1.0 - GENERAL

1.1 Scope

Furnish and install all hollow metal doors and frames including view windows, as indicated on the drawings and herein specified.

1.2 Submittals

A. Submit shop drawings for approval.

B. Drawings shall show a schedule of openings using architectural opening numbers, all dimensions, jamb and head conditions, construction details, preparations for hardware, gauges, and finish.

1.3 Templates

A. Manufacturer shall obtain templates of all applicable hardware from the Finish Hardware Contractor and make proper provision for the installation of this hardware.

B. Unless otherwise specified in the hardware section of the specifications, hardware locations shall be in accordance with the recommendations of The National Builder's Hardware Association.

1.4 Marking and Storage

Mark each frame for intended location. Store frames off the ground and in a manner to protect them from damage.

1.5 Storage

A. Doors shall be stored in a dry, secure location to prevent exposure to weather and/or moisture.

B. Frames shall be stored off the ground and protected from weather until in place.

2.0 - PRODUCTS

2.1 Door Construction

A. Exterior Doors: Formed up sheets not less than 16 U.S. gauge rigidly connected and reinforced inside with continuous interlocking 20-gauge hat stiffeners, spaced a maximum of 6" apart. Interior Doors: Formed up sheets not less than 18 U.S. gauge rigidly connected and reinforced inside with continuous interlocking 20-gauge hat stiffeners, spaced a maximum of 6" apart. Sound deadening material of rock wool batts, insulites or other standard recognized available sound deadening materials shall be placed between all stiffeners and plates. Honeycomb doors are not acceptable. Suitable provision shall be made to receive glass panels or louvers. Edge seams are to be continuously welded and ground smooth. Bondo seams are not acceptable.

B. Louvers for interior metal doors shall be of sizes and types as indicated, inverted "V" with metal frame overlapping the door face.

C. Louvers for exterior doors shall be of sizes and types as indicated, rainproof, 20 ga. galvanized steel. Provide No. 16 wire mesh screen at inside of louvers.

D. Doors and frames shall be equal to Steelcraft, Curries, Republic or approved equal.

E. Doors shall be coordinated with thresholds specified under FINISH HARDWARE - SECTION 08710 to meet A.D.A. requirements. Doors shall be extended as required to seal against threshold.

F. Non-full height doors such as Toilet Stall Doors shall be provided with an inverted filler cap channel at head to maintain smooth uniformity at top of door surface.

G. Hollow metal doors shall be provided with beveled hinge and lock edges. Bevel hinge and lock door edges 1/8 inch (3 mm) in 2 inches (50 mm).

H. Exterior door face sheets shall be galvannealed steel, level A60 (ASTM A653).

I. Hardware preparation for hollow metal doors: hinge reinforcements shall be minimum 7-gauge x 9" length.

J. Hardware Reinforcements:

1. Hinge reinforcements for full mortise hinges: minimum 7 gage [0.180" (4.7mm)].

2. Lock reinforcements : minimum 16 gage [0.053" (1.3mm)].

3. Closer reinforcements : minimum 14 gage [0.067" (1.7mm)], 20" long.

4. Galvannealed doors: include Galvannealed hardware reinforcements. Include Galvannealed components and internal reinforcements with Galvannealed doors. Close tops of exterior swing-out doors to eliminate moisture penetration. Galvannealed steel top caps are permitted.

5. Projection welded hinge and lock reinforcements to the edge of the door.

6. Provided adequate reinforcements for other hardware as required.

K. Glass moldings and stops (both labeled and non-labeled doors):

1. Fabricate glass trim from 24 gage [.6mm] steel conforming to:
   a. Interior openings ASTM designation A 366 cold rolled steel.

   b. Exterior openings ASTM designation A 924 Zinc-Iron Alloy-Coated Galvannealed steel with a zinc coating of 0.06 ounces per square foot (A60) for exterior openings.

      1) Install trim into the door as a four-sided welded assembly with mitered, reinforced and welded corners.

      2) Trim: identical on both sides of the door.

      3) Exposed fasteners are not permitted. Labeled and non-labeled doors: use the same trim.

      4) Acceptable mounting methods:

a) Fit into a formed area of the door face, not extending beyond the door face, and interlocking into the recessed area.
b) Cap the cutout not extend more than 1/16" [1.6mm] from the door face.

L. Electrical Requirements for Doors:

General: Coordinate electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

1. Doors with Electric Hinges:

a. General: Furnish conduit raceway to permit wiring from electric door hardware.

b. Hinge Locations: Provide electric hinge at intermediate or center location. Top or bottom electric hinge locations are not acceptable.

c. Refer to 08710 for electrified hardware items.

2.2 Frame Construction

A. Frames shall be of sizes as indicated, completely assembled, buck and frame formed from 14-gauge exterior, 16-gauge interior, steel with 2" face unless otherwise indicated and 5/8", minimum, integral stop. Exterior frames and interior frames at cafeteria, kitchen, locker room and shower areas shall be Galvannealed A60 (ASTM A653).

B. Corners of frames to be mitered and continuously welded. Joints shall be pulled up tight, welded, and ground smooth with faces in correct alignment.

