etc., shall be properly installed, securely fastened, water and weather tight, and free from damage of any kind. Contractor shall replace any damaged or defective materials at no additional cost to the Owner.

End of Section

SECTION 07631 - GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Prefabricated aluminum eave gutters and downspouts, with baked enamel finish, complete with required connecting pieces, roof aprons, end caps, anchorages, etc. as required for a complete installation.

B. Precast concrete splash pads.

1.02 REFERENCES

A. ASTM B209 - Aluminum Alloy Sheet and Plate

1.03 SUBMITTALS

A. Submit shop drawings of gutters and downspouts.

B. Clearly indicate general construction, configurations, jointing methods and locations, fastening methods and locations and installation details.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Alcoa

B. Reynolds Metals

C. Kaiser

D. Substitutions: Reviewed equal.

2.02 MATERIALS

A. Gutters shall be made of 3005-H25 Aluminum Sheet.

B. Gutter shall be 6" .032" nominal with 3" x 4" downspouts .027".

C. Expansion joint to be aluminum, lined with neoprene.

D. Downspout Clip .014"

E. Gutter hangers shall be strap hangers.

F. All Accessories used shall be by the same manufacturer.

2.03 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated on Drawings and as required to properly collect and remove water. Fabricate complete with required connection pieces.

B. Form sections square, true and accurate in size, in maximum possible lengths and free of distortions and defects detrimental to appearance or performance. Hem exposed edges. Allow for expansion at joints.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Before starting work, verify governing dimensions at building; examine, clean and repair, if necessary, any adjoining work on which this work is in any way dependent for its proper installation.

B. Upon completion, the contractor shall clean all aluminum work.

C. Dissimilar materials

1. Care must be exercised in placing aluminum in contact with metals or materials not compatible with aluminum.

2. Dissimilar materials shall be painted or otherwise protected when they are in contact with aluminum or when drainage from them passes over aluminum.

PART 4 - RIDGE VENT

A. When indicated on the Drawings, furnish and install at building roofs manufacturer's standard, continuous, ridge-type with minimum high impact copolymer vent such as shingle vent II Series SHFV203 as manufactured by Air Vent, Inc., Peroia, Illinois or reviewed equal with minimum net free area of 18 sq. inches per linear foot, and shall include end and connector plugs, weather baffles, joint covers, and aluminum screw shank nails as required by the installations or reviewed equal.

B. Installation shall be in accordance with manufacturer's printed instructions.

C. Colors to match roof.

D. Slant Vents

E. Furnish and install where shown on drawings, manufacturer's standard slant vent such as RV-61, net free area, 61 square inches, heavy-duty polypropylene construction with aluminum screen, nominal 19½"x16¼" size by the solar group, Taylorsville, Mississippi or reviewed equal.

F. Color to match roof.

End of Section

SECTION 09300 - CERAMIC TILE

PART 1 - GENERAL

1.01 Description

A. Provide porcelain tile at fireplace hearth and surround as shown on drawings and as specified herein.

B. Work includes preparation of surfaces to receive ceramic tile, setting bed, grout and expansion joint sealant.

1.02 Quality Assurance

A. Tile shall be standard grade, conforming to ANSI A137.1 standards and supplied in grade-sealed containers.

B. Manufacturer mortars, grouts and adhesives shall contain hallmarks certifying compliance with reference standards and be types recommended by Tile Manufacturer for application shown.

C. Installation shall be in accordance with Tile Council of America (TCA) Installation Handbook, latest edition.

1.03 Submittals

A. Submit color samples of tile and grout for products specified.

B. Submit manufacturer’s recommended maintenance guidelines.

1.04 Product Delivery, Storage and Handling

A. Deliver materials in Manufacturers’ unopened, original standard containers with grade seals unbroken and labels intact.

B. Store under cover.

1.05 Job Conditions

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer’s printed recommendations.

B. Protect adjoining surfaces.

1.06 References

A. ANSI A101.1: Installation of Ceramic Tile with Portland Cement.

B. ANSI A108.4: Installation of Ceramic Tile with Water-Resistant Organic Adhesives.

C. ANSI A108.5: Installation of Ceramic Tile Installed with Dry Set Portland Cement Mortar or Latex-Portland Cement Mortar.

D. ASTM C-150.

E. Tile Council of America, Inc., Handbook for Ceramic Tile, latest edition.

PART 2 - PRODUCTS

2.01 Materials

A. Tile materials: Sizes, colors and finishes of specified tiles shall be as indicated on floor tile patterns, details and finish schedule as provided in contract documents on Architectural Drawings/Finish Schedule.

B. Adhesive Materials: TEC/H.B. Fuller Company, Full Flex Universal Latex-Modified Thin Set Mortar (TA-391 white) to be used on floors and walls with unglazed porcelain products.

C. Grouting Materials: TEC/H.B. Fuller Company, AccuColor XT premixed, stain-resistant grout to be used on floors with porcelain product. Sanded or Unsanded as required by tile type. Color to be selected by Architect.

D. Grout Sealer: TEC/H.B. Fuller Company, Silicone Grout Sealer (TA-210) applied as recommended by the manufacturer.

E. Specialty items:

1. Cove - Schluter “Dilex” - AHKA, clear anodized aluminum. Used only where tiled walls meet tile floors.

2. Expansion joints - Schluter “Dilex” - BUS-100. Color to match grout. Spacing of expansion joints as recommended by TCA Handbook.

PART 3 - EXECUTION

3.01 Inspection

A. Before starting installation, inspect surfaces scheduled to receive ceramic tile. Variations of surfaces to be tiled should fall within maximum variations shown below:

	Walls	Floors
Dry Set Mortar	1/8" in 8'	1/8" in 10'
Epoxy	1/8" in 8'	1/8" in 10'
Organic Adhesive	1/8" in 8'	1/8" in 3'

Report all unacceptable surfaces to the Architect, and do not tile such surfaces until they are leveled to meet the above requirements.

3.02 Preparation

A. Where subfloors or wall surfaces require filling or building up to produce satisfactory level surfaces, do so in an approved manner with an underlay material approved for use over surfaces affected. High spots shall be ground off or otherwise removed and leveled to provide satisfactory conditions for tile installation.

B. Clean surfaces of grease, oil, wax, curing compounds, dirt and foreign matter before proceeding with installation. Surface must be completely dry.

C. Layout and install expansion joints as recommended by TCA "Handbook for Ceramic Tile Installation".

3.03 Installation

A. Unless otherwise directed, do not begin work until other trades, including painting, have been completed.

B. Ceramic tile shall be installed, grouted and cleaned in accordance with applicable ANSI standards for setting method specified.

C. Smooth all exposed cut edges. Fit tile carefully against trim, penetrations and built-in accessories and fixtures.

D. Grout in accordance with Manufacturer's specifications.

E. Install sealant in expansion joints after tile is clean and thoroughly dry.

F. Lay all tile square with room axis, starting at center of room, or in accordance with tile patterns indicated on architectural plans.

G. Whenever tiled floors change or adjoin other flooring materials, provide appropriate transition strips as scheduled below:

Surface	Transition Strips
Tile to tile	Marble threshold
Tile to V.C.T.	Vinyl beveled edge strip
Tile to sheet vinyl	Vinyl beveled edge strip
Tile to carpet	Vinyl beveled edge strip or built-up floor with butted edges

Note: Schluter products may be substituted for transitions listed above.

3.04 Cleaning and Protection

A. After tile has been set and grouted, thoroughly clean tile work with a neutral cleaner in accordance with Manufacturer's recommendations.

B. Remove all foreign matter, excess materials or tools from area.

C. After cleaning, protect floor with non-staining paper covering and prohibit foot and wheel traffic from using newly tiled floors for at least 3 days.

D. Contractor shall be responsible for removing and replacing any defective materials, unacceptable tiling conditions or tiles damaged by construction as recommended by the Architect at no additional cost to the Owner.

E. At the completion of work, the Contractor shall provide the Owner with one (1) unopened carton of tiles of the same lot as used in the project.

END OF SECTION

SECTION 09650 - RESILIENT FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of resilient flooring and accessories as shown on Drawings and Specified herein.

Work includes:
1. Vinyl Cove Base
2. Luxury Vinyl Tile/Plank
3. Transition Strips
4. Adhesives

1.02 SUBMITTALS

A. Product Data: Submit manufacturer=s technical data and installation instructions for resilient flooring and accessories in accordance with Section 01300.

B. Samples: Submit, for verification purposes, samples of each type, color and pattern of resilient flooring and accessory required, indicating full range of color/pattern variation.

C. Maintenance Instructions: Submit copies of manufacturer=s recommended maintenance practices for each type of resilient flooring required to Owner.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of standard quality of manufacturers as specified. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer=s instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

Refer to Finish Schedule on Drawings for styles and colors of specified materials.

A. Vinyl Cove Base, 4” high x 1/8” gauge set-on type, as manufactured by Tarkett or approved equal, and furnished in 120' long rolls meeting the requirements of ASTM F1861, Type TV, Group 1 and ASTM E-648/NFPA 253, Class 1.

B. Luxury Vinyl Tile/Plank shall be glue-down resilient planks, 3.0-4.0mm thickness with minimum 20 mil wear layer, Class III printed vinyl, ASTM E648 – Class 1, meeting ADA requirements for slip resistance.

C. Resilient Edge Strips: ADA compliant, homogeneous vinyl or rubber transition strips as required where change of flooring types occur. Color to match flooring or as selected by Architect from standard colors available.

D. Adhesives: Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

F. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

G. Leveling Compound: As recommended by flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Make a thorough examination of surfaces to receive resilient flooring. If surfaces are defective and will not permit a proper finished installation, immediately notify the Architect in writing, or assume responsibility for and rectify any resulting unsatisfactory condition.

B. Inspect floor for holes, cracks and smoothness. Test for dryness. Do not proceed with laying until subfloors are dry and smooth, holes and cracks filled.

3.02 PROJECT CONDITIONS

A. Substrate Conditions: The installer shall verify in writing to the Owner, a minimum of 30 days prior to scheduled resilient flooring installation, the following substrate conditions:

1. Moisture: Initial emission rate, as tested with a calcium chloride test kit.

2. Alkalinity: pH range of 6-8. Must not exceed pH of 10.

B. Install resilient flooring and accessories after they have the same temperature as the space and after other finishing operations, including painting, have been completed. Moisture content and alkalinity level of concrete slabs, as well as environmental conditions, must be within limits recommended by manufacturer of products being installed.

3.03 PREPARATION AND INSTALLATION

A. Broom clean or vacuum surfaces to be covered, and inspect subfloor. Start of flooring installation indicates acceptance of subfloor conditions and full responsibility for completed work.

B. Accessories: Apply resilient base to walls, columns, pilasters, casework and other

permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable, with preformed corner units or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout length of each piece, with continuous contact at horizontal and vertical surfaces.

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

2. Place resilient edge strips tightly butted to flooring and secure with adhesive. Install edging strips at edges of flooring which would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Immediately upon completion of the resilient flooring remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by flooring manufacturer.

1. Do not wash or machine scrub linoleum for at least 3-5 days after installation.

2. Do not strip factory finish from linoleum sheet flooring per Manufacturer recommendations.

B. Protect installed flooring with heavy Kraft paper or other covering.

C. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean all floors and accessories.

End of Section

SECTION 10800 - TOILET ROOM ACCESSORIES

PART 1 - GENERAL

1.01 Work Included

A. Toilet room accessories.

1.02 Related Work

A. Wall blocking required to secure accessories
B. Glazing/caulking
C. Toilet compartments
D. Gypsum wallboard systems
E. Plumbing fixtures
F. Countertops

1.03 References (including but not limited to)

A. ANSI A117 - 1986 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

B. UBC - Chapters 5 and 33 Requirements for Handicapped.

C. Title 24, California Code of Regulations, Parts 2, 3, and 5.

D. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.

E. Fair Housing Amendments Act of 1988, Accessibility Guidelines, Federal Register Volume 56, Number 44.

F. Southern Building Code.

1.04 Quality Assurance

A. Manufacturer

1. Model numbers for toilet room accessories manufactured by Bradley Corp. Washroom accessories are listed to establish a standard of quality for design, function, materials, workmanship and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions of the substitutions clause. Other accepted manufacturers include the following or an approved equal:
   a. ASI
   b. Bobrick

2. Accessories shall be the products of a single manufacturer. Accessories with tumbler locks shall be keyed alike with the exception of coin boxes in vending equipment.

B. Regulatory requirements
   1. Operation of accessories shall comply with guidelines set forth by the American Disabilities Act, Title III. Documentation and samples to be provided to the architect upon request.

1.05 Submittals

A. Comply with requirements of Section regarding submittals.

B. Manufacturer's Data
   1. Provide required number copies of:
      a. Product data sheets.
      b. Installation instructions.
      c. Service and parts manual.

1.06 Product Delivery, Storage, and Handling

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store materials in original protective packaging to prevent physical damage, or wetting.

C. Handle so as to prevent damage to accessories.

1.07 Warranty

A. Furnish one year guarantee against defects in material and workmanship on all accessories. In addition to the above the following shall apply:
   1. Welded stainless steel framed mirrors shall have a fifteen year guarantee against silver spoilage.

PART 2 - PRODUCTS

2.01 Schedule:

A. Grab Bars of sizes as shown on plans, #812-001, heavy-duty stainless steel with sanitary safety grip finish, concealed mounting kits to be included.

B. Mirror 30" x 42", #7802–30 x 42, angle framed mirror, ¼" tempered glass.

C. Mirror 24" x 42", #7802–24 x 42, angle framed mirror, ¼" tempered glass

D. Toilet Tissue Dispenser, #5084, surface mounted, single roll, stainless steel with satin finish.

E. Paper Towel Dispenser, Model 250-15, surface-mounted, stainless steel.

2.02 Materials (if applicable to items in contract)

A. All cabinets shall be constructed of 18-8, type 304 stainless steel.

B. All waste receptacle shall be constructed of 18-8, type 304 stainless steel or rigid molded leak-proof plastic.

C. Waste receptacles or cabinets manufactured of type 400 stainless steel are not acceptable.

D. All tumbler locks to be fastened to accessories with lock nuts. Fastening locks to units with spring clip is not acceptable.

PART 3 - EXECUTION

3.01 Inspection

A. Check wall opening for dimensions, plumbness of blocking or frames that would affect installation of recessed accessories. For surface mounted accessories check condition of wall and confirm installation of backing within wall.

B. Verify spacing of plumbing fixtures and toilet compartments that affect installation of toilet room accessories.

End of Section

MECHANICAL SPECIFICATION INDICES

DIVISION 22 - PLUMBING

DIVISION 23 - HVAC

ELECTRICAL SPECIFICATION INDICES

DIVISION 26 – ELECTRICAL

DIVISION 28 – SAFETY AND SECURITY

Division 22 & 23
Mechanical

220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. All requirements under Division One and the General and Supplementary Conditions of these specifications shall be a part of this section. Each contractor shall be responsible to thoroughly familiarize himself with all its contents as to requirements which affect this division or section. The work required under this section includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications.

1.2 SCOPE

A. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Plumbing System(s)/Equipment indicated or specified in the Contract Documents.

B. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Plumbing Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and,or specifications, shall be included as part of this Contract.

C. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to coordinate all new systems with items of construction provided by others, and to relocate items which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

1.3 DEFINITIONS AND ABBREVIATIONS

A. Contractor - Any Contractor whether proposing or working independently or under the supervision of a General Contractor and,or Construction Manager and who installs any type of mechanical work or, the General Contractor.

B. Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc.

C. Architect - The Architect of Record for the project.

D. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

E. Provide - Furnish and install complete, tested and ready for operation.

F. Indicated - Shown on the Drawings or Addenda thereto.

G. Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

H. OSHA - Office of Safety and Health Administration.

I. NEC - National Electrical Code.

J. NFPA - National Fire Protection Association.

K. AGA - American Gas Association

L. ASME - American Society of Mechanical Engineers.

M. ANSI - American National Standards Institute.

N. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

O. NEMA - National Electrical Manufacturers Association.

P. UL - Underwriters Laboratories.

1.4 INSPECTION OF THE SITE:

A. The contractor shall personally inspect the site of the proposed work and inform himself fully as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

1.5 MATERIAL AND WORKMANSHIP:

A. All material and apparatus shall be new and in first class condition. All workmanship shall be of the finest possible by experienced mechanics. All installations shall be made in a manner that will comply with applicable Codes and laws. In general, all materials and equipment shall be of commercial specification grade in quality.

1.6 DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item that may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. Each Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

C. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

D. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, etc.. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

1.7 COORDINATION:

A. Coordinate all work with that of other trades so that the various components of the systems will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Any components which are installed without regard to the above shall be relocated at no additional cost to the owner.

B. It is the Contractor's responsibility to provide materials with trim which will fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

1.8 ORDINANCES AND CODES:

A. Comply with National Fire Protection Association codes, Kentucky Building Code, Kentucky Plumbing Code, and/or all other applicable codes and ordinances. Obtain and pay for all permits. Contractor shall be held responsible for any violation of the law.

B. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having any jurisdiction, whether indicated or

specified or not.

C. The contractor shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work.

1.9 PROTECTION OF EQUIPMENT:

A. Adequately protect equipment from damage after delivery to job. Cover with heavy polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment which has been damaged by construction activities will be rejected, and contractor is obligated to furnish new equipment of a like kind.

B. Keep premises broom clean at all times from foreign material created under this contract. All piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

1.10 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc.. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall renumerate them for all necessary changes in their work.

B. NOTE: Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.

C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of the paragraph immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of five days prior to bids.

1.11 SUPERVISION OF WORK

A. Each Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

1.12 SHOP DRAWINGS:

A. Submit for approval eight sets of manufacturers shop drawings of all major items of equipment and all items requiring coordination between contractors. Before submitting shop drawings and material lists, the contractor shall verify that all equipment submitted is mutually compatible and suitable for the intended use, and shall fit the available space and allow ample room for maintenance. The Engineer's checking and subsequent approval of such shop drawings shall not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or omissions of components or fittings; or for coordinating items with actual building conditions. Provide any needed wiring diagrams.

B. Catalog data must have the item or model number clearly marked and all accessories indicated. Mark out all inapplicable items.

C. NOTE: Any shop drawings received without being reviewed and stamped by the Contractor shall be returned Rejected without review.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Submit to the architect four (4) copies each of material for maintenance and operation instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed:

1. Manufacturers Catalog Sheets
2. Wiring Diagrams
3. Maintenance Instructions
4. Recommended Maintenance Schedules and Timelines
5. Operating Instructions
6. Parts Lists
7. Preventative Maintenance Recommendations

B. All binders shall be as per the applicable Division I General Specifications.

1.14 GUARANTEE:

A. Each Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at

his own expense, which are proven defective for a duration as indicated in the Division I General Conditions and Specifications.

B. Where such duration is not identified, then guarantee shall be for one year from final acceptance of the work by the Engineer/Architect. The effective date of completion of the work shall be the date of the Engineer's (Architect's) Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. Refer to other sections for any special or extra warranty requirements.

1.15 CONDUCT OF WORKMEN

A. Each Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

1.16 ROUGH-IN:

A. Coordinate without delay all roughing-in with general construction. All piping, conduit, rough-in shall be concealed except in unfinished areas and where otherwise shown.

1.17 CUTTING AND PATCHING:

A. Each Mechanical Contractor shall be responsible for all openings that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work prior to execution. Improperly located openings shall be reworked at the expense of the responsible Contractor.

B. Each Mechanical Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing structure, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Architect and Engineer.

C. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, of like type to match adjacent surfaces and in a manner

acceptable to the Architect & Engineer.

D. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the penetrations MUST be made using a U.L. listed through penetration assembly. These materials must be U.L. listed as a recorded assembly and shall be submitted for approval prior to use.

E. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.

1.18 LINTELS

A. The Mechanical Contractor shall provide lintels for all masonry bearing openings required for the mechanical work (Louvers, wall boxes, duct penetrations, etc.). Lintels shall be sized as indicated by the structural drawings and specifications. Coordinate requirements with the general contractor and the Structural Engineer. Contact Engineer for additional direction if necessary. Plan all lintel depths to ensure maintenance of all Architectural ceiling levels. Also, plan all required angles for fire damper and UL listed sleeves for a total depth for coordination with ceiling heights. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Structural Engineer. Provide lintels where ever bearing walls are penetrated. Plan the location of all lintels prior to any penetrations being performed.

1.19 ACCESSIBILITY

A. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and,or parts such as valves, filters, fan belts, motors, prime shafts, etc.

1.20 REQUIRED CERTIFICATIONS

A. Upon completion of the project, the Contractor shall deliver all inspection certificates acquired during the course of the project to the Owner for their records, inclusive of the boiler certificate (if applicable).

B. The Contractor shall upon completion of the Final Punch list, deliver to Architect and Engineer a written certification that all systems and work has been completed in compliance with the plans and specifications. The Contractor also shall deliver over to the Owner all required maintenance manuals and phone numbers of the equipment suppliers. The delivery of these documents and certifications will be required prior to final payment and release of retainage.