C. Provide adjustable "T" type anchors, three to each jamb; welded angle clips at bottom of frames for anchorage to floor construction; detachable type metal spreaders. Jamb anchors shall be T-shaped and of the same thickness as the metal of the frames. Where "T" anchors are not feasible, provide anchors as required and/or recommended.

D. Machine frames for attachment of hardware, including special reinforcing for extra heavy duty use, drilling, and tapping. Provide mortar tight metal dust boxes in back of lock location.

E. Frames for sidelights shall be integral with door frames; borrowed light window frames and other openings shall be as detailed.

F. Prepare frames for rubber silencers, three for single swing door and two for each pair of doors.

G. Frames not extending to the floor surface shall have a closed welded jamb bottom.

H. Electrical Requirements for Frames:

1. General: Coordination all electrical requirements for doors and frames. Make provisions for installation of electrical items arranged so that wiring can be readily removed and replaced.

a. Provide cutouts and reinforcements required for metal door frame to accept electric components.

b. Frame with Electrical Hinges: Weld UL listed grout guard cover box welded over center hinge reinforcing. Top or bottom hinge locations are not permitted. Contractor to reference 3.01.E, for continuous hinges.

c. Provide cutouts and reinforcements required to accept security system components.

d. Refer to 08710 for electrified hardware items.

2. Provide mortar box, welded in head of door frame at exterior frames for future door contact switch provided by Owner. Size, type, location and conduit requirements to be provided by Owner.

2.3 Labeled Assemblies

A. All openings shall be protected by assemblies which include doors, frames, hardware, closing devices, anchorage, sills, etc. installed in accordance with NFPA Standard "FIRE DOORS and WINDOWS, NFPA 80," as per Standard Building Code.

B. To further clarify the basic requirements and/or the correct method of labeling that will be acceptable; the labels will include, but not be limited to, the following:

1. **Labeling of Fire Doors and Frames**
All door openings in fire resistive walls and partitions requiring a rating shall be protected by assemblies which include doors, frames, hardware, closing devices, anchorage, sills, etc., installed in accordance with the National Fire Protection Association (NFPA) 80, Standard for "Fire Doors and Fire Windows" and the State Building Code.

To further clarify the basic requirements and the correct method of labeling that will be acceptable to the Division of Construction Management, the labels shall include the following:

a. Accessibility: Each component shall bear a label located to be accessible after installation.

b. Permanence: Each component shall bear a label of a type of material and be so attached that the life of the label and the attachment thereof can reasonably be expected to equal the life of the component to which it is attached. Labels shall be raised or embossed on metal labels or stamped into metal frames. Plastic or paper labels are unacceptable.

c. Legibility: The label design shall be such that it can always be visible and legible and must be clean of any paint or other coverage making the label illegible.

d. Fire Resistance: All approved labels on doors and on frames shall include thereon the fire resistance rating in hours and minutes for which the door or frame is labeled. Labels on frames with transoms or sidelights must identify that the

opening assembly includes same.

e. Other Requirements: The labels or stamps applied to frames must be provided by a manufacturer that has been approved by a laboratory or organization to provide testing and follow-up services for fire-rated opening assemblies.

2. Other Requirements - As directed by the approved laboratory or organization providing testing and follow-up services and labeling.

2.4 Finish

A. Metal doors and frames shall be thoroughly cleaned of dirt, grease, and impurities and shall be bonderized and finished with one coat of baked-on primer ready to receive finish paint.

B. Primer shall be manufacturer's standard in accordance with ASTM B117. **Do not prime paint labels**.

C. Final painting as specified and applied under Painting Section.

3.0 - EXECUTION

3.1 Installation

A. **BITUMINOUS COATING IS TO BE FIELD APPLIED TO THE INSIDE OF FRAMES THAT ARE TO BE INSTALLED IN MASONRY, OR TO BE GROUTED, PRIOR TO INSTALLATION.**

B. Install frames plumb, rigid, and in true alignment; properly brace until built in. Set spreader and attached jambs to floor through floor anchors.

C. In masonry openings, where required, install a second spreader at the mid-height of the door opening, and do not remove until the masonry jambs are in place. Spreader shall be notched wood of approximate jamb width and 1" minimum thickness. Install a minimum of three anchors per jamb to be imbedded in masonry joint as the wall is laid up.

D. Frames shall be grouted solid.

E. Doors shall be rigidly secured in frames, hardware applied, and adjusted to achieve smooth operation without forcing or binding. Doors shall be capable of maintaining any degree of opening.

3.2 Protection

After installation, doors and frames shall be protected from damage during subsequent construction activities. Damaged doors and frames shall be replaced.

END OF SECTION

PART 1 – GENERAL

1.1 Related Documents

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

1.2 Section Includes

A. Flush Wood doors

B. Acoustical Rated Doors

C. Positive Pressure Fire Rated Wood Doors

D. Factory Glazing for Fire Rated Doors

1.3 Related Sections

A. Section 08110 – Hollow Metal Doors and Frames

B. Section 08710 – Finish Hardware

C. Section 08810 – Glass and Glazing

1.4 Requirements Of Regulatory Agencies

A. Wood Doors and installation shall comply with provisions and standards listed. The latest published edition of each standard applies.

B. ASTM - American Society for Testing and Materials

1. ASTM E 90-09 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements. (All doors tested shall be fully operable.)
2. ASTM E 413-10 - Classification for Rating Sound Insulation.
3. ASTM F 476 Section 18 - Security Test of Swinging Door Assemblies - Door Impact Test

C. ANSI - American National Standards Institute

1. ANSI/DHI A156.115W - Specifications for Hardware Preparation in Wood Doors and Frames.
2. ANSI/DHI A115.IG - Installation Guide for Doors and Hardware.
3. ANSI A156.7 - Hinge Template Dimensions.
4. ANSI/HPVA HP-1 Standards for Hardwood and Decorative Plywood
5. ANSI A208.1-Particleboard
6. ANSI A208.2-Medium Density Fiberboard (MDF)
7. ANSI-ASA S12.60 - Standard Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools
8. ANSI/A117.1 – Accessible and Useable Buildings and Facilities

D. ANSI/WDMA – Window and Door Manufacturers Association

1. WDMA I.S. 1A-13, Industrial Standards for Architectural Flush Doors

   a. J-1 – Job Site Information "How to Store, Handle, Finish, Install, and Maintain Wood Doors"
   b. P-1 – Performance Standards for Architectural Wood Flush Doors
   c. T-1 – Test for Telegraphing
   d. T-2 – Test for Warp
   e. T-3 – Test for Squareness

2. WDMA Test Methods - Provide documentation showing compliance to WDMA performance duty level.

   a. Adhesive Bonding Durability: WDMA TM-6
   b. Cycle Slam: WDMA TM-7
   c. Hinge Loading: WDMA TM-8
   d. Screw Holding: WDMA TM-10

E. Building Code references

1. IBC – 2021 International Building Code
2. NFPA 80 - Standard for Fire Doors and Other Opening Protective's.
3. NFPA 101 – Life Safety Code
4. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and Other Opening Protective's
5. NFPA 252 – Standard Method of Fire Tests of Door Assemblies
6. ANSI/UL 10C - Standard for Safety for Positive Pressure Fire Tests of Door Assemblies
7. UL 1784 - Air Leakage Tests of Door Assemblies
8. Underwriters Laboratories (UL) - ULI0C Positive Pressure Fire Test of Door Assemblies
9. ITS/WH Certification - Certification Listings for Fire Doors
10. Consumer Products Safety Commission (CPSC) 16 CFR 1201 – Standard for Architectural Glazing
11. US Green Building Council (USGBC)

1.5 Supplier Qualifications

A. The Wood Door Supplier shall maintain at the location which will be managing the project, a credentialed Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) as a full-time employee and member in good standing of DHI - Door Security + Safety Professionals.

B. The Architectural Hardware Consultant (AHC) or Certified Door Consultant (CDC) shall supervise other individuals employed by the Wood Door Supplier who work on the project and be available throughout the project to meet with the Contractor, Architect or Owner as needed.

C. Supplier shall be experienced and have completed projects with material, design and scope similar to that specified for this project. If requested by the Owner or Architect, submit a list of projects completed in the last five (5) years with the project name, location, Owner, Architect and Contractor.

D. As a requirement, the Wood Door Supplier shall maintain an office and warehouse complete with a wood door inventory within a one hundred (100) mile radius of the jobsite. The Supplier shall further have a qualified field service staff available to service the project.

E. After delivery of wood doors and prior to installation, the Hardware or Door Consultant shall meet with the Contractor to review templates, installation instructions, final hardware schedule, coordination with other trades and preview samples.

F. Failure to meet the above requirements will disqualify the bidder.

G. The Owner may visit the location of the Distributor's office and warehouse to observe if the intent of the requirements set forth in the specifications have been met.

1.6 Submittals

A. Submit complete copies of the wood door shop drawings covering complete details of items required for the project. Complete copies of technical data sheets and other pertinent data are required to indicate compliance with the specification.

1. Shop Drawings: Submit door and frame schedule using reference designations indicated on Drawings. Include opening size(s), handing of doors, details of each frame type, elevations of door design types, location, hardware group numbers, fire label requirements, including fire rating time duration, maximum temperature rise requirements, hardware mounting locations, glass beads/moldings, glass kits, internal blocking, vertical edge details, top and bottom rail details, undercuts, beveling and other pertinent data.

B. As part of the Shop Drawing submittal, provide copy of WDMA J1, Job Site Information, "How to store, handle, finish, install and maintain wood doors."

C. Data submitted shall be job specific and shall include product data and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

D. Provide door construction details/drawings of vertical edges, top rail and SWE details for all doors.

E. Indicate location of cutouts for hardware and blocking to ensure doors are properly prepared and coordinated to receive hardware.

F. Shop drawings, product data, and samples: Contractor to stamp Shop Drawings verifying they have been coordinated and reviewed for completeness and compliance with the contract documents.

G. Shop drawings submitted without the above documentation will be considered incomplete, will not be reviewed, and returned directly to the Contractor.