1.21 INDEMNIFICATION

A. The Contractor(s) shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss,damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 2 - PRODUCTS

2.1 NONE

PART 3 - EXECUTION

3.1 NONE

END OF 220500

220519: METERS AND GAGES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of gauges and thermometers required by this section is indicated on drawings and/or specified in other Division 22 sections.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of pressure gauges and thermometers, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, and installation instructions, for each type of measuring device required. Submit showing Manufacturer's figure number, size, and features for each required device.

PART 2 - PRODUCTS

2.1 TEMPERATURE GAGES:

A. Direct Mount Dial Thermometers:

1. General: Provide direct mount dial thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2. Type: Vapor tension, universal angle.

3. Case: Drawn steel or brass, clear acrylic plastic lens, 4½" diameter.

4. Adjustable Joint: Die cast aluminum, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

5. Thermal Bulb: Copper with phosper bronze bourbon pressure tube, on scale division accuracy.

6. Movement: Brass precision geared.

7. Scale: Progressive, satin faced, non-reflective aluminum, permanently etched markings.

8. Stem: Copper plated steel, or brass, for separable socket, length to suit

installation.

9. Range: Conform to the following:

   a. Hot & Cold Water: 40° - 240°F (10°-115°C).

10. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial thermometers which may be incorporated in the work include, but are not limited to the following:

    a. Marsh Instrument Co., Unit of General Signal.
    b. Trerice (H.O.) Co.
    c. Weiss (Albert A. & Son, Inc.

B. Dial Type Insertion Thermometers:

1. General: Provide dial type insertion thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2. Type: Bi-metal, stainless steel case and stem, 1" diameter dial, dust and leak proof, 1/8" diameter stem with nominal length of 5".

3. Accuracy: 0.5% of dial range.

4. Range: Conform to the following:

   a. Hot & Cold Water: 0°- 220°F (-10°-110°C).

5. Available Manufacturers: Subject to compliance with requirements, manufacturers offering direct mount dial type insertion thermometers which may be incorporated in the work include, but are not limited to the following:

    a. Marsh Instrument Co., Unit of General Signal.
    b. Taylor Instrument Process Control Div., Sybron Corp.
    c. Trerice (H.O.) Co.
    d. Weiss (Albert A.) & Son, Inc.

C. THERMOMETER WELLS:

1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping.

2.2 PRESSURE GAGES AND FITTINGS:

A. General: Provide pressure gages of materials, capacities and ranges indicated, designed

and constructed for use in service indicated.

B. Type: General use, 1% accuracy, ANSI B 40.1 grade A, phosphor bronze bourdon type, bottom connection.

C. Case: Drawn steel or brass, clear acrylic plastic lens, 4½" diameter.

D. Connector: Brass with ¼" male NPT.

E. Scale: White coated aluminum, with permanently etched markings.

F. Range: Conform to the following:

1. Water: 0 - 100 PSI.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering pressure gages which may be incorporated in the work include, but are not limited to the following:

1. Ametek, U.S. Gauge Div.
2. Marsh Instrument Co., Unit of General Signal.
3. Marshalltown, An Eltra Company
4. Trerice (H.O.) Co.
5. Weiss (Albert A.) & Son, Inc.

H. Pressure Gage Cocks:

1. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with ¼" female NPT on each end, and "T" handle brass plug.

I. Snubber: ¼" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

J. Pressure Gage Connector Plugs:

1. General: Provide pressure gage connector plugs pressure rated for 150 PSI and 200°F. Construct of brass and finish in nickel-plate, equip with ½" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion pressure gage. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.

PART 3 - EXECUTION

3.1 INSTALLATION OF TEMPERATURE GAGES:

A. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

B. Locations: Install at the following locations, and elsewhere as indicated:

1. At the supply line from the domestic water heaters

C. Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Fill well with oil or graphite, secure cap.

3.2 INSTALLATION OF PRESSURE GAGES:

A. General: Install pressure gages in piping tee with pressure gage cock, located on pipe at most readable position.

B. Locations: Install in the following locations, and elsewhere as indicated:

1. At water service entrance
2. At inlet and discharge of each pump

END OF 220519

220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1. DESCRIPTION OF WORK:

1.1 Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.

A. Types of valves specified in this section include the following:

1. Gate Valves.
2. Globe Valves.
3. Drain Valves.
4. Ball Valves.
5. Swing and Lift Check Valves.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.

PART 2 - PRODUCTS

2.1 VALVES:

A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 GATE VALVES:

A. Packing: Select valves designed for repacking under pressure when fully opened,

equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

1. For Low Pressure Domestic Water Service:

   a. Threaded Ends 2" and Smaller: Class 125, bronze body, union bonnet, rising stem, solid wedge.

   b. Flanged Ends 2½" and Larger: Class 125, iron body bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge.

   c. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, non-rising stem, solid wedge.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to the following:

   a. Crane Co., Valve Div.
   b. Fairbanks Co.
   c. Hammond Valve Corp., Div. of Conval Corp.
   d. Jenkins Bros., A Corp.
   e. NIBCO, Inc.
   f. Powell (Wm.) Co.
   g. Stockham Valves and Fittings, Inc.
   h. Walworth Co.

2.3 GLOBE VALVES:

A. Packing: Select valves designed for repacking under pressure when fully opened, equipped with packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

B. Composition Discs: Where required, provide suitable material for intended service. For stem throttling service, fit composition disc valve with throttling nut.

C. Comply with the following standards:

   1. Bronze Valves: MSS SP-80.

D. For Domestic Water Service:

1. Flanged, Threaded or Solder Ends 2½" and Larger: Class 150, bronze body, union bonnet, plug-type, OS&Y, renewable seat and disc, rated for severe throttling.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering globe valves which may be incorporated in the work include, but are not limited to, the following:

1. Crane Co., Valve Div.
2. Fairbanks Co.
3. Hammond Valve Corp., Div. of Conval Corp.
4. Jenkins Bros., A Corp.
5. NIBCO, Inc.
6. Powell (Wm.) Co.
7. Stockham Valves and Fittings, Inc.
8. Walworth Co.

2.4 SWING CHECK VALVES:

A. General: Construct pressure containing parts of valves as follows:

1. Bronze Valves, 125 or 150 PSI: ANSI/ASTM B 62.

B. Construct valves of pressure castings free of any impregnating materials.

C. Construct valves of bronze, regrinding, with seating angle 40° to 45°, unless composition disc is specified.

D. Provide stop plug as renewable stop for disc hanger, unless otherwise specified.

E. Construct disc and hanger as separate parts, with disc free to rotate.

F. Support hanger pins on both ends by removable side plugs.

2.5 Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to the following:

1. Crane Co., Valve Div.
2. Fairbanks Co. (The)
3. Hammond Valve Corp., A Condec Co.
4. Jenkins Bros., A Corp.
5. NIBCO, Inc.

6. Powell Co. (The Wm.)
7. Stockham Valves and Fittings, Inc.
8. Walworth Co.

2.6 LIFT CHECK VALVES:

A. General: Provide lift check valves, 2" and smaller, constructed of bronze or forged steel to suit service. Construct bronze valves with basic rating of 125 or 150 PSI with pressure containing parts of materials having at least physical properties of ANSI/ASTM B 62. Conform to ANSI /FCI 74-1 for design, rating, and testing. Construct pressure castings, free of any impregnating materials.

B. Horizontal Lift Check Valves: ¼" to 2", straight pattern threaded or soldered ends, pressure rated for 150 PSI, renewable composition disc, screw-over cap, bronze body.

C. Spring Loaded Horizontal Lift Check Valves: ¼" to 2", straight pattern, threaded or soldered ends, pressure rated for 150 PSI, renewable composition disc, phosphor bronze wire spring, screw over cap, bronze body.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering lift check valves which may be incorporated in the work include, but are not limited to the following:

1. Fairbanks Co. (The).
2. Hammond Valve Corp.,A Condec Co.
3. Jenkins Bros., A Corp.
4. Lunkenheimer Co. (The), Div. Conval Corp.
5. Powell Co. (The Wm.).
6. Stockham Valves & Fittings, Inc.

2.7 BALL VALVES:

A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

B. For Domestic Water Service:

1. Threaded Ends 2" and Smaller: Class 125, bronze 2 piece body, bronze ball, bronze stem.

2. Soldered Ends 2" and Smaller: Class 125, bronze, 2 piece body, bronze ball, bronze stem.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball valves which may be incorporated in the work include, but are not limited to the following:

1. Conbraco Industries, Inc.
2. Crane Co., Valve Div.
3. Fairbanks Co.
4. Hammond Valve Corp., Div. of Conval Corp.
5. Jamesbury Corp.
6. NIBCO, Inc.
7. Stockham Valves and Fittings, Inc.
8. Walworth Co.

2.8 DRAIN VALVES:

A. For Low Pressure Drainage Service:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.

2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed bonnet, rising stem, composition disc, 3/4" hose outlet connection.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drain valves which may be incorporated in the work include, but are not limited to, the following:

1. Crane Co., Valve Div.
2. Fairbanks Co.
3. Hammond Valve Corp., Div. of Conval Corp.
4. Jenkins Bros., A Corp.
5. NIBCO, Inc.
6. Walworth, Co.

2.9 SWING CHECK VALVES:

A. General: Construct pressure containing parts of valves as follows:

1. Bronze Valves, 125 or 150 PSI: ANSI/ASTM B 62.

2. Metallic Seated Bronze Valves, 200 or 300 PSI: ANSI/ASTM B 61.

3. Iron Body Valves: ANSI/ASTM A 126, Grade B.

B. Comply with MSS SP-71 for design, workmanship, material and testing.

C. Construct valves of pressure castings free of any impregnating materials. Construct valves of bronze, regrinding, with seating angle 40° to 45°, unless composition disc is specified.

D. Provide stop plug as renewable stop for disc hanger, unless otherwise specified.

E. Construct disc and hanger as separate parts, with disc free to rotate.

F. Support hanger pins on both ends by removable side plugs.

G. For Domestic Water Service:

1. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc.

2. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, horizontal swing, bronze disc.

3. Flanged Ends 2½" and Larger: Class 125, iron body bronze mounted, bolted cap, horizontal swing, cast iron disc.

H. Available Manufacturers: Subject to compliance with requirements, manufacturers offering swing check valves which may be incorporated in the work include, but are not limited to the following:

1. Crane Co., Valve Div.
2. Fairbanks Co. (The)
3. Hammond Valve Corp., A Condec Co.
4. Jenkins Bros., A Corp.
5. NIBCO, Inc.
6. Powell Co. (The Wm.)
7. Stockham Valves and Fittings, Inc.
8. Walworth Co.

2.10 VALVE FEATURES:

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1

B. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.

C. Inside Screw, Non-Rising Stem: Stem and handwheel designed to rotate without rising when valve is operated from closed to open position.

D. Threaded: Valve ends complying with ANSI B2.1.

E. Bonnet: Part of gate or globe valve through which stem passes to valve body, and attached to valve body by screws, bolts, union or welding.

F. Solid Wedge: One piece tapered disc in gate valve, designed for contact on both sides.

G. Outside Screw and Yoke: Stem and handwheel designed to rise out of bonnet or yoke as valve is operated from closed to open position.

H. Inside Screw, Non-Rising Stem: Stem and handwheel designed to rotate without rising when valve is operated from closed to open position.

I. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

J. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Except as otherwise indicated, comply with the following requirements:

B. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

C. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose end adapter for each valve that must be installed with stem below horizontal plane.

D. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

E. Applications Subject to Shock: Install valves with bodies of metal other than cast iron where thermal or mechanical shock is indicated or can be expected to occur.

F. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

G. Fluid Control: Where throttling is indicated or recognized as principal reason for valve, install globe valves.

H. Installation of Check Valves:

1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of flow.

END OF 220523

220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of supports, anchors and seals required by this section is indicated on drawings and/or specified in other Division 22 sections.

B. Types of supports, anchors, and seals specified in this section include the following:

1. Horizontal-Piping Hangers and Supports.
2. Vertical-Piping Clamps.
3. Hanger-Rod Attachments.
4. Building Attachments.
5. Saddles and Shields.
6. Miscellaneous Materials.
7. Anchors.

C. Supports, anchors, and seals furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 22 sections. Also refer to Drawings for notes regarding the post tension slab system.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of supports, anchors, and seals, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Select and apply pipe hangers and supports, complying with MSS SP-69. Size hangers and supports to support pipe weight and fluid conveyed.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or

shield for insulated piping.

1. Adjustable Steel Clevises: MSS Type 1.
2. Alloy Steel Pipe Clamps: MSS Type 2.
3. Steel Double Bolt Pipe Clamps: MSS Type 3.
4. Steel Pipe Clamps: MSS Type 4.
5. Pipe Hangers: MSS Type 5.
6. Adjustable Swivel Pipe Rings: MSS Type 6.
7. Adjustable Steel Band Hangers: MSS Type 7.
8. Adjustable Band Hangers: MSS Type 9.
9. Extension Split Pipe Clamps: MSS Type 12.
10. Single Pipe Rolls: MSS Type 41.
11. Pipe Roll Stands: MSS Type 44.
12. Adjustable Roller Hangers: MSS Type 43.
13. Pipe Rolls and Plates: MSS Type 45.

2.2 VERTICAL-PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe.

1. Two-Bolt Riser Clamps: MSS Type 8.
2. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with ANSI/MSS SP-58. Select size of hanger-rod attachments to suit hanger rods.

1. Steel Clevises: MSS Type 14.
2. Swivel Turnbuckles: MSS Type 15.
3. Steel Weldless Eye Nuts: MSS Type 17.

2.4 BUILDING ATTACHMENTS:

1. General: Except as otherwise indicated, provide factory fabricated building attachments complying with ANSI/MSS SP-58

2.5 SADDLES AND SHIELDS:

1. General: Except as otherwise indicated, provide saddles or shields for piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hangers and supports which may be incorporated in the work include, but are not limited to the following:

1. Anvil
2. C & S Mfg. Corp.
3. Carpenter and Patterson, Inc.
4. Elcen Metal Products Co.
5. F & S Central Mfg. Corp.
6. Fee & Mason Mfg. Co., Div. of A-T-O, Inc.
7. ITT Grinnel Corp.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install supports with maximum of eight foot spacing. Building attachments and/or hangars systems shall be cast in place into the concrete post tension slab system during concrete placement. Refer to Drawings for additional notes. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which

are copper plated, or by other recognized industry methods.

D. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes.

E. Insulated Piping: Comply with the following installation requirements.

F. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

G. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

END OF 220529

220533 - IDENTIFICATION FOR DOMESTIC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this sections indicated on drawings and/or specified in other Division 23 sections. Systems which must be identified are as follows:

1. Water Heaters
2. Domestic Hot Water Systems
3. Natural Gas Piping

B. Type of identification devices specified in this section include the following:

1. Engraved Plastic-Laminate Signs
2. Pipe Identification

1.2 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

PART 2 - PRODUCTS

2.1 IDENTIFICATION MATERIALS:

A. PIPE STENCILING

1. Provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract after the piping has been painted. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor.

B. VALVE TAGS:

1. Provide the following:

a. Brass Valve Tags: Provide 19 gauge polished brass valve tags with stamp engraved piping system abbreviation in ¼" high letters and

sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1½" diameter tags, except as otherwise indicated.

b. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or headed type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. ENGRAVED PLASTIC-LAMINATE SIGNS:

1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units. Fasteners: Self-tapping stainless steel screws, expect contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of mechanical systems and equipment. Lettering in no case shall be less than 1/2" in height.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. PIPING & VALVING:

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

2. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior exposed locations and above removable acoustical ceilings.

a. Near each valve and control device.

b. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

c. Near major equipment items and other points of origination and termination.

d. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3. Valve Identification General: Provide valve tag on every valve, cock and control device in each piping system listed under the paragraph entitled "DESCRIPTION OF WORK"; exclude check valves, valves within factory-fabricated equipment units, and shut-off or isolation valves at equipment. List each tagged valve in valve schedule for each piping system.

4. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by the Architect/Engineer.

5. Do not use plastic piping markers where located in a return air plenum.

3.2 PIPE PAINTING AND IDENTIFICATION

A. Piping shall be required to be painted and identified as follows:

1. Domestic Hot Water: Black Letters on Yellow or White Background: “ DOM. HOT “
2. Natural Gas Piping: Yellow Letters on a Green Background: " N.GAS"

3.3 PLUMBING EQUIPMENT:

A. Mechanical Equipment Identification, General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein.

1. Water Heaters

END OF 220533

220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

a. Domestic Cold Water Lines
b. Hot Water & Circulating Hot Water Lines
c. Lavatory P-Trap and Supplies

1.2 QUALITY ASSURANCE:

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

1. Armaflex
2. Armstrong World Industries, Inc.
3. Babcock & Wilcox Co., Insulating Products Div.
4. Certainteed Corp.
5. Johns-Manville Corp.
6. Keene Corp.
7. Knauf Fiber Glass
8. Owens-Corning Fiberglass Corp.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.3 INSULATION SHIELDS

A. Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc with lengths equal to at least twice the pipe diameter.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Certified Tests: With product data submit certified test reports on performances including burning characteristics and thermal insulating valves.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove damaged insulation from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION: Piping Insulation:

A. All hot water, and domestic water piping shall be insulated. The insulation shall be a heavy density, pipe insulation with a K factor .22 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket with self-sealing lap, equal to Certain-teed, Mansville, Owens-Corning. Cover fittings with Zeston or equal premolded insulating fittings. Insulation shall be installed in a professional, neat appearing manner; poor workmanship shall be corrected at the Contractor's expense.

B. Application thicknesses shall be as follows:

Domestic hot and recirc. hot water piping:	1" thick
Domestic cold water piping:	1/2" thick

C. Lavatory P-traps and supplies shall be insulated with 1/2" premolded fiberglass "Trap-wrap" with integral plastic white jacket.

PART 3 - EXECUTION

3.1 INSTALLATION OF INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surface. Insulate each continuous run of piping or ductwork with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

C. Clean and dry all surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Extend piping insulating without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

G. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.2 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF 220700

221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of domestic water piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.

1.2 QUALITY ASSURANCE:

A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.

1.3 DELIVERY STORAGE, AND HANDLING:

A. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Protect flange and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.4 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve, specialty, etc. Include pressure drop curve or chart for each type and size of equipment.

PART 2 - PRODUCTS

2.1 PLUMBING PIPING MATERIALS:

A. All piping for hot and cold water above the slab, within the building, shall be type "L" hard temper copper tube with wrought copper fittings and soldered connections made up with lead free solder equal in performance to 95/5 solder.

B. All piping for cold water below the slab shall be type "K" hard temper copper tube with

wrought copper fittings and soldered connections made up with lead free solder equal in performance to 95/5 solder.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION;

A. Pipe shall be accurately cut from job measurements and shall be neatly aligned, securely connected, and properly supported. Piping shall be thoroughly cleaned before installation. Provide pipe sleeves where piping passes through structure. Threaded and soldered joints shall be made in a workmanlike manner according to good pipe fitting practices.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

C. Electrical Equipment Spaces: Do not run piping through transformer vaults, over panels and other electrical or electronic equipment spaces and enclosures.

D. Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B31.

E. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

F. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install shut-off valves for each piece of plumbing equipment.

G. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose end adapter for each valve that must be installed with stem below horizontal

plane.

H. Ferrous pipe hangers shall be Fee & Mason Figure 215 or equal Unistrut malleable iron split ring hanger; copper pipe hangers shall be Figure 361 cast brass with plated adjuster. No perforated strap iron hangers will be permitted. Fee & Mason #400 "Auto-Grip" type hangers are an acceptable alternative hanger. Concrete inserts, where required, shall be Unistrut, Midwest, or Truscon. Hangers shall be spaced at ten foot intervals or less, as required to avoid sag, prevent vibration, and allow accurate leveling or grading. Vertical piping shall be supported by Fee & Mason Figure 241 or equal clamp for ferrous piping, and Figure 368 for copper. Provide sheet metal saddles for insulated piping.

I. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items. Install hangers and supports to provide indicated pipe slopes.

3.2 AIR CHAMBERS AND TRAPS:

A. Wherever water piping terminates at a fixture or valve, furnish and install air chambers of sufficient capacity to prevent water hammer. Length shall be at least 12 times branch pipe diameter. Every fixture shall be separately trapped with a water sealed trap installed as close to the fixture as possible.

3.3 PIPING STERILIZATION:

A. Sterilize the new hot and cold water piping system with solution containing not less than 50 PPM available chlorine. Solution shall remain in the system a minimum of 24 hours, with each valve being operated several times during the period. After completion, flush system with city water until chlorine residual is lowered to incoming city water level.

3.4 TESTING:

A. All water piping shall be tested with 50 PSI hydrostatic pressure; isolate piping from boiler prior to testing. All piping shall be tested before any insulation installed, and shall be subject to the above pressure for an uninterrupted period of not less than 4 hours. All lines, joints, flanges, valve stems, etc., shall be leak tight.

B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed. Remove control devices before testing.

C. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use

chemicals, stop-leak compounds, mastics, or other temporary repair methods.

END OF 221116

221119 -: DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of piping specialties required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.