H. Follow the same procedures for re-submittal as the initial submittal with the appropriate revised dates noted in the shop drawings.

1.7 Quality Assurance

A. Comply with the requirements of the referenced standards. Submit test reports upon request by the Owner or Architect.

B. Underwriters' Laboratories or Intertek Testing Services / Warnock Hersey, Positive Pressure - Category A labeled fire wood doors:

1. Label fire doors listed in accordance with Underwriters Laboratories standard UL10C, Positive Pressure Fire Tests of Door Assemblies and Air Leakage Tests of Door Assemblies - UL 1784.
2. Construct and install doors in accordance with the standards of NFPA 80.
3. Manufacture fire rated doors under the UL or ITS/WH factory inspection program providing the degree of fire protection capability indicated by the door schedule drawings.
4. Provide metal labels permanently fastened on each fire door at an authorized and licensed facility as evidence of compliance with procedures of the labeling agency.
5. No field modifications shall be made to the fire door assembly that would void the label. Field modifications to a fire door shall be in accordance with NFPA80. Work shall be done by a licensed labeling service approved by the manufacturer.
6. Labels are not to be removed, defaced or made illegible while the door is in service per NFPA 80. Fire labels are not to be painted or pre-finished.
7. Fire doors with continuous hinges shall have the physical label located on the top rail of the door.
8. Conform to applicable codes for fire ratings. It is the intent of this specification that wood doors comply or exceed the standards for labeled openings. In case of conflict between door types required for fire protection, furnish the type required by NFPA and UL.
9. Validate the Smoke and Draft Control ("S") Label for hardware sets that include Category H smoke and draft control seals.
10. All Category G seals required will be concealed in the door or applied to the top rail. No Category G seals will be allowed on the door frame.

C. Door Supplier shall provide one (1) extra door with 6" top rail and exit device blocking. The Contractor, Door Supplier and the Owner to observe and inspect destructive sampling for proper internal construction.

1.8 Warranty

A. Provide Manufacturer's standard warranty form, signed by manufacturer, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship for the life of the original installation of the door.

1.9 Samples

A. Sample Submittal

1. Color samples for factory pre-finishing shall consist of four (4) sets of three (3) finish samples per set. Samples to be minimum 5" x 8" size on specified veneer species. The sample should reasonably represent the color range of the veneer species expected in the finished work.

B. Fire Rated Wood Doors

1. Provide three (3) 10" x 10" cut away corner samples demonstrating door construction with provisions for vertical stiles and top rails as specified.

C. Non-Fire Rated Wood Doors

1. Provide three (3) construction samples demonstrating door construction with provisions for vertical stiles and top rails as specified herein.

1.10 Delivery, Storage, And Handling

A. Provide protective measures throughout the construction period to safeguard doors from damage or deterioration from the time of acceptance.

B. Store and protect doors in accordance with manufacturer's recommendations and Section J-1 of WDMA I.S. 1A-13 - "How to Store, Handle, Finish, Install and Maintain Wood Doors"

1. Store doors flat and off the floor on a level surface in a dry, well-ventilated building. Do not store on edge. Protect doors from dirt, water and abuse and allow for air circulation.
2. Protect all doors from exposure to direct sunlight and artificial light after delivery.
3. Do not subject interior doors to extremes of either heat or humidity. HVAC systems must be operational and balanced, providing a temperature range of 50 to 80 degrees Fahrenheit and 30% to 60% relative humidity.
4. When handling doors, lift and carry when moving. Do not drag across other doors or surfaces. Handle with clean, dry hands or while wearing clean dry gloves.
5. Manufacturer shall mark each door on the top rail and top hinge pocket with the door opening number. In addition, mark the top rail with manufacture's name, factory order number, and other additional markings to properly identify the door.

1.11 Coordination

A. Coordinate work with other sections involving manufacture or fabrication of internal cutouts and internal blocking for door hardware, electrified and mortised items. Provide necessary blocking in mineral core doors to prevent door failure from surface applied hardware.

B. The Contractor shall field verify existing door opening conditions, where existing doors or frames are to remain or be replaced in part, for coordination with the specified hardware and notify the Architect of conflicts prior to proceeding. Failure to notify the Architect of conflicts that result in additional work or material is the responsibility of the Contractor, with no cost to the Owner.

C. The supplier shall be responsible for proper coordination, templating, dimensions and all details required for doors, frames and hardware application.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Acceptable manufacturers for wood doors specified are listed below. Only the products of the listed manufacturers will be accepted. No alternates will be

accepted. The manufacturers listed are acceptable providing they adhere to the quality standards as noted herein.

1. Eggers Industries
2. Marshfield-Algoma
3. V.T. Industries

B. **The manufacturers listed herein are capable of providing products that meet or exceed the specified requirements. Products that do not comply with the specified requirements and construction will be rejected.**

C. If doors are rejected, replacement doors shall be furnished expeditiously, at no cost to the Owner.

2.2 Doors

A. Quality Assurance Requirements: Flush Wood Doors: Comply with the ANSI/WDMA I.S. 1A–13 Industry Standard for Architectural Wood Flush Doors.

B. Non-Fire Rated Wood Doors - All solid core flush wood doors shall meet WDMA Door Grade and WDMA Performance Duty Level specified.

1. Grade-Custom Grade Construction and Face Grade.
2. WDMA Performance Duty Level-Extra Heavy Duty. All doors shall meet specified WDMA Performance Duty Level, including face screw holding requirement. Surface applied hardware shall be installed in accordance with Section 08710.
3. Door Type - PC-5 - Bonded Wood Based Particle Core, Stiles and rails securely bonded to the core and entire unit abrasively planed prior to application of faces to assure uniform thickness of all components.

C. Fire Rated Wood Doors: Where fire-resistance classifications are shown or scheduled, provide doors that comply with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Label Certification: Doors requiring fire-rating shall carry either UL or ITS (Warnock Hersey) label.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 250 degrees F (121 degrees C)] above ambient after 30 minutes of standard fire-test exposure.
3. Construction: Category A - intumescent included in door construction where required.
4. Cores: Provide wood fiber or mineral fire-resistant composite core required to provide fire-protection rating indicated.
5. Blocking: Provide composite blocking approved in doors of fire-protection ratings as indicated.

D. Electrical Requirements:

1. General: Make provisions for installation of electrical items specified in Section 08710.

a. Provide all cutouts and blocking required for wood doors to accept electrical door hardware and security system components.

E. Acoustical Doors:

1. Acoustical Doors shall conform to the American National Standard Acoustical Performance Criteria, Design Requirements and Guidelines for Schools, ANSI/ASA S12.60.

   a. These spaces include, but are not limited to, classrooms, instructional pods or activity areas, group instruction rooms, conference rooms, libraries, offices, speech clinics, offices used for educational purposes and music rooms for instruction, practice and performance.

2. Doors into classrooms and other core learning spaces shall conform to the requirements of ANSI/ASA S12.60 with a minimum of a STC 30 operable rating. Doors to music rooms and doors between two classrooms shall be a minimum STC 40 operable rating. Comply with additional requirements as noted in the door schedule.
3. Provide vision lite system consisting of acoustic glass, lite kit and glazing tape of the proper size and thickness to meet or exceed the STC acoustical rating of the door and frame assembly. Provide Anemostat LoPro-STC vision lite system. The vision lite system is to be factory installed on doors with a STC rating of 40 or greater.
4. Door manufacturer shall provide a Letter of Certification from an independent testing laboratory accredited as an acoustical laboratory verifying that conformance to the acoustical performance has been met. Testing shall be performed at laboratories that are fully accredited.
5. Coordinate door preparation for adjustable mortise door bottom as specified under Section 08710 Mortise prep to end 1/4" before edge of door at lock edge, Solid Wood Edge (SWE) prep configuration from DHSI. Bottom rail shall be hardwood or structural composite lumber. Doors are to be factory prepped to receive the door bottom.
6. Doors shall have a 3/8" undercut.
7. Sound seals and gasketing are not to be painted.

F. Veneer and Veneer Matching

1. Veneer Species and Cut: Architect to specify veneer and cut.

   a. Veneer Face Grade WDMA: Grade "A" as described in WDMA I.S. 1A and HPVA Door Veneer tables ANSI/HPVA-1.

2. Matching Between Leaves: Book Match
3. Veneer match: Assembly of Spliced Veneer: Running Match
4. Pair match all pairs and set of pairs separated only by mullions.
5. Set match all groups of pairs and/or individual doors indicated on the door schedule or plans.
6. Veneer Cut: Plain Sliced.
7. Veneer Species: Select White Birch.

G. Non- Fire Rated Door

1. Provide wood based particleboard core. Core to be securely bonded to the stiles and rails with Type I Adhesive.

2. Crossbands

   a. Shall be a minimum thickness of 1/16".
   b. Extend the full width of the door and have no seams.
   c. Composite crossbands of either MDF or particleboard are only permitted provided they meet or exceed the following minimum requirements:

      1) Minimum properties for composite crossband must meet physical and mechanical properties of thin MDF - Grade 230 as described in ANSI 208.2
      2) Internal bond minimum strength of 150 psi.
      3) Linear expansion minimum of < 0.3 % measured between 50% and 80% relative humidity.

3. Vertical Edges

   a. Vertical Edges to be same species as face veneer, constructed of two ply laminate hardwood outer layer (outer stile) and hardwood lumber or SCL inner layer (inner stile). Outer ply to be minimum thickness of 1/2" after trim, same species lumber as face. Veneer or lumber less than 1/2" is not acceptable. The net stile width to be minimum 1" after trimming. Veneer edge banding is not acceptable.
   b. Provide detail/cross section drawing of door edge construction.

4. Horizontal Edges

   a. Rails must be present on all doors.
   b. Rails are solid hardwood lumber, with grain running perpendicular to stiles. SCL is allowed for rails. Minimum rail after trim to be 7/8". MDF is unacceptable.

5. Side Panels

   a. Fabricate matching panels with same construction as the door. Side panels will be pair matched to the associated door and receive the same finish.