B. Types of piping specialties specified in this section include the following:

1. Wall Hydrants
2. Backflow Preventer
3. Pipe Escutcheons
4. Pipeline Strainers.
5. Dielectric Unions.
6. Sleeves.

1.2 QUALITY ASSURANCE:

A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.

B. Manufacturers: Firms regularly engaged in manufacturer of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.3 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, installation instructions, Also submit dimensioned drawings for pipeline strainers. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location and features for each required pipeline strainer.

B. Maintenance Data: Submit maintenance data and spare parts lists for each type of pipeline strainer. Include this data in Maintenance Manual.

PART 2 - PRODUCTS

2.1 MANUFACTURED PIPING SPECIALTIES:

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types, pressure ratings, voltage and wattage indicated for each service, or if not indicated, provide proper selections as determined by Engineer to comply with installation requirements. Provide sizes as indicated, and connections, which properly interface with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Hose Valves: American-Standard #4224.028 with screw-on vacuum breaker and 3/4" hose thread outlet.

C. Wall Hydrants: Wall hydrants shall be Jay R. Smith #5609-PB "non-freeze", cast bronze, polished bronze face, with integral vacuum breaker, ¾" hose connection, removable key handle operator; or equal Josam, Wade, or Zurn. Provide accessible stop valve inside building.

D. Backflow Preventer: This contractor shall furnish and install a reduced pressure backflow preventer or a double check valve assembly, at the water service entrance, and where else indicated on the Drawings. Reduced pressure type valves to have relief chamber piped floor drain or through exterior wall. Backflow preventer assembly to be equal to Watts #LF709 or approved equal Wilkins, double check valve type interim relief chamber, bronze body, trim, and bronze ball valve shut-offs on inlet and outlet. Lead Free.

E. Pipe Escutcheons, General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

1. Pipe Escutcheons for Moist and Wet Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate provide cast brass or sheet brass escutcheons, solid or split hinged.

2. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

F. Low Pressure Y-Type Pipeline Strainers, General: Comply with FCI 73-1. Provide

strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure with Type 304 stainless steel screens, with 3/64" performance at 233 per sq. in.

1. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

2. Threaded Ends, 2½" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

3. Flanged Ends, 2½" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering low pressure Y-type strainers which may be incorporated in the work include, but are not limited to the following:

    a. American Air Filter, an Allis-Chalmers Co.
    b. Armstrong Machine Works.
    c. Hoffman Specialty, ITT Fluid Handling Div.
    d. Metraflex Co.
    e. Sarco Co., Div. of White Consolidated.
    f. Crane Co.
    g. Trerice (H.O.) Co.
    h. Victaulic Co. of America

G. Dielectric Unions, General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion. Universal Controls or equal

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dielectric unions which may be incorporated in the work include, but are not limited to the following:

    a. Atlas Products Co.
    b. Capital Mfg. Co., Div. of Harsco Corp.
    c. Eclipse, Inc.
    d. Epco Sales, Inc.
    e. FMC Corp.
    f. McNally, Inc.
    g. PSI Industries.
    h. Stockham Valves and Fittings.

i. Universal Controls

2.2 FABRICATED PIPING SPECIALTIES:

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.

a. Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

b. Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe, remove burrs.

PART 3 - EXECUTION

3.1 INSTALLATION OF MANUFACTURED PIPING SPECIALTIES:

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration thru floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole and is flush with adjoining surface

B. Wall Hydrants: Install as indicated on the Drawings in accordance with manufacturer’s recommendations.

C. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

D. Y-Type Strainers: Install Y-type strainers, full size of pipe line, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.

E. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment, or if suction diffuser is not indicated.

3.2 INSTALLATION OF FABRICATED PIPING SPECIALTIES:

A. Sleeves: Install pipe sleeves of type indicated where piping passes through walls,

floors, ceilings and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation.

1. Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings.

2. Install iron-pipe sleeves at exterior penetrations, both above and below grade.

3. Install steel-pipe or plastic-pipe sleeves except as otherwise indicated.

3.3 SPARE PARTS:

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

END OF 221119

221123 - NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of domestic water piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.

1.2 QUALITY ASSURANCE:

A. Plumbing Code Compliance: Comply with Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.

1.3 DELIVERY STORAGE, AND HANDLING:

A. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Protect flange and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.4 SUBMITTALS:

A. Product Data: Submit catalog cuts, specifications, installation instructions, and dimensioned drawings for each type of valve, specialty, etc. Include pressure drop curve or chart for each type and size of equipment.

PART 2 - PRODUCTS

2.1 BASIC IDENTIFICATION:

A. Building Distribution Piping: Plastic pipe markers.

B. Gas Valves: Brass valve tags.

2.2 BASIC PIPE, TUBE AND FITTINGS:

A. Exterior Gas Piping:

1. All Pipe Sizes: Galvanized steel pipe, Schedule 40 with Wrought-steel, threaded fittings.

B. Underground Exterior Gas Service Piping:

1. Pipe Sizes ½" Through 4": Thermoplastic gas pressure pipe, tubing, and fittings complying with ANSI/ASTM D 2513. All joining methods shall be as approved by the International Mechanical Code and Kentucky State Code Revisions. All underground thermoplastic pipe shall be provided with No. 18 AWG copper tracer wire with yellow insulation.

C. Building Distribution Piping:

1. Pipe Size 2" and Smaller: Black steel pipe, Pipe Weight: Schedule 40 with Malleable iron threaded fittings.

2. Pipe Size 2½" and Larger: Black steel pipe, Schedule 40 with Wrought-steel buttwelded fittings.

2.3 SPECIAL VALVES

A. Gas Cocks 2" and Smaller: 150 PSI non-shock WOG, bronze straightway cock, flat or square head, threaded ends.

B. Gas Cocks 2½" and Larger: 125 PSI non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

PART 3 - EXECUTION

3.1 INSTALLATION OF NATURAL GAS PIPING:

A. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

B. Remove cutting and threaded burrs before assembling piping.

C. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

D. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connection are completed.

E. Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

3.2 Install drip-legs in gas piping where indicated, and where required by code or regulation.

A. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

B. Use dielectric unions where dissimilar metals are joined together.

C. Install piping with 1" drop in 60' pipe run (0.14%) in direction of floor.

3.3 EQUIPMENT CONNECTIONS:

A. General: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.

3.4 PIPING TESTS:

A. Test natural gas piping in accordance with ANSI B31.2, and local utility requirements.

END OF 221123

221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of sanitary waste and vent piping required by this section is indicated on drawings and/or specified in other Division 22 sections or as required to provide a complete system.

1.2 QUALITY ASSURANCE:

A. Plumbing Code Compliance: Comply with applicable portions of Kentucky State Plumbing Code and pertaining to plumbing materials, construction and installation of products. Also comply with all state and local codes having jurisdiction. No work shall begin until the Contractor has approved plumbing plans. The Contractor is responsible for installing the indicated systems in accordance with code, therefore any modifications to the project required by the Division of Plumbing shall be considered as part of this project and shall be made at no increase in contract price.

PART 2 - PRODUCTS

2.1 PLUMBING PIPING MATERIALS:

A. Soil and waste: Piping materials to be as below for the indicated areas.

1. Soil and waste piping may be Schedule 40 PVC and pipe fittings, or hub service weight cast iron with sealed fittings.

B. Plumbing Vents: <u>All vent piping to cast iron no-hub or DWV copper</u> where located above lay-in ceilings in the return air plenum. Vent piping concealed in walls may be Schedule 40 PVC and pipe fittings, or cast iron no hub; however piping must transition once it exits the wall cavity to non-PVC material.

C. Condensate Waste: Condensate waste piping may be Schedule 40 PVC, unless piping must travel through a return air plenum, in which it should be Type M copper.

2.2 CLEANOUTS

A. All **floor cleanouts** shall be Jay R. Smith #4051 series, coated cast iron, with square Nikaloy top, hub outlet with gasket, of sizes required. It shall be the responsibility of this contractor to determine the type of floor covering to be used at each cleanout location, and to rough-in and install each cleanout flush with the finished floor construction.

B. All **wall cleanouts** shall be Jay R. Smith #4472 series, with round stainless steel access cover, center screw and recessed bronze tapped plug, of sizes required.

C. All **cleanouts for installation exterior to the building** where required by the drawings or code, shall be Jay R. Smith #4237-U, full size of line, cast iron, hub outlet, heavy duty round cast iron tractor cover with vandal proof screw.

D. Approved equivalent Josam, Zurn, or Wade is acceptable.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION;

A. Pipe shall be accurately cut from job measurements and shall be neatly aligned, securely connected, and properly supported. Piping shall be thoroughly cleaned before installation. Joints shall be made in a workmanlike manner according to good pipe fitting practices.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment.

C. Do not use wire or perforated metal to support piping, and do not support piping from other piping, ductwork or other supported mechanical or electrical items. Install hangers and supports to provide indicated pipe slopes.

3.2 CLEANOUTS:

A. Cleanouts shall be installed at points as noted on the drawings, as well as at the foot of each soil, waste or interior downspout stack, minimum every 80 feet in horizontal soil and waste lines, and at other points as required for easy system maintenance. Cleanouts shall be full size of the pipe up to 4", and 4" size for pipe above 4" size. Grease all cleanout plugs.

B. Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screw driver operable.

C. Access panels for cleanouts shall be of the Zurn, 1460 series or equivalent by Josam or Wade. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes. They may, at the Contractor's

option, be Perma-Coated steel, prepared to receive finish.

D. Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.

E. Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.

F. Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction. Hold a minimum of 12" from all walls.

G. In finished walls, floors, etc., insure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.

3.3 FLOOR DRAINS

A. Provide floor drains at locations indicated and/or as required by Kentucky Building Code. Install in a neat and workmanlike manner. Coordinate locations with appropriate persons or party to insure floor pitch to drain where required.

B. Each floor drain located on floors above the lowest floor shall to provided complete with flashing and clamping collar.

C. Ensure by coordination with the appropriate persons or party that spaces served by a floor drain(s) has a water seal extending at least three (3) inches from the floor of the space served on all floors above the lowest level.

D. The floor drains shall be Zurn, Josam, Wade, Ancon or equivalent, as specified on the Drawings.

3.4 TESTING:

A. All waste piping shall be tested with all stacks filled with water, and any other tests required by the Plumbing Inspector. All lines, joints, flanges, etc., shall be leak tight.

B. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage.

C. Drain test water from piping systems after testing and repair work has been completed.

END OF 221316

SECTION 223400 – NATURAL GAS WATER HEATERS

PART 1 - **GENERAL**

1.1 DESCRIPTION OF WORK:

A. Extent of water heater work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of natural gas water heaters, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ASME Compliance: Construct water heaters in accordance with American Society of Mechanical Engineers (ASME) Pressure Vessel Codes, where such requirements is indicated.

C. UL Labels: Provide electrical water heaters which have been listed and labeled by Underwriters Laboratories (UL).

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Handle water heaters carefully to prevent damage, breaking, and scoring. Store heaters and equipment in clean dry place. Protect from weather, dirt, fumes, water, construction debris and physical damage.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER HEATERS

A. Provide domestic natural gas water heaters as scheduled on the drawings.

B. Water heaters shall meet ASHRAE 90.1 and 90.1b energy efficiency standards. Water heater to use PVC, CPVC or ABS pipe for intake and exhaust. Rated for direct vent.

C. Provide high efficiency pre-mix powered burner to provide optimum efficiency and quiet operation. Top-mounted burner position to prevent condensation from affecting burner operation

D. Water heaters shall be provided with durable glass lining, with insulated water heater jacket. Integral thermostats shall be provided. Provide anode rod.

E. Tanks shall be provided with three (3) year minimum warranty.

END OF SECTION 223400

224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of plumbing fixture work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications for plumbing fixtures, equipment and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers and installation instructions.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES:

A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

B. Fixtures shall be set firm and true, connected to all required piping services ready to use; all fixtures shall be left clean.

2.2 PLUMBING FITTINGS, TRIM AND ACCESSORIES:

A. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shutdown of water supply piping systems.

B. P-Traps: Include adjustable and removable P-traps where drains are indicated for direct connection to drainage system.

C. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

D. Carriers: Provide carriers indicated, or if not indicated, provide cast-iron supports for fixtures of either graphite gray iron, ductile iron, or malleable iron as required.

E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated cast-brass escutcheons with set screw.

G. All faucets, stops and fittings must be of one manufacturer with interchangeable parts, unless otherwise specified.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION:

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of the Kentucky State and local codes pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

3.2 CLEAN AND PROTECT:

A. Clean plumbing fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise,

remove and replace with new units and proceed with retesting.

END OF 224000

230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. All requirements under Division One and the General and Supplementary Conditions of these specifications shall be a part of this section. Each contractor shall be responsible to thoroughly familiarize himself with all its contents as to requirements which affect this division or section. The work required under this section includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications.

1.2 SCOPE

A. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s)/Equipment indicated or specified in the Contract Documents.

B. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and,or specifications, shall be included as part of this Contract.

C. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to coordinate all new systems with items of construction provided by others, and to relocate items which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

1.3 DEFINITIONS AND ABBREVIATIONS

A. Contractor - Any Contractor whether proposing or working independently or under the supervision of a General Contractor and,or Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Boiler Work, Sprinkler, Air Systems, etc.) or, the General Contractor.

B. Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc.

C. Architect - The Architect of Record for the project.

D. Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

E. Provide - Furnish and install complete, tested and ready for operation.

F. Indicated - Shown on the Drawings or Addenda thereto.

G. Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

H. OSHA - Office of Safety and Health Administration.

I. NEC - National Electrical Code.

J. NFPA - National Fire Protection Association.

K. AGA - American Gas Association

L. ASME - American Society of Mechanical Engineers.

M. ANSI - American National Standards Institute.

N. ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

O. NEMA - National Electrical Manufacturers Association.

P. UL - Underwriters Laboratories.

1.4 INSPECTION OF THE SITE:

A. The contractor shall personally inspect the site of the proposed work and inform himself fully as to the conditions under which the work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

1.5 MATERIAL AND WORKMANSHIP:

A. All material and apparatus shall be new and in first class condition. All workmanship shall be of the finest possible by experienced mechanics. All installations shall be made in a manner that will comply with applicable Codes and laws. Any abnormal noise caused by

rattling equipment, piping, ducts, air devices, and squeaks in rotating components will not be acceptable. In general, all materials and equipment shall be of commercial specification grade in quality.

1.6 DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. Each Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

C. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

D. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc.. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

1.7 COORDINATION:

A. Coordinate all work with that of other trades so that the various components of the systems will be installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Any components which are installed without regard to the above shall be relocated at no additional cost to the owner.

B. It is the Contractor's responsibility to provide materials with trim which will fit properly the types of ceiling, wall, or floor finishes actually installed. Model numbers in specifications or shown on drawings are not intended to designate the required trim.

1.8 ORDINANCES AND CODES:

A. Comply with National Fire Protection Association codes, Kentucky Building Code, International Mechanical Code, and/or all other applicable codes and ordinances. Obtain and pay for all permits. Contractor shall be held responsible for any violation of the law.

B. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having any jurisdiction, whether indicated or specified or not.

C. The contractor shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Contractor shall submit all required documents to obtain boiler permit and inspection.

D. Contractor shall be responsible for submitting plans and obtaining boiler permit for boiler system and all hot water piping.

1.9 PROTECTION OF EQUIPMENT:

A. Adequately protect equipment from damage after delivery to job. Cover with heavy polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment which has been damaged by construction activities will be rejected, and contractor is obligated to furnish new equipment of a like kind.

B. Keep premises broom clean at all times from foreign material created under this contract. All piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

1.10 EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc.. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall renumerate them for all necessary changes in their work.

B. NOTE: Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.

C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of the paragraph immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of five days prior to bids.

1.11 SUPERVISION OF WORK

A. Each Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

1.12 SHOP DRAWINGS:

A. Submit for approval eight sets of manufacturers shop drawings of all major items of equipment and all items requiring coordination between contractors. Before submitting shop drawings and material lists, the contractor shall verify that all equipment submitted is mutually compatible and suitable for the intended use, and shall fit the available space and allow ample room for maintenance. The Engineer's checking and subsequent approval of such shop drawings shall not relieve the contractor from responsibility for errors in dimensions, details, size of members, or quantities; or omissions of components or fittings; or for coordinating items with actual building conditions. Provide any needed wiring diagrams.

B. Catalog data must have the item or model number clearly marked and all accessories indicated. Mark out all inapplicable items.

C. NOTE: Any shop drawings received without being reviewed and stamped by the Contractor shall be returned Rejected without review.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Submit to the architect four (4) copies each of material for maintenance and operation instruction manuals, appropriately bound into manual form including approved copies of the following, revised if necessary to show system and equipment as actually installed:

a) Manufacturers Catalog Sheets
b) Wiring Diagrams
c) Maintenance Instructions

d) Recommended Maintenance Schedules and Timelines
e) Operating Instructions
f) Parts Lists
g) Preventative Maintenance Recommendations

B. All maintenance schedules and recommendations shall be developed in full coordination with the Engineer. All binders shall be as per the applicable Division I General Specifications, unless such specifications are not included or are not as stringent as the below requirements.

1.14 GUARANTEE:

A. Each Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to the best of its respective kind and shall replace all parts at his own expense, which are proven defective for a duration as indicated in the Division I General Conditions and Specifications.

B. Where such duration is not identified, then guarantee shall be for one year from final acceptance of the work by the Engineer/Architect. The effective date of completion of the work shall be the date of the Engineer's (Architect's) Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. Refer to other sections for any special or extra warranty requirements.

1.15 RECORD DRAWINGS

A. Each Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer may review the record documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to Deviations in the Control Systems. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineers the originals and three (3) copies of the record drawings upon completion of the work. Delivery of these documents will be contingent of final payment.

1.16 QUALIFICATIONS OF WORKMEN

A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Mechanical contractors shall be licensed as required

by Kentucky State Law.

B. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades.

C. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

1.17 CONDUCT OF WORKMEN

A. Each Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

1.18 ROUGH-IN:

A. Coordinate without delay all roughing-in with general construction. All piping, conduit, rough-in shall be concealed except in unfinished areas and where otherwise shown.

1.19 CUTTING AND PATCHING:

A. This contractor shall do all cutting of walls, floors, ceilings, etc. as required to install work under this section. Contractor shall obtain permission of the Architect before doing any cutting. All holes shall be cut as small as possible. Contractor shall patch walls, floors, etc. as required by work under this section. All patching shall be thoroughly first class and shall match the original material and construction.

1.20 ACCESSIBILITY

A. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and,or parts such as valves, filters, fan belts, motors, prime shafts, etc.

1.21 ELECTRICAL WIRING:

A. All power conduit and wiring shall be furnished by the electrical contractor. All control and interlock conduit and wiring for mechanical systems is the responsibility of the Mechanical Contractor; however he may choose to hire an electrician to perform this work. All wiring shall be in conduit and in accordance with the National Electric Code.

1.22 REQUIRED CERTIFICATIONS

A. Upon completion of the project, the Contractor shall deliver all inspection certificates acquired during the course of the project to the Owner for their records.

B. The Contractor shall upon completion of the Final Punch list, deliver to Architect and Engineer a written certification that all systems and work has been completed in compliance with the plans and specifications. The Contractor also shall deliver over to the Owner all required maintenance manuals and phone numbers of the equipment suppliers. The delivery of these documents and certifications will be required prior to final payment and release of retainage.

1.23 INDEMNIFICATION

A. The Contractor(s) shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss,damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 2 - **PRODUCTS**

NONE

PART 3 - EXECTUTION

NONE

END OF 230500

230533 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this sections indicated on drawings and/or specified in other Division 15 sections. Systems which must be identified are as follows:

1. Indoor Furnaces
2. Energy Recovery Unit
3. Duct Heaters
4. Exterior Condensing Units
5. Refrigerant Piping

B. Type of identification devices specified in this section include the following:

1. Engraved Plastic-Laminate Signs
2. Preprinted Pipe Markers

1.2 SUBMITTALS

A. Product Data: Submit product specifications and installation instructions for each identification material and device required.

PART 2 - **PRODUCTS**

2.1 MECHANICAL IDENTIFICATION MATERIALS:

A. PIPE MARKERS:

1. General: Provide pre-printed, flexible or semi-rigid, permanent, color-coded, pipe markers complying with ANSI A13.1, and the 2024 International Mechanical Code for flammable refrigerant piping.

2. Attach markers using one of the following methods:

a. Laminated or bonded application of pipe marker to pipe (or insulation).

b. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both end of pipe marker, tape lapped 1½".

3. Lettering: Pre-printed nomenclature of at least ½" tall lettering that states the following:

   a. Refrigerant designation and Safety Group Classification
   b. Flow Direction
   c. "Warning – Risk of Fire Flammable Refrigerant"

4. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

B. ENGRAVED PLASTIC-LAMINATE SIGNS:

1. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units. Fasteners: Self-tapping stainless steel screws, expect contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.2 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer's or as required for proper identification and operation/maintenance of mechanical systems and equipment. Lettering in no case shall be less than 1/2" in height.

PART 3 - **EXECUTION**

3.1 APPLICATION AND INSTALLATION:

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPE MARKERS

A. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), exterior exposed locations and

above removable acoustical ceilings.

1. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.

2. Near major equipment items and other points of origination and termination.

3. Spaced intermediately at maximum spacing of 20' along each piping run

3.3 MECHANICAL EQUIPMENT:

A. Mechanical Equipment Identification, General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein.

1. Indoor Furnaces
2. Energy Recovery Unit
3. Duct Heaters
4. Exterior Condensing Units

END OF 220533

230548 - VIBRATION AND SOUND CONTROLS FOR PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of vibration isolation work required by this section is indicated on drawings and schedules, and/or specified in other Division 15 sections.

B. Types of vibration isolation products specified in this section include the following:

1. Flexible Duct Connectors.

C. Vibration isolation products furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division 23 sections.

1.2 QUALITY ASSURANCE:

A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years' successful experience in production of units similar to those required for project.

1.3 QUALITY ASSURANCE:

A. Product Qualification: Provide each type of vibration isolation unit produced by specialized manufacturer, with not less than 5 years' successful experience in production of units similar to those required for project.

PART 2 - PRODUCTS

2.1 ISOLATION MATERIALS AND SUPPORT UNITS:

A. Fiberglass Pads and Shapes: Glass fiber of not more than 0.18 mil diameter, produced by multiple-flame attenuation process, molded with manufacturer's standard fillers and binders through 10 compression cycles at 3 times rated load bearing capacity, to achieve natural frequency of not more than 12 Hertz, in thickness and shapes required for use in vibration isolation units.

B. Neoprene Pads: Oil-resistant neoprene sheets, of manufacturer's standard hardness and cross-ribbed pattern, designed for neoprene-in-shear-type vibration isolation, and in thicknesses required.

C. Flexible Duct Connectors: Laminated flexible sheet of cotton duct and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full-faced flanges and accordion bellows to perform as flexible isolators unit, and of manufacturer's standard length for each size unless otherwise indicated. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering vibration isolation products, which may be incorporated in the work include, but are not limited to the following:

1. Peabody Noise Control, Inc.
2. Korfund Dynamics Corp.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.

PART 3 - EXECUTION

3.1 APPLICATIONS:

A. General: Except as otherwise indicated on drawings, apply the following types of vibration isolators at indicated locations or for indicated items of equipment. Selection is Installer's option where more than one type is indicated.

B. Flexible Duct Connectors: Install at the following ductwork connections:

1. Connections with vibration-isolation-mounted air handling equipment (i.e. Rooftop Unit Curb Plenum, Fan Powered Boxes, Vent Fans, etc.).

2. Provide flexible duct connections wherever ductwork connects to vibration isolated equipment or as indicated on the Drawings. Construct flexible connections of neoprene coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment Duro-Dyne, Elgen, Ventfabric or equal. All canvas connections shall have a flame spread of 25 or less and smoke developed rating not higher than 50.

C. Isolation Hangers: Install where the following suspended equipment is indicated:

1. All Furnaces
2. Energy Recovery Units

END OF 230548

230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of testing, adjusting, and balancing work is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of pressure testing, setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.

B. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:

1. Split System HVAC Units
2. Exhaust/Ventilation Fans
3. Energy Recovery Unit
4. Kitchen Hood
5. Make-up Air Supply Fan
6. Air terminals

1.3 QUALITY ASSURANCE:

A. Installer: A firm certified by Associated Air Balance Council (AABC) or National Environmental Balance (NEBB) in those testing and balancing disciplines similar to those required for this project.

B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.4 SUBMITTALS:

A. Submit certified test reports signed by Test and Balance Supervisor who performed

TAB work.

B. Include identification and types of instruments used and their most recent calibration date with submission of final test report.

1.5 JOB CONDITIONS:

A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.

B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discharged building materials.

C. HVAC Testing, Adjusting and Balancing:

1. All equipment shall be adjusted to operate as intended by the specification. All bearings shall be lined up. Bearings that have dirt or foreign material in them shall be replaced with new bearings without additional cost to the owner. All thermostats and control devices shall be adjusted to operate as intended. Adjust burners, fans, etc. for proper and efficient operation. Certify to Engineer that all adjustments have been made and that system is operating satisfactorily. Adjust all supply outlets to supply the amount of air shown on the drawings. Further adjustments shall be made to obtain uniform temperature in all spaces. Calibrate, set, and adjust all automatic temperature controls. Check proper sequencing of all interlock systems, and operation of all safety controls.

2. Contractor shall employ the services of a testing and balancing firm to take test readings on all fans and units, and to adjust fan speeds to deliver specified amounts of air. Testing and balancing report logs shall be made showing all air supply quantities, fan and unit test readings, etc.; (3) three copies of the log shall be submitted to the Engineer before final inspection of the project and is necessary for final payment. Log shall be listed by unit, and shall additionally indicate unit horsepower, motor nameplate amps, and actual amps draw after all adjustments are completed. Also each room shall be listed with total exhaust, supply and return air quantities listed.

3. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original installer.

4. Prepare a report of recommendation for correcting unsatisfactory mechanical performances when system cannot be successfully balanced; including, where

necessary, modifications which exceed requirements of contract documents for mechanical work.

5. Retest, adjust and balance systems subsequent to significant system modifications, and resubmit test results.

D. Additional Testing Requirements:

The certified test and balance company shall also perform the following tests in addition to the above test, and shall include the results of these tests with the test and balance report:

1. All ducted split system furnaces are to have the cooling capacities test and included in the report. The information shall include the following:
    a. Entering air temperature and humidity
    b. Leaving temperature and humidity
    c. Airflow
    d. Exterior outdoor ambient temperature and humidity
    e. Exterior condensing unit nameplate voltage/phase/amps
    f. Exterior condensing unit measured voltage/phase/amps

END OF 230593

SECTION 230700: HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Ductwork Insulation:

a. Interior Supply Air Duct (where concealed)
b. Outside Air Intake Ductwork (where located outside of attic, such as in mechanical rooms and mechanical mezzanines)
c. Supply and Return Ductwork in Attic
d. Energy Recovery Exhaust Ductwork in Attic
e. Flexible duct to diffusers.

2. Piping System Insulation:

a. Refrigerant Suction Piping
b. Condensate Piping

1.2 QUALITY ASSURANCE:

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

1. Babcock & Wilcox Co., Insulating Products Div.
2. Certainteed Corp.
3. Johns-Manville Corp.
4. Keene Corp.
5. Knauf Fiber Glass
6. Owens-Corning Fiberglass Corp.

B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness,

and furnished accessories for each mechanical system requiring insulation.

B. Certified Tests: With product data submit certified test reports on performances including burning characteristics and thermal insulating valves.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove damaged insulation from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION:

A. All interior condensate piping is to be insulated with ½" thick, pipe insulation with a K factor .22 at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket with self-sealing lap, equal to Certain-teed, Mansville, Owens-Corning. Cover fittings with Zeston or equal premolded insulating fittings. Insulation shall be installed in a professional, neat appearing manner; poor workmanship shall be corrected at the Contractor's expense.

B. Refrigerant piping shall be insulated with 1" thick Imcolock flexible polyolefin foam pipe insulation. Insulation shall bear U.L. listing for a 25/50 flame smoke spread, and shall be rated for duty in return air plenums. Product shall be stabilized against ultra-violet light degradation. The following piping systems shall be insulated:

1. Condensing unit (CU): Suction lines.

C. As an option, exterior refrigerant piping and piping totally concealed in walls may be an open cell foam insulation product similar to Armaflex, but under no circumstances shall Armaflex, or equal plastic type insulation, be used in an air plenum, unless it bears a 25/50 flame/smoke spread rating. If Armaflex or similar product is used for outdoor service then two (2) coats of the weather-proofing sealant coating shall be applied as per manufacturer's installation instructions.

2.2 INSULATION SHIELDS

A. Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc with lengths equal to at least twice the pipe diameter.

2.3 DUCT INSULATION

A. Flexible Fiberglass Ductwork Insulation (Outside of Attic): FS HH-I-558, Form B, Type I. Insulation to have a density of 1.5 pcf density and shall have a "k" value of 0.28 maximum at 75

deg. F. Provide all-service insulation jacket with vapor barrier.

B. Flexible Fiberglass Ductwork Insulation (In Attic): FS HH-I-558, Form B, Type I. Insulation to have a density of 3.0 pcf density and shall have a "k" value of 0.28 maximum at 75 deg. F. Provide all-service insulation jacket with vapor barrier.

C. Application: Provide thicknesses of insulation on ductwork as follows:

1.	Supply Air Duct (where concealed):	1.5” thick
2.	Outside Air Intake Ductwork (where located outside of attic):	1.5” thick
3.	Supply and Return Ductwork in Attic:	2” thick
4.	Energy Recovery Exhaust Ductwork in Attic	2” thick
5.	Radon Piping:	1” thick

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner and angles and similar accessories as recommended by insulation manufacturer for applications indicated. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

E. All insulating materials, adhesives, coatings, etc., shall have a flame spread of 25 or less and smoke developed rating not higher than 50. All containers for mastics and adhesives shall have U.L. Label.

PART 3 - EXECUTION

3.1 INSTALLATION OF INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose. All ductwork shall be externally insulated unless otherwise indicated.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except at penetrations through exterior building barriers and where otherwise indicated.

3.2 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 230700

230900 - AUTOMATIC TEMPERATURE CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions Specifications section, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of electronic temperature control systems work is indicated by drawings and details, and by requirements of this section.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications for each control device, including installation instructions and start-up instructions.

B. Shop Drawings: Submit layout drawings of installed temperature control system including thermostats, controllers, switches, etc.. showing accurately scaled components and their relation to associated equipment, and connections. Submit shop drawings for each control system, containing the following information:

C. Include verbal description of sequence of operation.

1.4 WARRANTY WORK:

A. The Contractor shall be capable of responding to a warranty call within 24 hours of notification. The Contractor shall keep in stock material which routinely needs replacement or repairs.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Provide factory shipping cartons for each piece of equipment and control device. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe end damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS:

A. General: Provide electric temperature control products in sizes and of capacities indicated, conforming to manufacturer's standard materials and components as published in their product information.

2.2 MATERIALS AND EQUIPMENT:

A. General: Provide control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, sensors, controllers, and other components and required for complete installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information; designed and constructed as recommended by manufacturer, and as required for application indicated. Provide control systems with the following functional and construction features.

B. Relays And Switches

1. Relays and switches shall be of the positive and gradual acting type and shall be furnished and installed as required for the successful operation of the system. All switches shall have suitable indicating plates.

2. The Contractor shall provide all required relays, low-voltage transformers, terminal strips, enclosures, wiring, etc. to ensure that the required control sequences are maintained. Fully coordinate with the equipment manufacturer all control requirements that involves relays to the motor starters.

C. Carbon Dioxide Sensors/Controllers: Provide carbon dioxide sensors/controllers as indicated. Sensors shall achieve sensing through photoacoustic technology or other prior approved means. Sensor shall be complete with sampling chambers, transducers, wall mounting bracket & enclosure. provide with binary or analog output as needed. When binary "on-off" operation is desired, then provide DPDT control relay with unit. Manufacturer: The Trane Company or equal. Sensors shall include a display of present carbon dioxide measurement.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF AUTOMATIC TEMPERATURE CONTROLS:

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on the Drawings.

3.3 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Control Wiring: Install control wiring, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code. Install wiring in electrical conduit.

C. Install circuits over 25-volt with colored coded wire. Wire gauge to be in accordance with National Electrical Code.

D. Control wiring for analog functions shall be l8 AWG minimum with 600 volt insulation, twisted and shielded, 2 or 3 wire to match analog function hardware.

E. Power Wiring: Obtain power for temperature controls.

1. No more than 12 amps shall be put on one 20 amp circuit. No more than 3 circuits shall be run in one conduit.

F. Sensor Wiring: Sensor wiring shall be 20 AWG minimum twisted and shielded, 2 or 3 wire to match analog function hardware.

G. Software Programming: All software programs, including color graphic generation, shall be programmed by this Contractor.

H. Supply Circuit Identification:

1. Power feed locations for all controllers, DDC panels, etc. shall be indicated on the enclosures containing the device. Coordinate with electrical contractor and include Panel # and breaker.

3.4 FINAL ADJUSTMENT OF EQUIPMENT:

A. After completion of installation, adjust control valves, motors and similar equipment provided as work of this section.

B. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system. Coordinate services with Commissioning Authority.

C. Instruct the Owner's representative in the operation and maintenance of all control systems and equipment.

D. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

E. Adjustment and Service:

1. After completion of the installation, the automatic temperature control manufacturer shall regulate and adjust all thermostats, control valves, motors, and other equipment provided under his contract and shall place them in complete operating condition, subject to approval by the Architect and Owner.

PART 4 - CONTROL SEQUENCES

4.1 PROGRAMMABLE THERMOSTATS FURNISHED BY MANUFACTURER

A. Programmable thermostats shall be wired with remote temperature sensors as indicated on the Drawings for all thermostatic control and operation to be located in the indicated

office/storage area. Thermostats shall be programmed to the Owner's time schedules, and shall be thoroughly checked and placed in proper operation by the Contractor. Replace all units, where such thermostats are found faulty. Refer to equipment specifications and schedules for more information on scope of work.

B. Duct smoke detectors for shutdown of units are to be wired so that the sensing of smoke is hardwired to stop the fan operation. Smoke detector actuation is to be monitored by the fire alarm system or by local RED lamp that is visible from room occupants, and identified as to the unit served.

4.2 KITCHEN HOOD EQUIPMENT

A. Refer to Control Requirements under Section 15835. Refer additionally to Drawings for additional instructions.

4.3 VENTILATION CONTROLS

A. The ventilation equipment ERV-1 is to energize when one of the carbon dioxide sensors in meeting/dining room detects a carbon dioxide level above 900 PPM (adj.). Respective unit to de-energize when carbon dioxide levels fall below the limit.

B. Fan EF-1 is to be programmed for the building "Occupied-Unoccupied" sequence by wiring units through a 7-day/24 hour mechanical/electrical or electrical control time clock. Contractor shall set up the "Occupied-Unoccupied" schedule for this building as dictated by the Owner. Unit to operate when in Occupied mode, and de-energize in unoccupied mode.

C. EF-3 is to be controlled by a wall mounted fan switch.

END OF 230900

SECTION 232200 - REFRIGERATION PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of refrigeration piping systems work is indicated on drawings and schedules, and by requirements of this section.

B. Applications for refrigeration piping systems include the following:

1. Refrigerant suction, liquid and hot gas bypass piping between air handlers and their respective condensing units.

1.2 QUALITY ASSURANCE:

A. Installer: A firm with at least 3 years of successful installation experience on projects with refrigeration piping system work similar to that required for project.

B. Brazing: Comply with applicable requirements of ANSI B31.5 and ANSI B31-5a, "Refrigeration Piping", pertaining to brazing of refrigeration piping for shop and project site locations.

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data for refrigeration piping systems materials and products.

B. Brazing Certification: Certify brazing procedures, brazers and operators in accordance with ASME standards (ANSI B31.5).

C. Shop Drawings: Submit scaled layout drawings of installed refrigeration pipe and fittings including, but not necessarily limited to, pipe sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between piping and proximate equipment.

PART 2 - PRODUCTS

2.1 REFRIGERATION PIPING MATERIALS AND PRODUCTS:

A. General: Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for Refrigeration Piping where applicable, base pressure rating on refrigeration piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigeration piping systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE AND FITTINGS:

A. General: Provide pipe, tube, and fittings in accordance with the following listing:

1. Tube Size 4 1/8" and Smaller: Copper tube.

a. Wall Thickness: Type ACR, hard drawn temper.
b. Fittings: Wrought copper, solder joints. Joints: Soldered, silver lead solder, ANSI/ASTM B32, Grade 96 TS.

2. Tube Size 3/4" and Smaller: Copper tube. Wall Thickness: Type ACR, soft annealed temper.

a. Fittings: Cast copper alloy for flared copper tubes.
b. Joints: Flared.

3. Tube Size 7/8" through 4 1/8": Copper tube.

a. Wall Thickness: Type ACR, soft annealed temper.
b. Fittings: Wrought copper, solder joints.
c. Joints: Soldered, silver lead solder, ANSI/ASTM B32, Grade 96 TS.

2.3 SPECIAL REFRIGERATION VALVES:

A. General: Special valves required for refrigeration piping systems include the following types:

B. Ball and Check Valves:

1. Shutoff Valves: Forged brass, packed, levered ball valves, 300°F (149°C) temperature rating, 500 PSI working pressure.

2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250°F (121°C) temperature rating, 500 PSI working pressure.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering ball and check valves which may be incorporated in the work include, but are not limited to the following:

1. Henry Valve Co.
2. Parker Hannifin Corp, Refrigeration & Air Conditioning Div.
3. Sporlan Valve Co.

2.4 REFRIGERATION ACCESSORIES:

A. Thermal expansion valves and solenoid valves shall be as provided by the HVAC equipment supplier.

B. Refrigerant Strainers: Brass shell end and connections, brazed joints, monel screen, 100 mesh, UL listed, 350 PSI working pressure.

C. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200°F (93°C) temperature rating, 500 PSI working pressure.

D. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL listed, 500 PSI working pressure.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering refrigeration accessories which may be incorporated in the work include, but are not limited to the following:

1. Alco Controls Div., Emerson Electric Co.
2. Henry Valve Co.
3. Parker-Hannifin Corp., Refrigeration & Air Conditioning Div.
4. Sporlan Valve Co.

PART 3 - EXECUTION

3.1 INSTALLATION OF REFRIGERATION PIPING:

A. Pitch refrigerant piping in direction of oil return to compressor. Provide oil traps and double suction risers where indicated, and where required to provide oil return.

3.2 INSTALLATION OF REFRIGERATION ACCESSORIES:

A. Refrigerant Strainers: Install in refrigerant lines as indicated or required, and in accessible location for service.

B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines or required, in accessible location.

C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated or required, and in accessible location for service.

3.3 EQUIPMENT CONNECTIONS:

A. General: Connect refrigerant piping to mechanical equipment in manner shown, and comply with equipment manufacturer's instructions where not otherwise indicated.

3.4 FIELD QUALITY CONTROL:

A. Refrigerant Piping Leak Test: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5 and ANSI B31.5a, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then

200 PSI using halide torch. System must be entirely leak free.

B. Repair or replace refrigerant piping as required to eliminate leaks, and retest as specified to demonstrate compliance.

END OF SECTION 232300

233113 – METAL DUCTS AND FANS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) HVAC duct construction standards, latest edition.

B. Industry Standards: Comply with American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.

C. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".

D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's data for each type of duct accessory, including dimensions, capacities, and materials of construction; and installation instructions.

B. Submit assembly-type shop drawings for each type of duct assembly showing interfacing requirements with ductwork, and method of fastening or support.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

A. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lockforming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

2.2 FILTERS:

A. Two Types of filters shall be used where indicated on the drawings: 1” throwaway, and 2” pleated MERV 13 high efficiency throwaway.

B. All air units shall have filters installed any time they are operated before final

acceptance. Provide extra set of filters and install in units just before turning over building to owner. Manufactured by Duststop, Farr, Cambridge, or approved equal.

2.3 DUCTWORK:

A. Furnish and install all galvanized steel ductwork and housings as shown on drawings. All ducts shall be in conformance with current SMACNA Standards relative to gauge, bracing, joints, etc. Reinforce all housings and all ducts over 30" with 1¼" angles not less than 5'-6" on centers, and closer if required for sufficient rigidity to prevent vibration. Provide airtight joints and blade elbows. Support horizontal runs of duct on not to exceed 8'-0" centers from strap iron hangers.

B. All offsets in ducts of 45 degrees or more shall have turning vanes of same gauge as duct and shall be rigidly fastened with guide strips. Vanes in ducts over 30" deep shall be installed in multiple sections with vanes not over 30" long and shall be rigidly fastened.

C. Provide balancing dampers in all supply runouts, where shown on drawings and wherever necessary for complete control of air flow. Where access to dampers through a suspended ceiling is required, coordinate the proper location of the access doors. Provide "Spin-in" fitting and double bearing volume dampers for all round duct branch takeoffs to individual air devices. Spin-in fittings shall be installed with a minimum of (5-6) five to six sheet metal screws regardless of manufacturer's recommended screw layout.

D. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

E. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

F. Ductwork Support Materials: Except as otherwise indicated, provide hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.4 GREASE EXHAUST DUCTS:

A. Ducts connecting kitchen exhaust hoods to exhaust fans shall be #16 gauge black iron with continuously welded joints and clean-out doors. Duct shall be enclosed in fireproof enclosure

per International Mechanical Code if required by local code authorities.

B. Ducts shall be so constructed and sloped as to provide suitable drainage of grease to a collection point. At the base of each vertical riser, a residue trap shall be provided with provisions for cleanout.

C. Shop drawings of the kitchen rangehood exhaust ductwork shall be made and submitted to the appropriate reviewing agency. Any fees associated with this submittal shall be borne by this Contractor.

2.5 FLEXIBLE DUCT:

A. Flexible duct shall be Class 1, insulation type, polymeric liner with steel wire helix core duct, fiberglass insulation 1½" thick and outer fiberglass vapor barrier jacket. Flexible duct run shall not exceed 10 feet in length, and be installed in as straight a line as possible. Manufactured by Thermaflex "M-KE", Certainteed, Flexmaster.