H. Fire-Rated Doors: Provide Positive Pressure Label Doors.

1. Positive Pressure labeled doors to be Category A

   a. Validate the Smoke and Draft Control ("S") Label for hardware sets that include Category H smoke and draft control seals.

2. Core material shall be dictated by manufacturer's fire door approvals.

   a. Provide 20 and 45-minute fire doors with wood based particleboard core construction where allowed by manufacturers procedure. Mineral core construction is acceptable when requirements exceed particleboard core label procedures.

3. Stiles (Vertical Edges) - Provide manufacturer's standard solid or laminated edge construction approved for each fire protection level with improved screw holding capability of 550 lbs. in accordance with WDMA TM-10, Extra Heavy Duty.

a. Outer stile to be minimum thickness of ¼" after trim, same species lumber as the face. Veneer or lumber less than ¼" is not acceptable. Veneer edge banding is not acceptable. Provide detail/cross section drawing of door edge construction.

4. Rails (Horizontal Edges) - Rails are solid lumber or other material contained in manufacturer's fire door approvals.
5. Blocking for fire doors must meet WDMA-EMD face screw pull values for surface hardware.

   a. All fire doors shall have a 6-inch minimum top rail after trim. 45-minute wood fire doors are not required to have a 6" combined blocking top rail provided assembly meets heavy duty level.

6. Pairs: Provide fire rated pairs with manufacturers approved stiles which match face veneer constructed as Category A. Veneered edges allowed where required to match face veneer. Exposed intumescent at door meeting edges or applied to frames is not acceptable.

2.3 Door Fabrication

A. Factory pre-fit and pre-machine doors to receive hardware as specified under Section 08710.

1. All doors shall be machined in accordance with manufacturer's procedures in order to maintain manufacturer's warranty and to avoid any machining conflicts.
2. Doors are to be beveled at both hinge and lock edges.
3. Factory pre-drill all hinge screw pilot holes for full mortise hinges.
4. Doors shall have a 3/8" undercut.
5. Coordinate door undercuts per architect's details and hardware specified under Section 08710.
6. All fire doors shall be in accordance with NFPA 80 for clearances and undercutting requirements.

B. Factory preparation for light openings:

1. Factory preparation for new wood doors glazing materials in vision panels shall be installed in labeled glass light kits or in accordance with the fire door listing and shall be installed in accordance with inspection service procedure and under label service per NFPA 80, 4.4.3.1.
2. Glass in new wood doors must be installed by the door manufacturer or in a licensed door shop.
3. Fire protection glazing and fire resistance glazing shall meet all applicable impact safety standards.
4. Provide metal vision kits at all fire labeled doors. Vision kits shall be Anemostat LoPro, 20 gage, with tamperproof screws and beige baked enamel finish. Install tamperproof screw heads on secure side of door. Vision kits shall have UL or W/H classification markings visible for inspection.
5. Wood beads for light opening in non-fire rated wood doors:

   a. Provide manufacturer's standard solid wood straight beads flush design, matching veneer species of door faces. Include finish nails for removable stops in accordance with manufacturers recommendations.

2.4 Factory Finishing

A. All doors, including light beads and moldings, to be factory finished where indicated in schedules or on drawings as factory finished.

B. Finish Requirements.

C. Manufacturer's standard UV Cured Acrylated Polyester/Urethanes, equal to WDMA TR-8.

1. Grade-Premium

2. Coating-Clear

3. Satin Gloss (Gloss range 30-40)

D. Package factory finished doors with manufacturers standard packaging to protect doors from damage during shipment.

PART 3 - EXECUTION

3.1 Installation

A. Install all wood doors in accordance with door manufacturer's instructions and all tolerances outlined in ANSI/WDMA I.S. 1A-13.

B. Install label doors in accordance with NFPA-80. Labels are not to be removed, defaced or made illegible while the door is in service.

C. Inspect doors prior to installation for any damage, manufacturing defects or pre-finish inconsistency.

D. Remove and replace doors that are damaged, warped, twisted or unacceptable to the Architect or Owner.

E. Should there be any door issues do not proceed with installation. Contact door supplier to correct unsatisfactory conditions and proceed with installation only after corrections have been made.

3.2 Adjusting

A. Final Adjustments: Adjust doors and hardware prior to final inspection and acceptance by the Architect and Owner. Replace defective items, including doors that are damaged or unacceptable to the Architect or Owner.

B. Fire Door Assembly Inspection and Testing: Upon completion of the installation, provide functional testing and inspection of each fire door assembly on the project to confirm proper operation and that it meets all criteria of a fire door assembly as per NFPA 80, 5.2 - Inspection and Testing 2013 edition. Inspections shall be performed by individuals with knowledge and understanding of the operating components of the door being subjected to testing and who are certified by Intertek as a Fire Door Assembly Inspector (FDAI) or a credentialed Architectural Hardware Consultant (AHC). A written report using reporting forms provided by the Door and

Hardware Institute shall be maintained and transmitted to the Owner, Contractor, Architect and made available to the Authority Having Jurisdiction (AHJ). The report shall list each fire door throughout the project, and include each door number, location, hardware set used and summary of deficiencies.

1. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project. Coordinate inspection with the Contractor and Owner.
2. Contractor shall correct all deficiencies and schedule a re-inspection of fire door assemblies which were noted as deficient on the inspection report. All deficiencies must be repaired without delay.
3. Inspector shall re-inspect fire door assemblies after repairs are made.
4. Additional re-inspections which are required due to incomplete repairs will be performed by the inspector at the expense of the Contractor.

3.3 Protection

A. Provide protective measures required throughout the construction period to ensure that doors will be without damage or deterioration at time of acceptance.

END OF SECTION

1.0 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. Section Includes: Kawneer Aluminum Entrances and Storefronts, glass and glazing, hardware and components.

1. Type of Aluminum Entrance:
   500 Swing Door; Wide stile, 5" (127 mm) vertical face dimension, 1-3/4" (44.5 mm) depth, high traffic applications.

2. Type of Storefront:
   Thermal Barrier (Trifab® VG 451T):
   Kawneer IsoLock® Thermal Break with a 1/4" (6.4 mm) separation

B. Related Sections:
1. Section 07910 "Joint Sealants" for joint sealants installed as part of the aluminum storefront system.
2. Section 08710 - Finish Hardware
3. Section 08810 - Glass and Glazing

1.3 Definitions

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 Performance Requirements

A. General Performance: Aluminum-framed entrance and storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

   a. Basic Wind Speed (MPH): (120)
   b. Importance Factor (I, II, III): (1.15)
   c. Exposure Category B

B. Entrance System Performance Requirements:

1. Wind loads: Provide entrance system; include anchorage, capable of withstanding wind load design pressures based on the 2015 International Building Code.
2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 (0.3 l/s · m2) at a static air pressure differential of 6.24 psf (300 Pa).
3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.
4. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: .60 with SHGC not to exceed .25.
6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than:
   a. Glass to Exterior – 70 frame and 69 glass (low-e)
   b. Glass to Center – 62 frame and 68 glass (low-e)
   c. Glass to Interior – 56 frame and 67 glass (low-e)
7. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
   a. Glass to Exterior – 38 (STC) and 31 (OITC)
   b. Glass to Center – 37 (STC) and 30 (OITC)
   c. Glass to Interior – 38 (STC) and 30 (OITC)

1.5 Submittals

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum frame storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum framed entrance system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (300 mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Other Action Submittals:

1. Entrance Door Hardware Schedule: See Section 08710. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 Quality Assurance

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

G. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 Project Conditions

A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 Warranty

A. Manufactures Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
   1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

2.0 - PRODUCTS

2.1 Manufacturers

A. Basis-of-Design Product:
   1. Kawneer Company Inc.
   2. Trifab® 451T (thermal) Storefront System
   3. 2" x 4-1/2" (50.8 mm x 114.3 mm) System Dimensions
   4. Glass: Center, Exterior or Interior

B. Subject to compliance with requirements, provide a comparable product by the following:
   1. Manufacturer: YKK to meet or exceed the criteria specified.

C. Substitutions: Refer to Substitutions Section 01360 for procedures and submission requirements
   1. For pre-approval: Submit written requests ten (10) days prior to bid date.
   2. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years.

D. Substitution Acceptance: Acceptance will be in written form as an addendum or post bid documented by a formal change order signed by the Owner and Contractor and approved by Architect. No exceptions. No other substitutions will be considered post bid.

2.2 Materials

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.090" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
   1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semi-rigid, polypropylene sheet or polypropylene-coated material. Comply with AAMA 701/702.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 Storefront Framing System

A. Thermal Barrier (Trifab® VG 451T):
   1. Kawneer IsoLock® Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
      a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

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

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 Glazing Systems

A. Glazing: As specified in Division 08810 Section "Glass and Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.
   a. Color: To be selected by Architect.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
   a. Color: Matching structural sealant as selected by Architect.

2.5 Entrance Door Systems

A. Entrance Door Hardware: As specified in Division 08710 Section "Finish Hardware."

2.6 Accessory Materials

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 Fabrication

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

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

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.

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

2.8 Aluminum Finishes

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color to be selected by Architect from full range of colors.) Submit hard copy of color chart.

3.0 - EXECUTION

3.1 Examination

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum framed storefront system, accessories, and other components.

B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 Field Quality Control

A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 Adjusting, Cleaning, And Protection

A. Clean aluminum surfaces immediately after installing aluminum framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The work under this section consists of all glass and glazing.

1.2 Quality

A. Glazing shall be provided to comply with Table 5.3.1 Building Envelope Requirements - Climate Zone 1 of the Alabama Building Energy Conservation Code, and the 2021 International Building Code.

B. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.

C. Safety Glazing Products: Comply with size, glazing type, location, and testing requirements of 16 CFR 1201 for Category I and II glazing products, and requirements of authorities having jurisdiction.

D. Glazing Industry Publications: Comply with glass product manufacturers' recommendations and the following:

1. GANA Publications: GANA Laminated Division's 'Laminated Glass Design Guide' and GANA's 'Glazing Manual.'
2. IGMA Publication for Insulating Glass: IGMA TM-3000, 'Glazing Guidelines for Sealed Insulating Glass Units.'