2.6 DAMPERS:

A. Low Pressure Manual Dampers: Provide dampers of single blade or multiblade type, constructed in accordance with SMACNA "Low Pressure Duct Standards". Volume dampers shall be opposed blade interlocking type, factory made by Ruskin, APC, Air Balance, or approved equal.

2.7 TURNING VANES:

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "Low Pressure Duct Standards".

B. Manufactured Turning Vanes: Provide turning vanes constructed of 1½" wide curved blades set at 1 1/2" o.c., and set into side strips suitable for mounting in ductwork, per SMACNA Standards for low pressure duct.

2.8 DUCT HARDWARE:

A. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Concealed Damper regulators: For dampers located above inaccessible plaster or gypsum board ceilings, provide Young Regulator Co. Model No. 301 CDS concealed regulators with cover plates. Units shall be flush with finished surface. Key shall operate damper rod. Lock nut and spring washer shall hold damper in fixed position.

C. Bowden Cable Control Dampers: Where indicated on the drawings, (or in lieu of the type 301 system) Bowden cable control dampers (by Young Regulator) are to be provided to control inaccessible manual dampers above inaccessible ceilings. Cable controllers shall be locking with rack and pinion holding damper securely at setting. The control system to consist of a concealed damper regulator, sheathed stainless steel cable system, rack and pinion controller, worm gear actuator and damper compatible with system. Concealed cup regulator to be Young 270-301(FS) with coverplate. System specialties must be submitted for review prior to purchase.

2.9 DUCT ACCESS DOORS:

A. Construction: Construct of same or greater gate as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with 1 handle type latch for doors 12" high and smaller, 2 handle type latches for larger doors.

2.10 DUCT SEALANT

A. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

B. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

2.11 EXHAUST FANS (EF):

A. Provide tubular centrifugal fan, belt driven, vertical or horizontal mount, as scheduled. Jenn-air, Penn, Greenheck, Acme, Aerolator, Aerovent, Dayton, Cook or equal. Provide aluminum housings as scheduled, with the appropriate spark resistant construction. Provide capacitor-start, induction run type motor for belt driven fans.

B. Provide fans with inlet and outlet flanges with mounting holes. All fans are to receive a corrosion resistant; refer to Drawings for type and application.

C. Each fan to be provided with either spring mount vibration isolation or neoprene mounts; Refer to Drawings.

D. Motors to be high efficiency.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true to shape and to prevent buckling.

C. Seal ductwork, to seal class recommended, and method prescribed in SMACNA "HVAC Duct Construction Standards" Latest Edition.

D. Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements.

E. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations, or if not otherwise indicated, run ductwork in shortest route which does not obstruct unusable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearances to ½" where furring is shown for enclosure of concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct over duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1½".

G. Where ducts pass thru block walls, ensure that a lintel sized per the structural specifications is provide above penetration.

H. Install turning vanes in all rectangular supply, return and outside air duct turns 45 deg. or greater.

I. Coordinate duct installations with installation of accessories, dampers, equipment, controls and other associated work of ductwork system.

J. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards – Latest Edition".

3.2 CLEANING AND PROTECTION:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

3.3 TESTING FOR LEAKAGE:

A. General: After each duct system is completed, test for duct leakage in accordance with SMACNA "High Pressure Duct Standards - Latest Edition, Chapter 10 - Testing and Leakage". Repair leaks and repeat tests until total leakage is less than 3% maximum of system design air flow.

END OF 233113

233713 - GRILLES, REGISTERS, DIFFUSERS, & LOUVERS

PART 1 - GENERAL

1.1 SUBMITTALS:

A. Product Data: Submit manufacturer's data on outlets and inlets including the following:

B. Schedule of outlets and inlets indicating drawing designation, room location, number furnished, model number, size and accessories furnished.

C. Data sheet for each type of outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

D. Performance data for each type of outlet and inlet furnished, velocity traverse, throw and drop, and noise criteria ratings. Indicate selections on data.

E. Ratings are to be certified by ADC or AMCA.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Deliver outlets and inlets wrapped in factory fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, capacity, direction of throw, and type indicated; constructed of materials and components as specified in this section and as required for complete installation.

B. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as indicated and as specified in this section. The following requirements shall apply:

C. Diffuser Faces:

1. Square: Square housing, core of concentric louvers, square or round duct connection, housing extended to form panel to fit in ceiling module.

2. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or rectangular duct connection.

D. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

E. Dampers:

1. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser.

2. Butterfly: 2 semi-circular flaps connected to linkage adjustable from face of diffuser with key, and with straightening grid.

F. Diffuser Accessories:

1. Operating Keys: Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to the following:

1. Airguide Corp.
2. Anemostat Products Div., Dynamics Corp. of America
3. Carnes Co., Div. of Wehr Corp.
4. Barber-Colman Co., Air Distribution Div.
5. Environmental Elements Corp., Subs. Koppers Co.
6. Krueger Mfg. Co.
7. Tuttle & Bailey Div. of Interpace Corp.
8. Titus Co.

2.2 CEILING RETURN, EXHAUST AND TRANSFER AIR REGISTERS AND GRILLES:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling registers and grilles, where shown, of size, capacity and type indicated; constructed of materials and components as specified in this section; and as required for complete

installation.

B. Ceiling Compatibility: Provide registers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling register or grille.

C. Register and Grille Materials:

1. Aluminum Construction: Manufacturer's standard extruded aluminum frames and adjustable blades, unless noted otherwise.

D. Register and Grille Faces:

1. Horizontal Straight Blades: Horizontal blades, individually adjustable, at manufacturer's standard spacing.

2. Vertical Straight Blades: Vertical blades individually adjustable at manufacturer's standard spacing.

E. Register Dampers:

1. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register.

F. Register and Grille Accessories:

1. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to the following:

1. Airguide Corp.
2. Anemostat Products Div., Dynamics Corp. of America
3. Barber Colman Co., Air Distribution Div.
4. Carnes Co., Div. of Wehr Corp.
5. Environmental Elements Corp., Subs, Koppers Co.
6. Tempmaster Corp.
7. Titus Co.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Install all outlets and inlets as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of outlets and inlets with other work.

C. Provide transition ductwork as required to mate to the device inlet/outlet.

END OF 233713

233800 - KITCHEN HOOD EXHAUST EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Extent of kitchen exhaust hood, fire suppression, dishwasher exhaust, make-up air units, and exhaust fan work is shown on drawings, and by requirements of this section.

B. Provide motor starters, piping, wiring and other control equipment to deliver a complete operating and code compliant system.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of kitchen hoods, make-up air units, hood chemical suppression systems and power ventilators and exhaust fans, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years. Hood suppliers shall have proven experience obtaining approvals from the Kentucky Department of Housing, Building, and Construction.

B. AMCA Compliance: Provide power exhaust fans bearing the Air Movement and Control Association, Inc. (AMCA) Certified Ratings Seal.

C. UL Compliance: Provide equipment electrical components which have been listed and labeled by Underwriters Laboratories (UL).

1.3 SUBMITTALS:

A. Product Data: Submit manufacturer's data for power ventilators, exhaust fans, kitchen exhaust hoods, exhaust ductwork, hood fire suppression system, make-up air units, etc.; including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.

B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

C. It is the sole responsibility of the Contractor and Kitchen Hood Supplier to obtain the approval of the Fire Marshall. Upon the review of the Engineer, the Contractor shall then submit to the Fire Marshall's office and shall supply all required information including but not limited to: roof sections thru hood exhaust ductwork, air balance summaries, kitchen equipment plans to scale with hood overhangs indicated, hood elevations, suppression drawings stamped by a licensed suppression designer, grease filter data, etc. No allowance of time or funds will be made for failure to obtain proper approvals in a timely manner.

PART 2 - PRODUCTS

2.1 KITCHEN WALL CANOPY EXHAUST HOOD (H-1):

A. Provide Greenheck wall canopy hood supplied for required Hood (H-1) as indicated on the Darwings; Halton, Captive-Aire, Aerolator, or prior approved equal. Canopy exhaust hood shall be in strict accordance with NFPA 96, BOCA National Mechanical code and the requirements of the Kentucky Department of Housing, Buildings, and Construction. Hood construction to include a front plenum section with front discharge air grilles. Short cycle discharge air grilles will not be acceptable.

B. Hood requirements shall be as follows:

1. Provide the hood with a backsplash/filler panel, full height. The filler panel shall be stainless steel and be integral with the wall mounting flange. Also provide a stainless steel end skirt on the right and left hand side of the hood. End skirt to extend to 36" AFF and to be full width of hood.

2. All construction shall be 16 Ga. type 304 stainless steel with all welded and polished seams. Provide U.L. classified centrifugal grease filter of the non-clogging type that is easily removable. The hood shall be U.L. classified, and bear BOCA and NSF labels.

C. Provide the following additional items:

1. Exhaust duct collar.

2. Removable grease collection containers.

3. Vapor proof incandescent or compact fluorescent lighting with gasketed enclosures and unbreakable lenses. Fixtures shall be U.L. listed for hood service and be factory wired to a switch located on the hood. Provide with junction box.

4. Make-up air collars.

5. Grease X-tractor high efficiency grease filters.

6. Refer to Kitchen Hood Sequence of Control and Hood Fire Suppression System for additional information regarding the hood suppression system.

2.2 HOOD EXHAUST FANS:

A. Hood exhaust fans shall be Aerolator, Dayton, Penn, Cook, or equal as scheduled on the drawings, complete with roof-mounted aluminum housing, aluminum centrifugal wheel, heat baffle, UL grease approval, built-in grease trough, belt drive, motor with integral overload protection, motor starter, and disconnect switch in housing.

2.3 KITCHEN HOOD FIRE SUPPRESSION SYSTEM:

A. Provide Ansul or approved equal wet chemical type fire extinguishing system for the hood system complete with hood nozzles, wet chemical cylinders, piping, etc. and all accessories to provide an approved, operating system. Fully coordinate with the kitchen hood supplier as to the requirements for the suppression of the hood. Cylinders and local controls for the system shall be contained in a stainless steel compartment located as indicated on the drawings. Two remote pull stations shall be located near the exits of the kitchen. Provide required interlocks to shunt trip the power supply to the kitchen equipment per code. System shall be in full conformance with NFPA Bulletin 96. System shall also be interlocked to shut off makeup air fan when activated.

B. Provide wiring of the fire extinguishing system for each exhaust hood and interlock wiring of automatic shut-off valves and shunt trip breakers for complete shut-down of all equipment under hood. Furnish relay controls, panels, switches, pilot lights, starter contacts, transformers, etc. as required to control the exhaust fans, hoods, make-up air units, and Ansul fire suppression system per NFPA 96. Provide dry contacts for each hood system to communicate a fire situation to the fire alarm panel. Certification documentation shall be furnished as a part of the shop drawing submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install units as indicated and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Protect units with protective covers during balance of construction.

3.2 ADJUSTMENT AND CLEANING OF UNITS:

A. General: After construction is completed, including painting, clean unit exposed surfaces, clean grease filters and inside of hoods.

B. Retouch any marred or scratched surfaces of factory finished hood serfaces, using finish materials furnished by manufacturer.

3.3 TESTING:

A. General: After installation of ventilators and exhaust fans has been completed, test each to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

B. Refer to Division 23 section "Testing, Adjusting, and Balancing".

3.4 SEQUENCE OF OPERATION, KITCHEN MAKEUP AIR SYSTEM CONTROL:

A. Controls for hood to include manual hood exhaust fan ON-OFF and automatic control by rise of temperature above a baseline temperature of room. Provide hood thermostat and room thermostat for baseline. Upon rise in temperature indicating cooking use under the hood, hood exhaust fan shall auto start. Upon a temperature fall to below differential setpoint, exhaust fan and associated make-up air devices shall de-energize.

B. The supply fan unit SF-1 shall be interlocked with the hood exhaust fan to operate when the exhaust fan is on. A gravity damper upstream of fan shall open when fan is energized; damper shall gravity return closed upon a loss of power.

C. Electric duct heater DH-1 for the make-up air system is to be furnished with a leaving air temperature controller which will maintain minimum leaving air temperature during winter operation. The unit is to be furnished with an outdoor thermostat to lock out the heating section when outdoor temperature rises above its delivery setting (60° F., adjustable). The SCR controller for the duct heater to maintain 62 deg.F (adj.) leaving air temperature sensor, with a sail switch or differential pressure switch installed to prove airflow before the heat engages.

D. All controls to be UL listed.

END OF SECTION

238127 - UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacturer of terminal units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. ARI Compliance: Test and rate heat pump units in accordance with Air Conditioning and Refrigeration Institute (ARI) Standards.

C. UL or ETL Compliance: Construct and install heat pump units in compliance with applicable standards.

1.2 SUBMITTALS:

A. Shop Drawings: Submit assembly type shop drawings showing unit dimensions, construction details, and field connection details.

B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor, and drive replacement, and spare parts lists. Include this data in maintenance manuals.

PART 2 - **PRODUCTS**

2.1 COOLING ONLY CONDENSING UNITS (CU):

A. The exterior condensing units shall be Trane, York, Daikin, Mitsubishi, Carrier, Lennox, or approved equal. Provide split system cooling only service as listed on the drawings. Units shall be UL and ARI listed.

B. Provide unit with compressor mounted on vibration isolators, suction accumulator, loss of charge protection, high pressure cut-out, low suction pressure protection, external service valves, test port, crankcase heater, liquid line solenoid valve, thermostatic expansion valve, and liquid line filter-drier.

C. Provide unit with heavy ga. chassis and weather resistant coating, and full charge of R-32 or R-454B refrigerant.

D. Provide unit with accessories and additional requirements as listed on the drawings.

2.2 GAS FURNACES WITH DX COOLING COILS (AHU)

A. Provide horizontal or vertical flow propane gas fired furnaces Trane, Carrier, York, Lennox or equal as scheduled on the drawings. Unit construction shall be certified by A.G.A. Units shall be provided with aluminized steel primary heat exchanger.

B. Unit casing shall be heavy gauge steel with baked enamel finish. The heat exchanger section shall be insulated, and the filters shall be 1" replaceable.

C. Unit shall be provided with standard 100% safety controls to shut off all gas supply in case of malfunction. Ignition shall be electronically controlled by the unit control system with flame sensing devices. Provide all drain and vent components.

D. All venting and intake piping materials used shall meet with the listing requirements of the furnace. No venting materials to be used, which are not specifically approved by the furnace manufacturer.

E. Unit shall be provided with programmable 7-day/24-hour thermostatic controls, staged for heating and cooling. Provide all control transformers and relays as required. See control specifications for other potential requirements of thermostats.

F. Provide vertical units with discharge refrigerant 'A' frame cooling coil. All coils to be manufactured of copper tubes and aluminum fins. Coil casings shall be insulated, and shall be provided with drain pan and condensate pipe connections, with condensate overflow safety switch. Capacity control by factory installed expansion valve.

G. A refrigerant detection system to be provided for each HVAC system. The refrigerant detection system shall comply with the following:

1. Utilize a set point, nonadjustable in the field, to generate an output signal to initiate mitigation actions.

2. Be capable of detecting the presence of a specified refrigerant corresponding to the refrigerant designation of the refrigerant contained in the refrigeration system. Field recalibration of the refrigerant detection system shall not be permitted.

3. Have access for replacement of refrigerant detection system components.

4. Have self-diagnostics to determine operational status of the sensing element.

5. Energize air circulation fan of the equipment upon failure of a self-diagnostic check.

6. Generate an output signal in not more than 30 seconds when exposed to a refrigerant concentration of 25%LFL (+o%, -1%).

H .Mitigation Action Requirements. The following mitigation actions shall be completed in not more than 15 seconds after the initiation of the output signal of the refrigerant detection system, and shall be maintained for at least 5 minutes after the output signal has reset:

a. Energize the air circulation fan(s) of the equipment per the manufacturer's instructions.

b. De-energize furnace heat and/or heat pump heating functions. De-energize any duct resistance heat installed in the air duct that is connected to the refrigeration system.

c. Activate any safety shut-off valves utilized to reduce releasable refrigerant charge.

d. De-energize potential ignition sources, including open flames and unclassified electrical sources of ignition with apparent power rating greater than 1 kVA, where the apparent power is the product of the circuit voltage and current rating.

2.3 PACKAGE ENERGY RECOVERY OUTSIDE AIR INTAKE UNITS (ERV)

A. Core Type Energy Recovery ERV Units (Where indicated):

1. Provide Greenheck MiniCore or approved equal, provided all specifications are met. Units shall be listed per UL 1812, Heating and Cooling Equipment. Energy transfer ratings of the cross flow energy recovery core shall be AHRI Certified. Performance shall be as scheduled on plans. Entire unit warranty to be one year, with a 5 year warranty on the total energy core.

2. Unit cabinet construction shall include 0.5 in. fiber fill insulation and G90 galvanized paneling. Unit base to be designed to be hung or mounted on a base with neoprene isolation as an option. All components shall be easily accessible through removable lift off panels. Supply and exhaust air filters shall be 2 in. thick pleated fiberglass.

3. Provide with forward curved fans with EC motors to provide a high efficient blower. All internal electrical components shall be factory wired for single point power connection. All electrical components shall be UL Listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code.

4. Provide unit with the following:

a. Intake & exhaust filters
b. Winter Operation Control Kit with timed exhaust

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install units as indicated and in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Protect units with protective covers during balance of construction.

3.2 ADJUSTMENT AND CLEANING OF UNITS:

A. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

B. Retouch any marred or scratched surfaces of factory finished cabinets, using finish materials furnished by manufacturer.

END OF 238127

Division 26 & 28
Electrical

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables.
2. Sleeve seals.
3. Grout.
4. Common electrical installation requirements.

1.2 SUBMITTALS

A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico, Inc.
    c. Metraflex Co.
    d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
4. Pressure Plates: Stainless steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Stainless steel]of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items unless noted otherwise on the drawings.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetration unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 SUBMITTALS

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

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70.

B. Conductor Insulation: Comply with NEMA WC 70 for Types THW, XHHW, THHN and THWN.

2.2 CONNECTORS AND SPLICES

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

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

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.

3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

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

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both wall surfaces.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

I. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

J. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding critical equipment and service for compliance with requirements.

2. Perform visual inspections, mechanical inspections, and finally electrical megger testing for insulation integrity of the above item #1 conductors. Certify compliance with results of accepted testing parameters with documentation on standard megger testing forms, including weather conditions, meter utilized and the signature of the person performing the testing along with their qualifications to perform this testing.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
   a. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

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

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad, 3/4-inch by10 feet in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No.8 AWG and smaller, and stranded conductors for No.6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," or as detailed on the drawings, shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes,

using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at service disconnect enclosure grounding terminal, and at ground rods..

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power Distribution Panelboards Serving Electronic Equipment: 3 ohm(s).

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

Hangers and supports for electrical equipment and systems.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data: For steel slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.4 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

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

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

1) Hilti Inc.
2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
3) MKT Fastening, LLC.
4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [or other] support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks and manholes, and underground handholes, boxes, and utility construction.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.

B. IMC: ANSI C80.6.

C. EMT: ANSI C80.3.

D. FMC: Zinc-coated steel.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquid tight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

A. ENT: NEMA TC 13.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Nonmetallic Floor Boxes: Nonadjustable, round.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

I. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit or IMC.

2. Concealed Conduit, Aboveground: rigid steel conduit, IMC or EMT.
3. Underground Conduit: RNC, Type EPC-40PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFNC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:
   a. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: Rigid steel conduit or IMC.
7. Raceways for Optical Fiber or Communications Cable: EMT.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Installation at right angles to reinforcement, EC shall place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Raceways for Communications Cable: Install as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

P. Set metal floor boxes level and flush with finished floor surface.

Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

5. Warning Planks: Bury underground line warning tape or warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches on center. Align planks along the width and along the centerline of conduit.

3.4 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly

END OF SECTION 260533

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 FLOOR MARKING TAPE

A. 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES.

2.8 INSTRUCTION SIGNS

A. Engraved laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment to applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. The minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. The minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. The minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. The minimum letter height shall be 1 inch.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120v to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction (AHJ) permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning sign.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment as noted on the drawings.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: engraved limacoid label, unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
c. Elevated Components: Increase the sizes of labels and letters to those appropriate for viewing from the floor.
d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor photoelectric switches.
3. Indoor occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.
6. Emergency shunt relay.

B. See Division 26 Section "Network Lighting Controls" for low-voltage, manual and programmable lighting control systems.

C. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Intermatic, Inc.
3. Leviton Mfg. Company Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Paragon Electric Co.; Invensys Climate Controls.

6. Sensor Switch
7. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: SPST.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Programs: channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
7. Astronomic Time: All channels.
8. Battery Backup: For schedules and time clock.

2.2 INDOOR OCCUPANCY SENSORS

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

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. RAB Lighting, Inc.
6. Sensor Switch, Inc.
7. TORK.
8. Watt Stopper (The).

D. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; Provide 0-10vdc dimming control with adjustable daylighting discount factor.

E. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft when mounted on a 96-inch-high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

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

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

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Novitas, Inc.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

D. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.

3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

E. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
2. Time Delay: 30-second minimum, to prevent false operation.
3. Lightning Arrester: Air-gap type.
4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.4 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.
6. Hubbell Lighting.
7. Lithonia Lighting; Acuity Lighting Group, Inc.
8. MicroLite Lighting Control Systems.
9. Square D; Schneider Electric.
10. TORK.
11. Touch-Plate, Inc.
12. Watt Stopper (The).

B. Description: Electrically operated and electrically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings matching the NEMA type specified for the enclosure.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No.14AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. When requested within 12 months of the date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

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

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work and shall be replaced.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.3 SUBMITTALS

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

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detailed bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Field quality-control reports.

D. Panelboard schedules for installation in panelboards.

E. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Sub feed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lug.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
   f. Shunt Trip: The trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
   h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and **incorporate Owner's final room designations.** Obtain owner's approval before installing. Use a computer or typewriter to create directories; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical megger testing.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace them with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall-box motion sensors.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

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

    a. Cooper; 5351 (single), 5352 (duplex).
    b. Hubbell; HBL5351 (single), CR5352 (duplex).
    c. Leviton; 5891 (single), 5352 (duplex).
    d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenance Réceptacles, 125 V, 20 A:

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

    a. Cooper; GF20.
    b. Pass & Seymour; 2084.

2.4 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

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

    a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.5 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic 0.035-inch.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp and wet Locations: cast aluminum with spring-loaded lift “in use lockable “cover, listed and labeled for use in "wet locations."

2.6 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: **As selected by Architect,** unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

a. Cut back and pigtail or replace all damaged conductors.
b. Straighten conductors that remain and remove corrosion and foreign matter.
c. Pig-tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3 Verify that dimmers used for LED luminaire control are listed for that application.
4. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with white-filled lettering on the face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace them with new, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Enclosures.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

D. Field quality-control reports.

E. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate **indicated** fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; **integrally mounted, self-powered** type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: **One SPDT switch** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Alarm Switch: One **NO** contact that operates only when circuit breaker has tripped.

2.3 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, **Type 1**.
2. Outdoor Locations: NEMA 250, **Type 3R**.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.2 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior lighting fixtures.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall mounted dimmers, motion detectors and on-off controls.

1.2 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

C. Field quality-control reports.

1.3 QUALITY ASSURANCE

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

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings].

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit cleaning and maintenance without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during cleaning and maintenance and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

    a. Lens Thickness: At least [0.125-inch minimum unless otherwise indicated.
    b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

2.3 EMERGENCY POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with driver. Comply with UL 924.
1. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2. Battery: Sealed, maintenance-free, nickel-cadmium type.
3. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
4. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.

2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, the relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. The lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports, and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture support.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to the lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.3 QUALITY ASSURANCE

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

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated in the Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. Doors shall be removable for cleaning or replacing lenses.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As **selected by the Architect,** from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: **shall be selected by architect at time of shop drawing submittals**– provide color samples with shop drawing submittals on similar metal as luminaire that is to be provided.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Fasten luminaire to structural supports as indicated on the drawings.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Adjust luminaires that require field adjustment or aiming.

3.2 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.3 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

END OF SECTION 265600

SECTION 283116 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections:

1. Division 01 General Requirements

2. Division 07 Thermal and Moisture Protection, Section 078413 Penetration Firestopping

3. Division 08 Openings, Section 087100 Door Hardware

4. Division 21 Fire Suppression

5. Division 23 Heating Ventilating and Air Conditioning Monitoring & Control (HVAC).

6. Division 26 Electrical, Section 260500 Common Work Results for Electrical

1.02 SUMMARY

A. Section Includes:

1. This specification describes an addressable Fire Detection and alarm signaling system. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

2. The system shall be in full compliance with National and Local Codes.

3. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.

4. All equipment furnished shall be new and the latest state-of-the-art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.

5. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.

6. In the interest of job coordination and responsibilities, the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a “UL Listing Certificate” for the complete system.

7. The system specified shall be that of the EDWARDS FIRE AND LIFE SAFETY COMPANY, which meets the project requirements. Systems manufactured by Simplex or Siemens will be considered for prior approval. Provide submittals of proposed equipment 10 days prior to bid date for prior approval consideration by the Engineer. Equipment approved shall meet all the requirements spelled out in this specification.

1.03 DEFINITIONS

A. ASME: American Society of Mechanical Engineers.

B. FACP: Fire alarm control panel.

C. FM: FM Global (Factory Mutual).

D. Furnish: To supply the stated equipment or materials.

E. Install: To set in position and connect or adjust for use.

F. LED: Light-emitting diode.

G. NCC: Network Command Center.

H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

I. NICET: National Institute for Certification in Engineering Technologies.

J. Provide: To furnish and install the stated equipment or materials.

K. UL: Underwriters Laboratories.

1.04 SYSTEM DESCRIPTION

A. The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor-based operating system having the following capabilities, features, and capacities:

1. The local system shall provide status indicators and control switches for all of the following functions:

a. Audible and visual notification alarm circuit zone control.

b. Status indicators for sprinkler system water-flow and valve supervisory devices.

c. Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

1.05 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.

B. All interconnections between this system and the monitoring system shall be arranged so that the entire system can be UL-Certificated.

C. System shall be a complete, supervised, non-coded, addressable multiplex fire alarm system conforming to NFPA 72.

D. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal.

E. The system shall be capable of the following configurations. Both configurations are permitted on the same network.

F. The system shall be p provided with digital alarm communication transmitter.

G. The system shall provide an off-normal warning prior to reset for all active devices.

H. The system shall be capable of remote monitoring via a proprietary software system that provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.

I. The system shall be capable of being configured via a PC Tool.

J. The system shall provide the following functions and operating features:

1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.

2. Provide Class B initiating device circuits.

3. Provide two Class B notification appliance circuits. Arrange circuits to allow individual, selective, and visual notification by zone. Notification appliance circuits shall be zoned to correspond with the building fire barriers and other building features.

4. Strobes shall be synchronized throughout the entire building.

5. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

K. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged in system history during the walk-test.

L. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

M. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual pull station

2. Heat detector

3. Addressable area smoke detectors

4. Standard Addressable Duct smoke detector

5. Specialized Duct Smoke detector

6. Automatic sprinkler system water flow switch.

N. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using an LCD display with multiple detail screens.

1. Fire Alarm Condition:

   a. Sound an audible alarm and display a custom message defining the building in alarm and the specific alarm point initiating the alarm on an LCD display.

   b. Log into the system history archives all activity pertaining to the alarm condition.

   c. Sound the ANSI 117-1 signal with synchronized audible notification appliances and synchronized strobes throughout the facility.

   d. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

   e. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

   f. System operated duct detectors as per local requirements shall accomplish HVAC shut down.

2. Supervisory Condition:

   a. Display the origin of the supervisory condition report at the local fire alarm control panel LCD display.

   b. Activate supervisory audible and dedicated visual signal.

   c. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

   d. Record within system history the initiating device and time of occurrence of the event.

3. Trouble Condition

   a. Display at the local fire alarm control panel LCD display, the origin of the trouble condition report.

   b. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

c. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

d. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

e. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

f. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

O. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:

1. Supervisory power requirements for all equipment.

2. Alarm power requirements for all equipment.

3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.

4. Voltage drop calculations for wiring runs demonstrating worst-case condition.

5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

C. Submit manufacturer's requirements for testing Signaling Line Circuits and device addresses prior to connecting to control panel. At a minimum the following tests shall be required; device address, the usage (Alarm, Supervisory etc), environmental compensation, temperature ratings for thermal detectors and smoke detector sensitivities. This requirement shall need approval before any wiring is connected to the control panel.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:

    a. Floor plans in a CAD compatible format at a scale of 1/8”=1’-0” showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.

    b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.

4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.

5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Light fixtures.

2. HVAC registers

3. Fire protection equipment interfaces

4. Special suppression system interfaces

F. Qualification Data: For qualified Installer, manufacturer, fabricator, testing agency, and factory-authorized service representative.

G. Source quality-control reports.

H. Field quality-control reports.

I. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.

J. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

K. Warranty: Sample of special warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. FM Global (Factory Mutual (FM)):FM Approval Guide

2. National Fire Protection Association (NFPA)

a. NFPA 70 National Electrical Code

b. NFPA 72 National Fire Alarm Code

c. NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems

d. NFPA 101 Life Safety Code

3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition

a. UL Fire Protection Equipment Directory

b. UL Electrical Construction Materials Directory

c. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems

d. UL 228 – Door Holding Devices

e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems

f. UL 268A - Smoke Detectors for Duct Application

g. UL 464 - Audible Signal Appliances

h. UL 497A – Secondary Protectors for Communications Circuits

i. UL 521 - Heat Detectors for Fire Protective Signaling Systems

j. UL 864 - Control Units for Fire Protective Signaling Systems

k. UL 1283 – Electromagnetic Interference Filters

l. UL 1449 - Transient Voltage Surge Suppressors

m. UL 1971 - Signaling Devices for the Hearing Impaired

4. International Code Council

a. International Building Code

b. International Fire Code.

5. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

6. ISO 9002

B. Supplier Qualifications

1. The manufacturer of the supplied products must utilize multi-channel product distribution on a national basis to be considered for this bid. The manufacturer must have factory branches as well as independent distributors to allow the end user with the ability to utilize factory trained and authorized competitive service providers after system installation and commissioning.

2. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided.

3. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.

4. The suppliers shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.

5. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.

C. Installer Qualifications:

1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.

2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.

3. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

D. Testing Agency Qualifications: Qualified for testing indicated.

E. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.

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

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.09 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.

1. Labor Installation Warranty Period: 1 year from date of Substantial Completion.

2. Equipment warranty Period: 3 years from date of shipment, with a provision to extend the warranty to 7 years with a signed service agreement Warranty Period: 1 year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements all equipment shall be Edwards Fire and Life Safety Company or approved equal systems manufactured by Siemens or Simplex subject to prior approval by the project engineer. See paragraph 1.02 (A) (7) hereinbefore.

2.02 CONTROL PANEL

A. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions.

B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal and reset the panel.

C. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks.

D. The system shall be capable of the following site-specific configurations. Both configurations are permitted on the same network.

a. Air handler shutdown, for testing purposes

b. Notification appliances disable for testing purposes

2. The system shall support up to 250 addressable devices, with no restriction on how many separate circuits can be created other than the maximum device count.

3. The system shall support up to four SLC of 250 addressable devices per circuit, with no restriction on how many separate circuits can be created other than the maximum device count.

E. The system shall be capable of supporting unshielded wiring applications.

F. System Components:

1. The system periphery board shall be capable of supporting two system drivers of 250 intelligent devices distributed between one, two, three, or four Class B SLC circuits, for a total panel capacity of 504 addressable devices. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED's on the board shall provide annunciation for the following: Power, Gnd. Fault, Alarm, Trouble. The board shall be model # FCI2016-U1.

2. The Signal Line Circuits (SLC) shall be tested for opens, shorts and communications with all addressable devices installed before connection to the control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.

3. The standard Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system .

4. The system periphery board shall be capable of supporting four system drivers of 250 intelligent devices with no restriction on how many separate circuits can be created other than the maximum device count, for a total panel capacity of 250 addressable devices. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED's on the board shall provide annunciation for the following: Power, Gnd. Fault, Alarm, Trouble. This board is integral to the system. The board shall be model number FCI2017-U1.

5. The LCD/LED Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system.

6. The System Periphery Board shall contain 4 Class B NAC circuits with 6 amps of power distributed across all four circuits, with power-limited outputs. The zones shall be isolated and independently supervised.

7. The control panel shall be equipped with three Form C relays for alarm, trouble, and supervisory. The system shall provide the mounting of all system cards, field wiring, and panel's inter-card wiring. All power limited field wiring shall be separated from all non-power limited internal wiring.

G. System response time from alarm to output shall be an average of three (3) seconds.

H. All system cards and modules shall have Flash memory for downloading the latest module firmware.

I. Passwords:

1. Technician Level Password - There shall be a 4-character password that a user must enter into the control panel in order to perform such maintenance- and control-related functions at the panel as:

a. Arming and disarming devices.

b. Activating, deactivating, or modifying detector ASD and sensitivity settings.

c. Activating and deactivating the History Log function, and deleting obsolete entries.

d. Changing the system time and date.

2. Maintenance Level Password - There shall be a 4-character password that a user must enter into the control panel in order to access the panel's reporting functions and walktest functions.

3. Acknowledge Silence-able Reset Access - There shall be a key required to open a locked cabinet that a system user must use in order to acknowledge events, turn silence-able audibles and visuals on and off, and perform panel resets.

J. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.

K. Logic: The fire alarm system shall support generic functions that deal with binary states (True/False, high/low), and produce desired outputs from one or more binary inputs (for example, alarm outputs from detector or manual station inputs). AND, OR, NOT, Any N, Latches, Start Timer, Delay Timer, Restart Timer are generic functions. Generic functions can be used as inputs to other function. The system shall support 500 logic functions.

L. History: The system shall store 2000 events in history. Trouble warnings will occur when the History buffer is full.

2.03 POWER SUPPLY

A. The system Power Supply shall provide adequate power to supply all electronic components available with the panel and 6-amps of useable 24 vdc power for auxiliary needs and NACs. The power supply shall be filtered and regulated. The power supply provides power for all system operation, including signaling line circuits, notification appliance circuits, auxiliary power, battery charger, and all optional modules. The power supply shall be rated for 120/240 VAC 50/60 Hz.

B. The battery charger shall be able to charge the system batteries up to 26 AH batteries. Battery charging shall be microprocessor controlled and programmed to select battery sizes.

C. Power supplies that transfer from AC to DC on AC power failure shall not be accepted, system shall run off of battery power constantly for a smooth and undiscernible transfer when AC Power fails.

2.04 SYSTEM ENCLOSURE

A. Provide the enclosure as specified. Provide the color as to the local AHJ requirements.

B. Provide Red cabinet enclosure.

2.05 INTELLIGENT INITIATING DEVICES

A. General

1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections.

B. Smoke Detectors – Standard Addressable H-Series

1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.

2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.

3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of eleven environmental fire profiles unique to the devices installed location.

4. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.

5. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.

6. The detector shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.

7. For the detector where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.

8. The smoke detector shall be model number Siga-OSD

C. Heat Detectors – Addressable

1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.

2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage. The thermal detector shall be model number Siga-HRD

3. Heat detector shall have the following temperature settings:

   a. Fixed temperature at 135°F, 145°F, 155°F, 165°F, 174°F
   b. Rate of Rise at 15°F/ min (8.3°C) at 135°F (57°C)
   c. Rate of Rise at 15°F/ min (8.3°C) at 174°F (79°C)
   d. Low temperature warning at 40°F (4.4°C)

D. Duct Smoke Detectors – Addressable

1. For duct detector applications, the smoke detector shall be an intelligent digital photoelectric detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes.

2. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation.

3. Where duct detectors are exposed to the weather a weatherproof enclosure shall be available. The duct housing cover shall include a test port for functional testing of the detector without cover removal. The duct housing shall include a cover removal switch capable of indicating cover removal status to the fire alarm control panel.

4. The intelligent duct detector shall be model number Siga-SD Where required there shall be available a duct housing with an on-board relay. Also, where required, there shall be a standalone housing available with its own power supply and test/reset switch that does not require connection to a fire alarm control panel.

5. Duct smoke detector housing shall allow use in duct systems with air velocity ranging from 100 to 4,000 feet per minute, within temperature ranges of -20°F to 158°F per minute, and with relative humidity ranging from 0 to 93%.

E. Manual Pull Stations – Addressable

1. Provide addressable manual stations were shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds.

2. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations were indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.

3. The double action pull station shall be model number Siga-278

4. Where required, there shall also be available pull stations with break glass, capable of explosion proof installation, capable of weatherproof installation, reset key operation, and metal housings.

F. Addressable Interface Devices

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required, the interface shall be equipped with a SPDT relay rated for 2 amps resistive and 2 amps inductive. The addressable interface modules shall be model number CT1(single input) CT2 (dual input),io(single input, single output)series.

2. Where needed, a Conventional Zone Module shall connect to the Signal Line Circuit, which will allow the use of conventional initiation devices. This module shall have the ability to support up to 16 conventional smoke detectors and an unlimited number of contact devices. This module shall also be capable of monitoring Linear Beam detectors and conventional Flame detectors. The module shall be model #RZ116-2

3. Any field modules required to monitor points outside the building (sprinkler supervisory devices, etc…) shall have surge suppression with proper grounding and cabling installed in accordance with manufacturer’s instructions at the point the wiring leaves the building. All underground wiring shall be rated for wet conditions.

4. All addressable interface modules shall be capable of being grouped together without the use of standard electrical boxes, trim rings, mounting plates and covers. The Edwards UIO6/R can accommodate up to six different modules in one electronic circuit board with a single SLC connection, and can be installed in a single, easy to wire cabinet model MFC

2.06 NOTIFICATION APPLIANCES

A. Genesis Series – Strobes, Horns, Horn/Strobes

1. Audible/Visual notification appliances shall be listed for indoor use, and shall meet the requirements of FCC Part 15 - Class B

2. Appliances shall be listed under UL Standard 1971 (Standard for Safety Signaling Devices for Hearing Impaired) and UL Standard 464 (Fire Protective Signaling)

3. Appliances shall use a universal back plate, which shall allow mounting to a single-gang, double-gang, 4-inch-square, 4”-octal, or a 3-1/2”-octal backbox

4. Two-wire appliance wiring shall be capable of directly connecting to the mounting back plate

5. Continuity check shall occur for entire NAC circuit prior to attaching any audible / visual-notification appliances

6. Dust cover shall fit and protect the mounting plate

7. Dust cover shall be easily removed when the appliance is installed over the back plate

8. Removal of an appliance shall result in a trouble condition by the Fire Alarm Control Panel (FACP)

9. Strobe appliances shall produce a minimum flash rate of 60 flashes per minute (1 flash per second) over the Regulated Input Voltage Range, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens

10. Strobes shall be available with two or four field-selectable settings in one unit, and shall be rated – per UL 1971 – for up to:

    a. 177cd for ceiling and wall mounting

11. Strobes shall operate over an extended temperature range of 32°F to 120°F (0°C to 49°C), and be listed for maximum humidity of 95% RH

12. Strobe inputs shall be polarized for compatibility with standard reverse-polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP)

13. Audibles and Audible/Strobe Combinations

    a. Horns and horn / strobes shall be listed for Indoor use under UL Standard 464

    b. Horns shall be able to produce continuous synchronized output or a temporal code-3 synchronized output

    c. Horns shall have at least 2 sound-level settings of 90 and 95 dBA

    d. Synchronization Modules

    e. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol

14. The strobes shall not drift out of synchronization at any time during operation

15. Audibles and strobes shall be able to synchronize on a 2-wire circuit with the capability to silence the audible, if required

16. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)

17. All notification appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their "Regulated Input Voltage Range"

2.07 DIGITAL COMMUNICATOR

A. The Multi-Point Digital Alarm Communicator SA-DACT(POTS Lines) or SA-ETH (Ethernet) shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remote Receiving Station. The DACT shall support the following:

1. Ademco Contact ID or SIA protocol

2. Ademco Contact ID selection shall provide the ability to transmit events for up to 999 individual zones

3. SIA selection shall provide the ability to transmit events for up to 10000 individual points

4. Programming of accounts and phone numbers

5. Dual phone line interface

6. Line fault monitoring.

7. Automatic 24-hour test

8. The DACT supports configurable alarm, alarm restoral, trouble, trouble restoral, supervisory, supervisory restoral, and reset events.

9. The DACT supports Ademco Contact ID alarm event codes for general alarm, smoke detector alarm, waterflow alarm, duct alarm, and manual alarm events.

10. Optionally, the DACT can be programmed to report events by event queue only.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.02 INSTALLATION

A. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1-2006, Standard of Good Workmanship in Electrical Contracting.

B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

C. Wiring Method: Install fire alarm cables in raceways where exposed or routed thru in-accessible areas. Cables installed in accessible ceiling spaces may be installed on “J” hooks.

D. All cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and were installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

F. Provide primary power for the fire alarm panel as indicated on the Electrical Power Plans. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

3.03 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. "Fire alarm system" decal or silk-screened label shall be applied to all fire alarm system junction box covers.

3.04 CONDUCTORS

A. Each conductor shall be identified as shown on the fire alarm vendor’s installation drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits minimum 18 AWG twisted.

D. All splices shall be made using solder-less connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.05 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

C. A consistent color code for fire alarm system conductors throughout the installation.

3.07 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: The installing electrical contractor shall engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Testing General:

1. All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.

2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.

3. The fire alarm acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

4. Test reports shall be delivered to the acceptance inspector as completed.

5. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:

a. Ladders and scaffolds as required to access all installed equipment.

b. Multi-meter for reading voltage, current and resistance.

c. Two-way radios and flashlights.

d. A manufacturer recommended device for measuring air flow through air duct smoke detector sampling assemblies.

e. Decibel meter.

f. In addition to the testing specified above to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

3.08 ACCEPTANCE TESTING

A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

D. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall attend the preliminary testing to make necessary adjustments.

E. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until meggar test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.

1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.

3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.

4. Visually inspect all wiring.

5. Verify that all software control and data files have been entered or programmed into the FACP.

6. Verify that Shop Drawings reflecting as-built conditions are accurate.

7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.

8. Measure voltage readings for circuits to assure that voltage drop is not excessive.

F. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:

1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:

a. Open, shorted and grounded signal line circuits.

b. Open, shorted and grounded notification, releasing circuits.

c. Primary power or battery disconnected.

2. System notification appliances shall be demonstrated as follows:

a. All alarm notification appliances actuate as programmed

b. Audibility and visibility at required levels.

3. System indications shall be demonstrated as follows:

a. Correct message display for each alarm input at the control display.

b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.

c. Correct history logging for all system activity.

4. System off-site reporting functions shall be demonstrated as follows:

a. Correct zone transmitted for each alarm input

b. Trouble signals received for disconnect

5. Secondary power capabilities shall be demonstrated as follows:

a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.

b. System primary power shall be restored for forty-eight hours, and system-charging current shall be normal trickle charge for a fully charged battery bank.

c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.09 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:

1. System record construction drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.

2. PDF copy of fire alarm vendor's submittal of installation drawings and shop drawings with documentation indicating review and approval of the system by the Common Wealth of Kentucky' Fire Marshall's office.

3. System operation, installation and maintenance manuals.

4. System matrix showing interaction of all input signals with output commands.

5. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.

6. System program showing system functions, controls and labeling of equipment and devices.

3.10 PROTECTION

A. Remove and replace devices and panel components that are wet, moisture damaged, or mold damaged.

3.11 DEMONSTRATION

A. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing and maintenance of the system provided. The instructor shall train the employees designated by the owner, in the care, adjustment, maintenance, and operation of the fire alarm system.

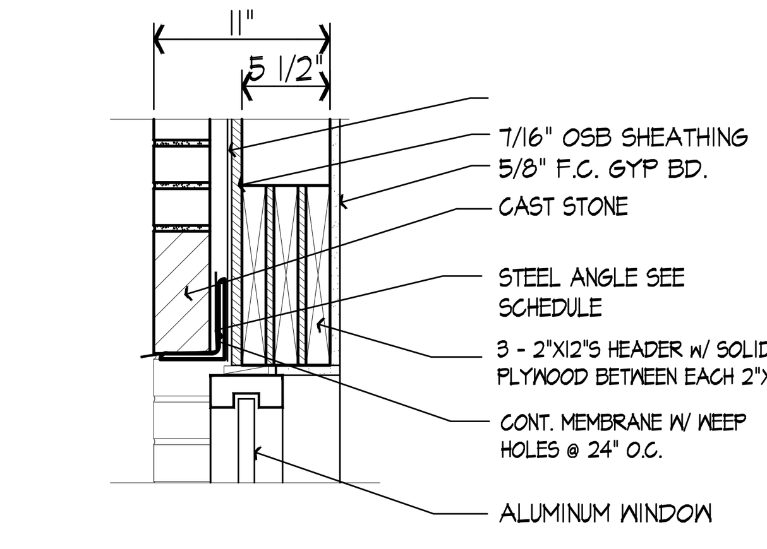
B. Training sessions shall cover all aspects of system performance, including system architecture, signaling line circuit configurations, sensor and other initiating device types, locations, and addresses, fire alarm control panel function key operation, and other functions as designated by the owner.

C. Required Instruction Time: Provide 8 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the owner. The instruction may be divided into two or more periods at the discretion of the owner.

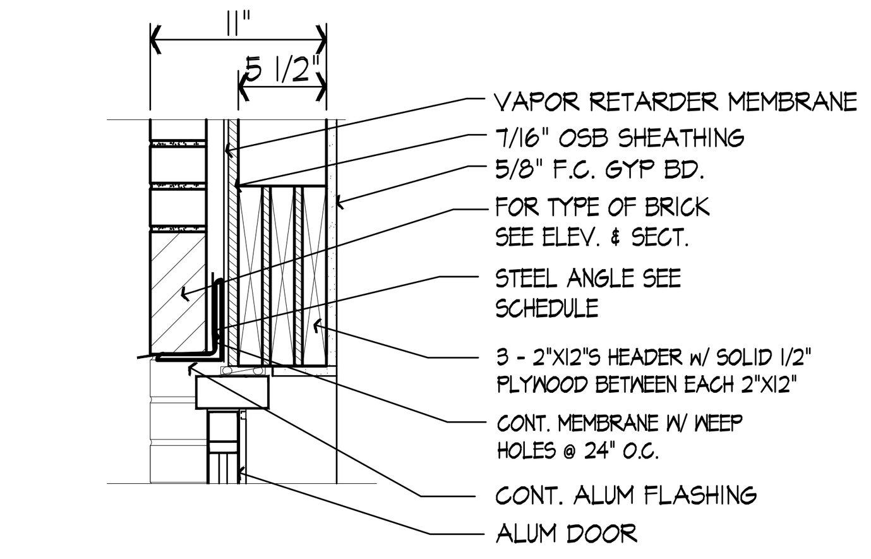
D. Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory and trouble. The instructions shall be approved by the owner.

E. All training sessions shall be conducted by an authorized fire alarm system distributor representative, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided.

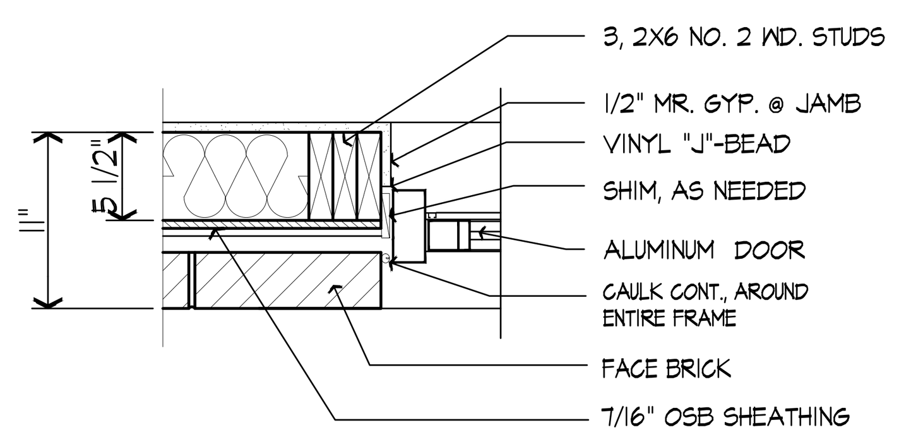
END OF SECTION



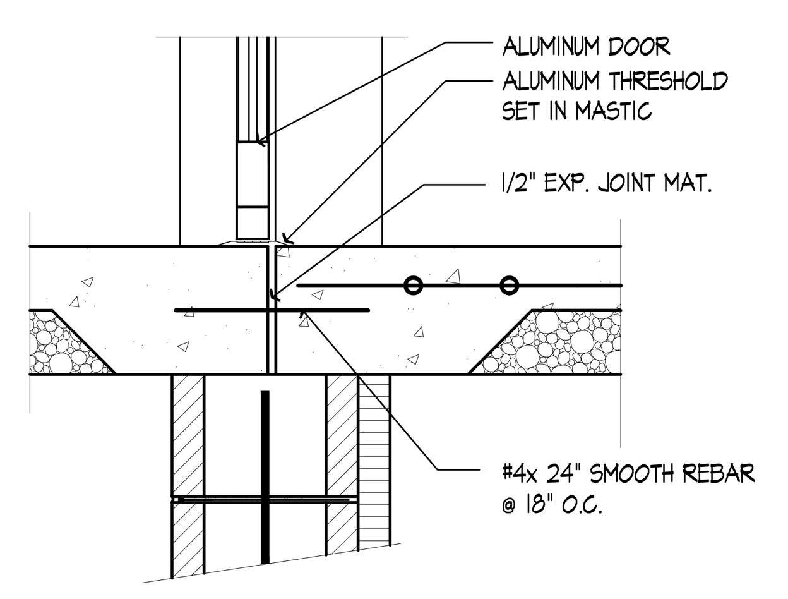
EXTERIOR DOOR HEAD (A / A-6)
SCALE: 1" = 1' - 0"



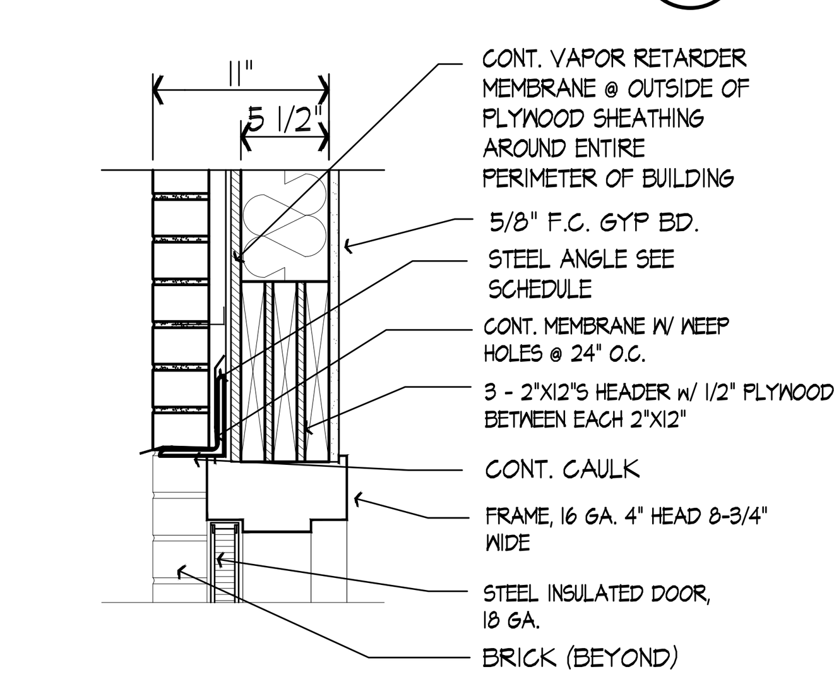
EXTERIOR DOOR HEAD (B / A-6)
SCALE: 1" = 1' - 0"



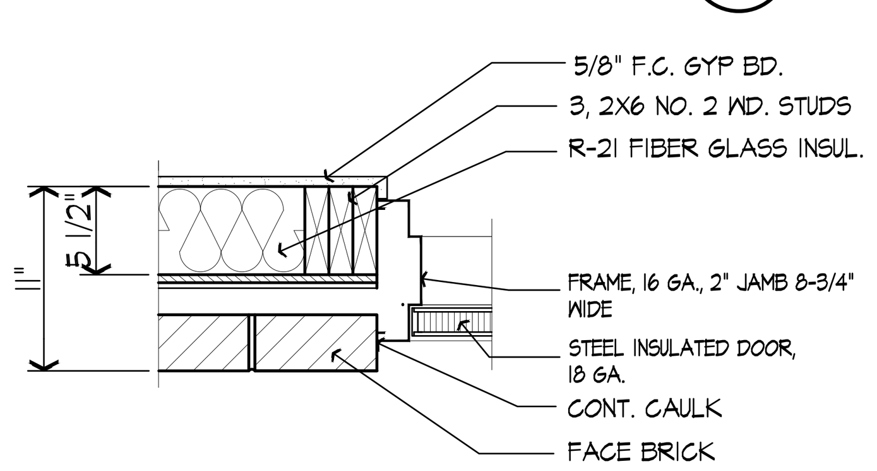
EXTERIOR DOOR JAMB (C / A-6)
SCALE: 1" = 1' - 0"



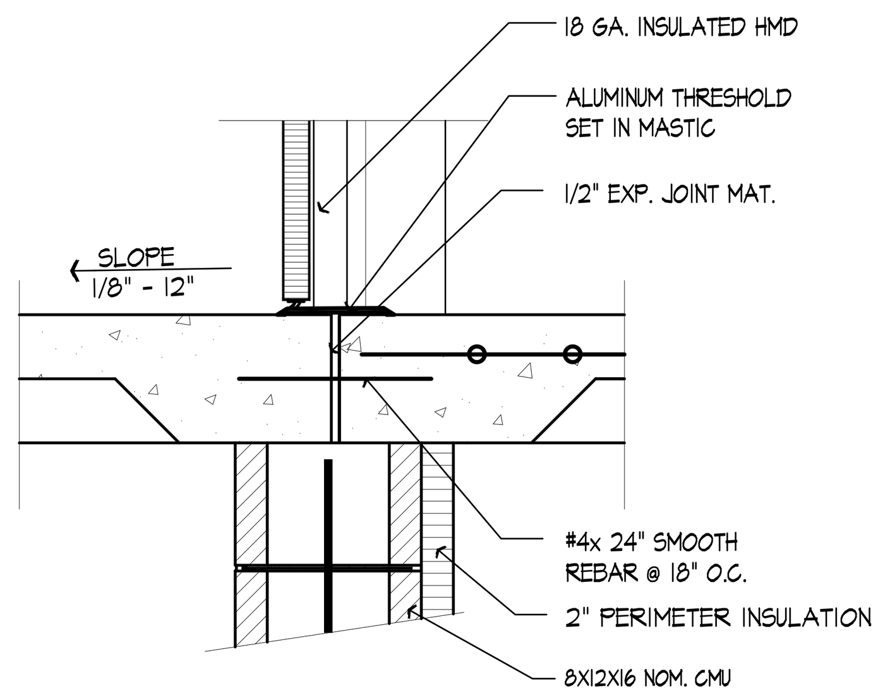
DOOR THRESHOLD (D / A-6)
SCALE: 1" = 1' - 0"



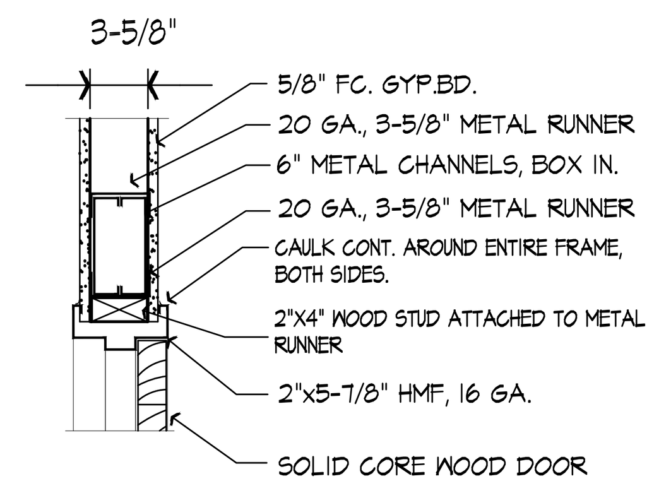
EXTERIOR DOOR HEAD (E / A-6)
SCALE: 1" = 1' - 0"



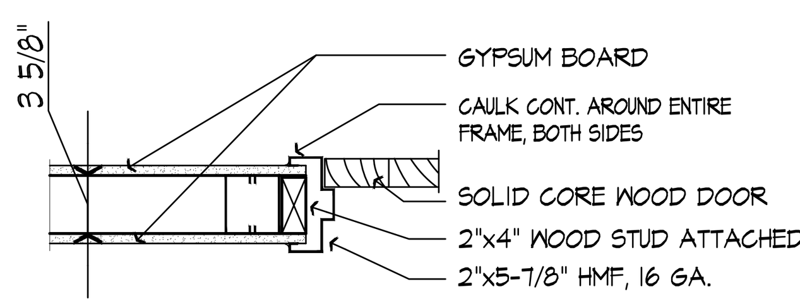
EXTERIOR DOOR JAMB (F / A-6)
SCALE: 1" = 1' - 0"



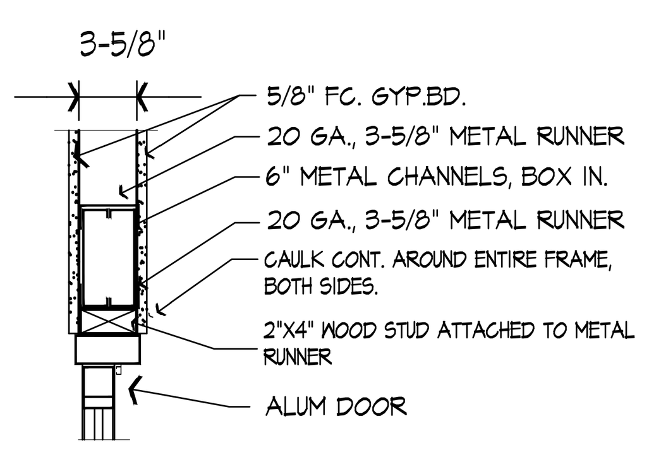
DOOR THRESHOLD (G / A-6)
SCALE: 1" = 1' - 0"



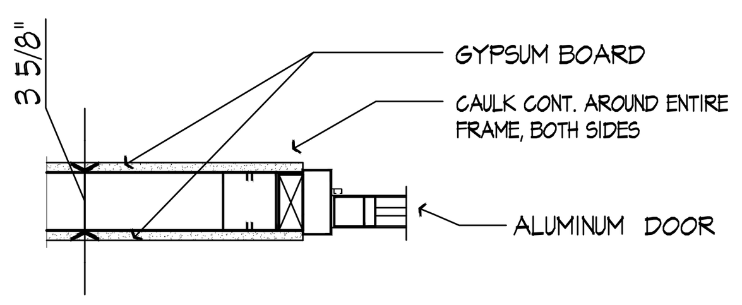
INTERIOR DOOR HEAD (H / A-6)
SCALE: 1" = 1' - 0"



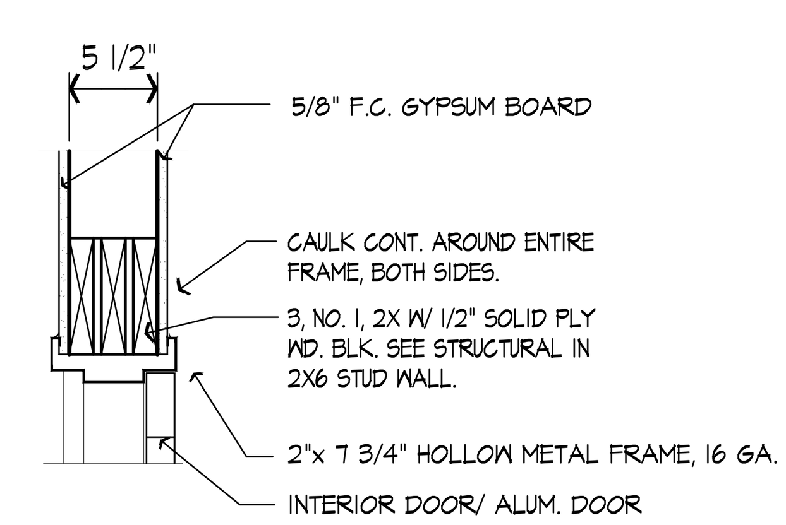
INTERIOR DOOR JAMB (J / A-6)
SCALE: 1" = 1' - 0"



INTERIOR ALUM. DOOR HEAD (K / A-6)
SCALE: 1" = 1' - 0"

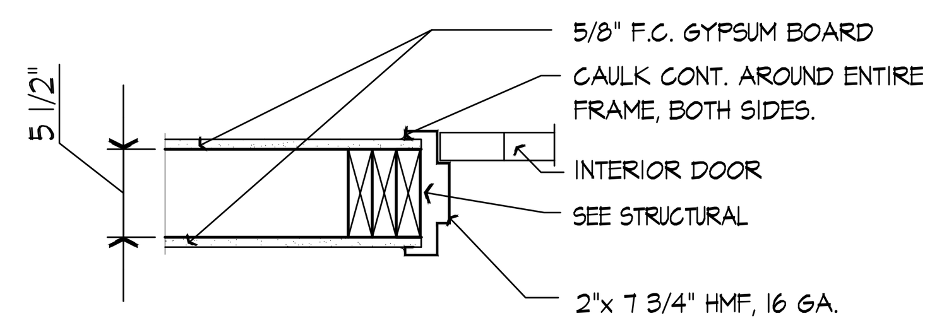


INTERIOR ALUM. DOOR JAMB (L / A-6)
SCALE: 1" = 1' - 0"



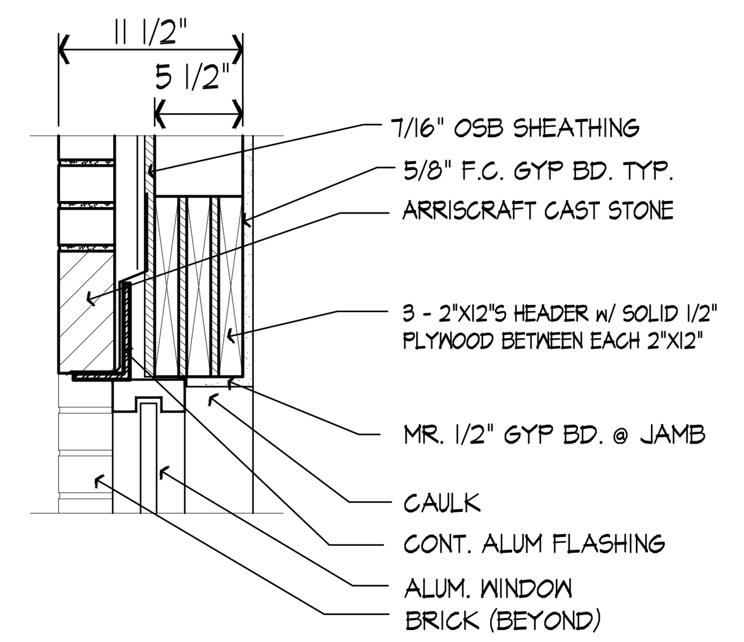
INTERIOR LOAD BEARING WALL

INT. DOOR HEAD DETAIL (M / A-6)
SCALE: 1" = 1' - 0"

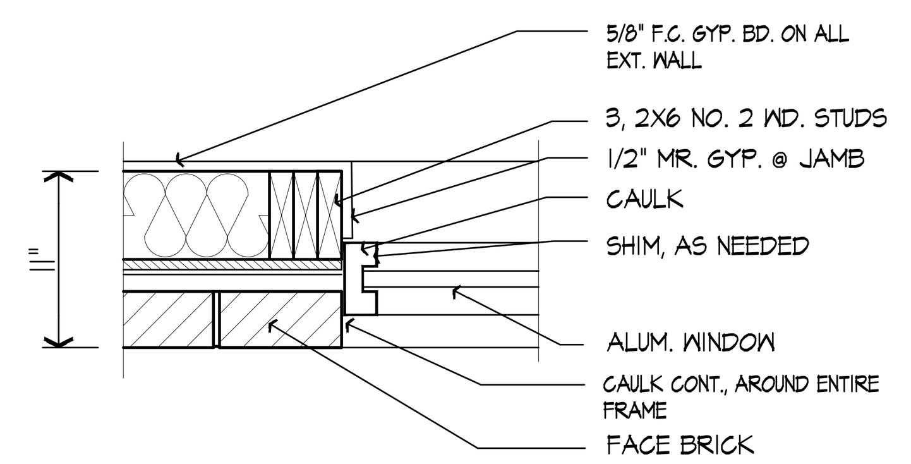


LOAD BEARING WALL

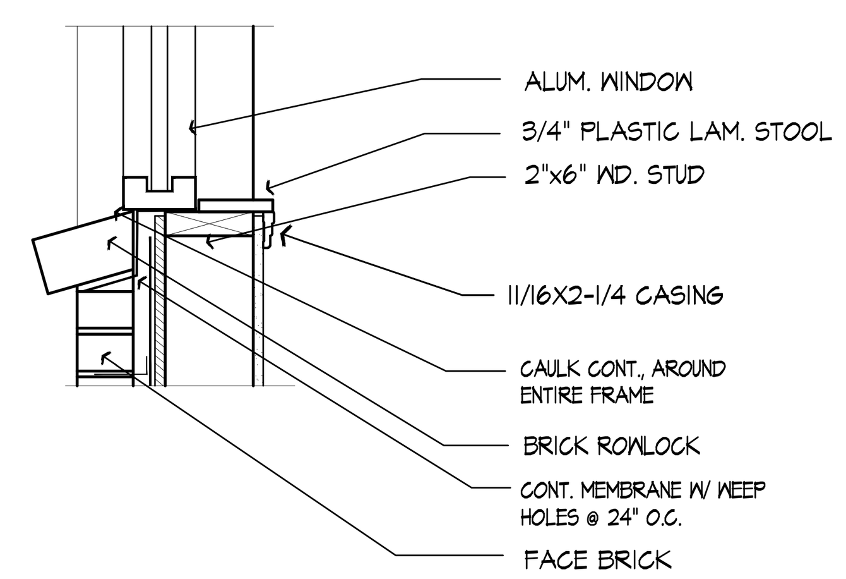
INT. DOOR JAMB DETAIL (N / A-6)
SCALE: 1" = 1' - 0"



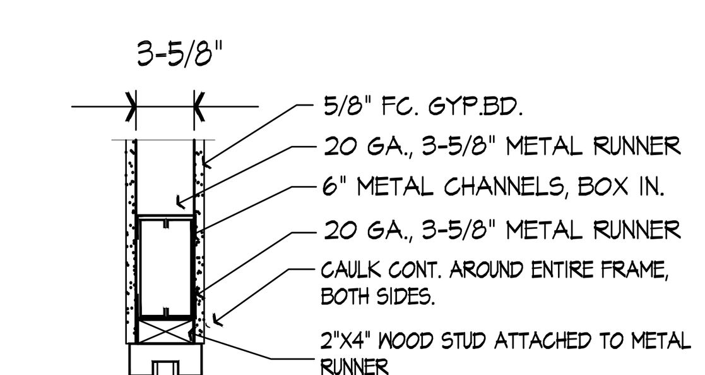
EXTERIOR WINDOW HEAD (O / A-6)
SCALE: 1" = 1' - 0"



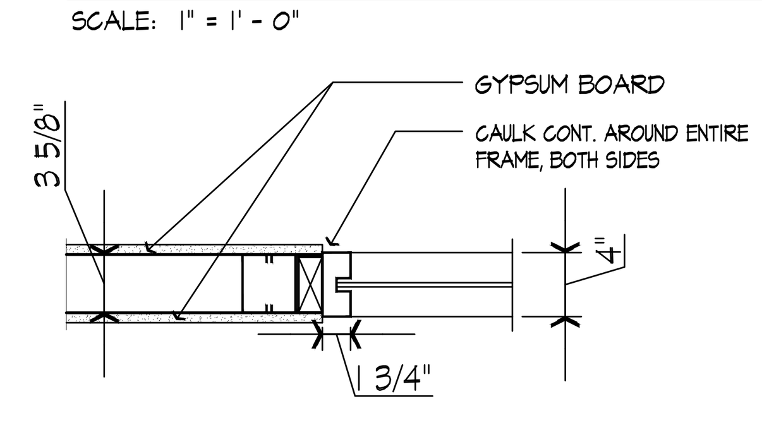
EXTERIOR WINDOW JAMB (P / A-6)
SCALE: 1" = 1' - 0"



EXTERIOR WINDOW SILL (Q / A-6)
SCALE: 1" = 1' - 0"



INTERIOR WINDOW HEAD (R / A-6)
SCALE: 1" = 1' - 0"



INT. WINDOW JAMB/SILL (S / A-6)
SCALE: 1" = 1' - 0"

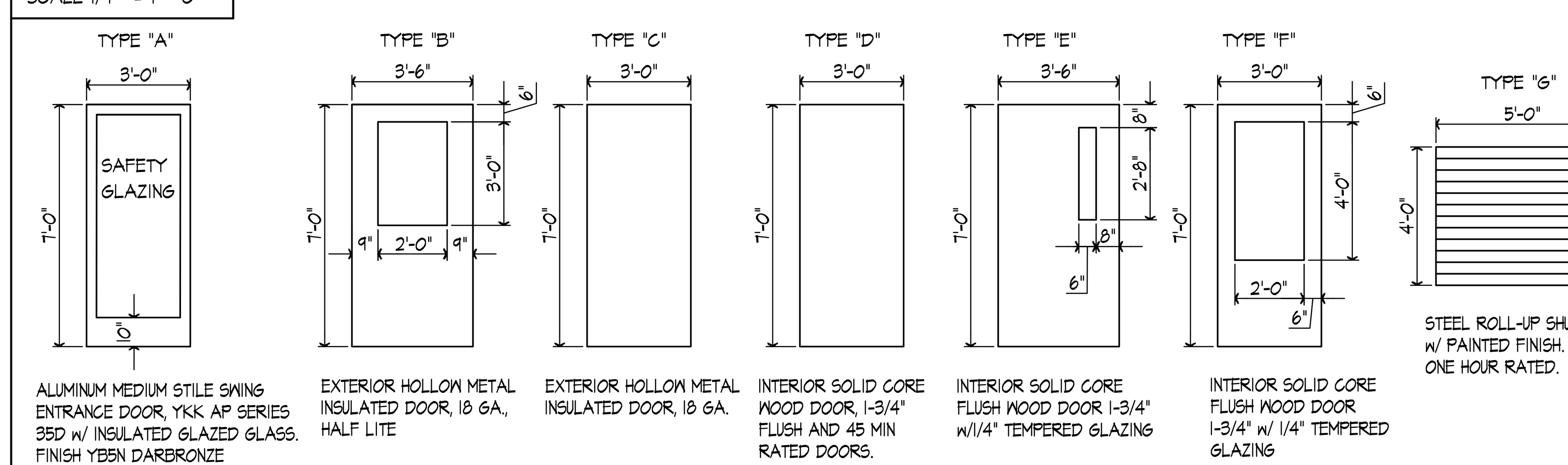
DOOR SCHEDULE

DOOR NO.	TYPE	MATERIAL	WIDTH	HEIGHT	THICK.	FRAME TYPE	HEAD	JAMB	SILL	REMARKS
01	A	ALUM.	3'-0"	7'-0"	------	1	A	B	D	
02	A	ALUM.	3'-0"	7'-0"	------	2	B	C	D	
03	B	H.M.. INS	3'-6"	7'-0"	1 3/4"	3	E	F	G	
04	C	H.M. INS	3'-0"	7'-0"	1 3/4"	4	E	F	G	
05	A	ALUM.	3'-0"	7'-0"	------	2	B	C	D	
06	A	ALUM.	3'-0"	7'-0"	------	11	K	L	---	
07	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
08	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
09	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
10	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
11	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
12	F	SCW	3'-0"	7'-0"	1 3/4"	8	H	J	---	
13	D	SCW	3'-0"	7'-0"	1 3/4"	5	G	H	---	
14	D	SCW	3'-0"	7'-0"	1 3/4"	7	M	N	---	
15	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
16	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
17	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
18	D	SCW	3'-0"	7'-0"	1 3/4"	5	H	J	---	
19	A	ALUM.	3'-0"	7'-0"	------	10	K	L	---	
20	E	MC	3'-6"	7'-0"	1 3/4"	6	H	J	---	45-MIN. RATED, DOOR AND 45 MIN. RATED FRAME. WOOD FACE
21	D	MC	3'-0"	7'-0"	1 3/4"	7	M	N	---	45-MIN. RATED, DOOR AND 45 MIN. RATED FRAME. WOOD FACE
22	D	MC	PR. 3'-0"	7'-0"	1 3/4"	8	H	J	---	45-MIN. RATED, DOOR AND 45 MIN. RATED FRAME. WOOD FACE
23	D	MC	3'-0"	7'-0"	1 3/4"	5	H	J	---	45-MIN. RATED, DOOR AND 45 MIN. RATED FRAME. WOOD FACE
24	G	STEEL	5'-0"	4'-0"	------	------	---	---	---	1 HOUR RATED
25	C	H.M. INS	3'-0"	7'-0"	1 3/4"	4	E	F	G	

SEE SPEC. SECTION 08710 FOR HARDWARE SETS

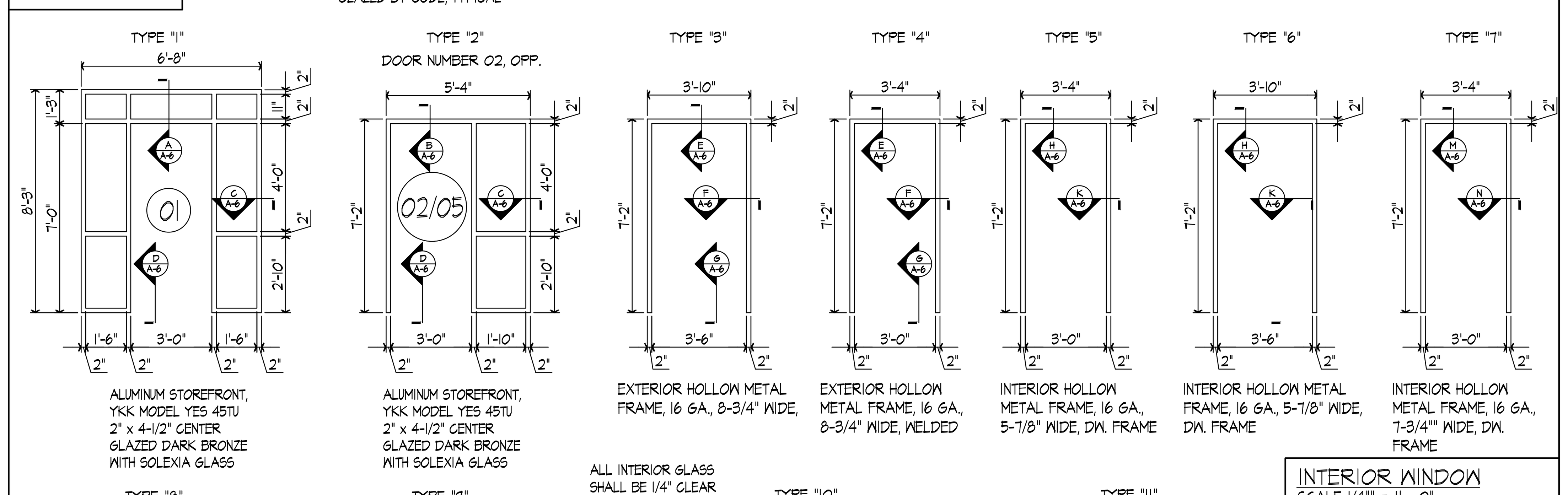
DOOR TYPES:
SCALE 1/4"" = 1' - 0"

*ALL DOORS GLAZED BY CODE.

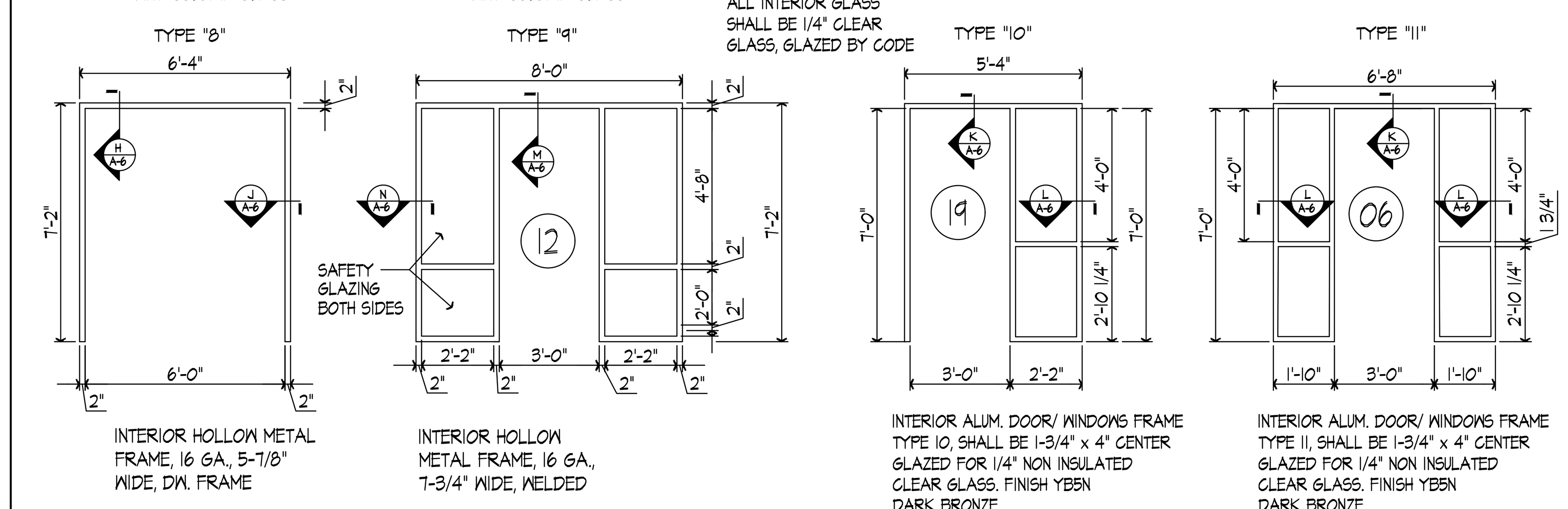


FRAME TYPES:
SCALE 1/4"" = 1' - 0"

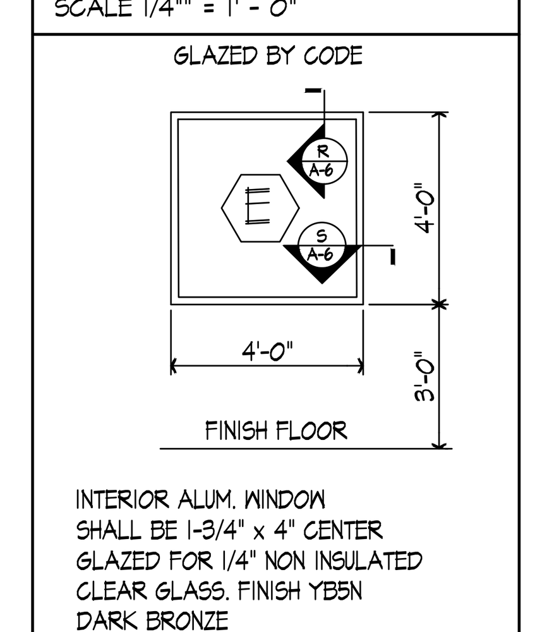
*ALUMINUM STOREFRONTS/DOORS GLAZED BY CODE, TYPICAL



ALL INTERIOR GLASS SHALL BE 1/4" CLEAR GLASS, GLAZED BY CODE

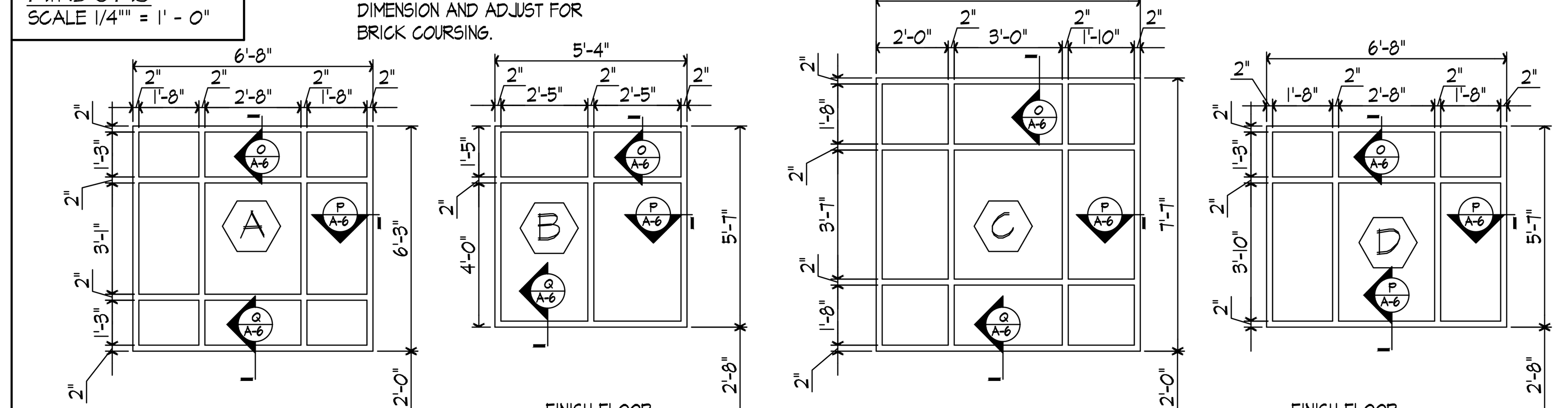


INTERIOR WINDOW
SCALE 1/4"" = 1' - 0"



WINDOWS
SCALE 1/4"" = 1' - 0"

FIELD VERIFY ALL WINDOW DIMENSION AND ADJUST FOR BRICK COURSING.



ALL EXTERIOR WINDOWS AND STOREFRONT SHALL BE CENTER GLAZED THERMALLY BROKEN YKK MODEL YES 45TU 2" x 4-1/2" DARK BRONZE, STANDARD MATTE FINISH FOR 1" GLASS OR REVIEWED EQUAL. ALL GLASS GLAZED IN ACCORDANCE BUILDING CODE.

ALL EXTERIOR GLASS SHALL BE SOLEXIA GLASS WITH 1"AIR SPACE, SOLARBAN 60 (3) ON CLEAR GLASS FOR A 1" UNIT BY PPG. OR EQUAL. ALUM EXTERIOR DOORS WILL BE GLAZED, INSULATED SOLEXIA GLASS.

MONTGOMERY COUNTY
SENIOR CITIZENS CENTER
MT. STERLING, KENTUCKY

BY	REVISION	DATE

DESIGN DOCUMENTS:
The design professional waives any and all responsibility and liability for problems which arise from failure to follow these plans, specifications and the design intent they convey.

PROJECT NO.	5067-03
DESIGNED BY	MSF/BLL
DRAWN BY	BLL
CHECKED BY	MSF
REVIEWED BY	
DATE	DECEMBER 2024
SCALE	AS NOTED

MSE OF KENTUCKY, INC.
Engineers Architects Planners
624 Wellington Way
Lexington, KY 40503
www.mselex.com
Phone: (859)223-5694
Fax: (859)223-2607

DRAWING NO.
A-6
SHEET OF