E. Insulating-Glass Certification Program: Indicate compliance with requirements of Insulating Glass Certification Council on applicable glazing products.

1.3 Samples

Submit for approval samples of each kind of glass required. Each sample shall bear a label indicating the kind and quality of the glass and the manufacturer. **Only 1 sample each is required.**

1.4 Warranty

A. Warranty for Coated-Glass Products: Manufacturer's standard form, signed by coated-glass product primary manufacturer or manufacturer/fabricator, as applicable, agreeing to replace coated-glass units that display peeling, cracking, and other deterioration in metallic coating under normal use, within 10 years of date of Substantial Completion.

B. Warranty for Laminated Glass: Manufacturer's standard form, signed by laminated-glass product manufacturer/fabricator, agreeing to replace laminated-glass units that display edge separation, delamination, and blemishes exceeding those allowed by ASTM C 1172, within five years of date of Substantial Completion.

C. Warranty for Insulating Glass: Manufacturer's standard form, signed by insulating-glass product manufacturer/fabricator, agreeing to replace insulating-glass units that exhibit failure of hermetic seal under normal use evidenced by the obstruction of vision by dust, moisture, or film on interior surfaces of glass, within 10 years of date of Substantial Completion.

D. Installer's Warranty: Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or

deterioration of glass or glazing products due to faulty installation, within 2 years of date of Substantial Completion.

2.0 - PRODUCTS

2.1 Manufacturer

Glass products shall be as manufactured by Vitro Architectural Glass., Guardian Industries, Inc., or Pre-approved equal. Laminated pattern glass shall be as manufactured by North American Glass Fabrication. Fire-rated, safety-rated wired glass shall be manufactured by Technical Glass Products, Pilkington or SaftFirst.

2.2 Materials

Glass shall be as defined in, and in accordance with Code of Federal Regulations 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

A. Compound for face glazing, or where shown or indicated as compound shall be an oleo-resinous knife grade elastic glazing compound such as Tremco's Trem-glaze, Pecora's M-242, or Dap-1012.

B. Sealant where shown or indicated shall be Tremco "Mono," Dow Corning 780, or GE's construction sealant.

C. Tape where shown or indicated shall be Tremco's 440 Tape, Curtis 606 Tape, or Warflex's "Sealing Tape."

D. Neoprene setting blocks as approved by glass manufacturer Shore "A" Hardness approximately 70 to 90.

E. Neoprene spacer shims as approved by glass manufacturer Shore "A" Hardness approximately 40 to 60.

F. Neoprene glazing beads as approved for aluminum store front and doors.

G. Color of compound, sealant, tape, etc. shall be as selected.

H. Glare reducing glass shall be 1/4" thick Solargray, Solargreen, or Solarbronze as selected.

I. Glare reducing Tempered Safety glass shall be 1/4" thick Solargray, Solargreen, or Solarbronze as selected. When multiple small glass panes are used in the same door or sidelight, provide one (1) only Decal and furnish certificate verifying the use of Safety Glass in other panels.

J. Interior Tempered Safety Glass shall meet 16CFR1201 Test Requirements, Cat. 1 and/or Cat. 2 as applicable. Etch label and furnish certificate verifying the use of Tempered Safety Glass.

K. Polished plate glass mirrors shall be 1/4" copper back, moisture resistant with ground edges and beveled face grooving. Secure with adhesive and clips. Sizes and locations indicated.

L. 1" insulating Glass - Pre-assembly Low-E unit consisting of 1/4" float glass exterior lite, 1/2" dehydrated air space and clear 1/4" float glass with Low-E interior lite meeting performance requirement for Class A or Class B Accelerated Test as specified in ASTM E744 with no visible fog. Match color on metal spacer to glazing

frame. As selected by Architect. Provide minimum SHGC of .25.

1. Solarban 70 Solar Gray + Clear
2. Solarban 60 Solar Gray + Clear
3. Solarban 70 Solar Bronze + Clear

(See corresponding SHGC and U-Value below when used with metal frame)

3.0 - EXECUTION

3.1 Preparation

A. Immediately prior to glazing, all surfaces shall be wiped clean and free of protective coatings, moisture, and dust. All glazing shall be done when the temperature is 35° F or above.

B. All sash shall be checked prior to glazing to make certain that the opening is square, plumb, and secured in order that uniform face and edge clearances are maintained. Inspect all butt and miter joints. If these joints are open, they shall be sealed with sealant prior to glazing. All ventilators shall be properly adjusted. Maintain 1/8" minimum bed clearance between glass and sash on both sides.

C. All glass indicated in non-rated doors shall be tempered with etched label.

D. All glass indicated in rated doors shall be fire safety glass with etched label.

3.2 Setting

A. Glazing preparation and procedures shall be as outlined in the Glazing Manual of the Flat Glass Jobbers Association.

B. Glass shall be set without springing, and with an equal bearing the entire width and length of each piece.

C. The actual sizes required shall be determined by measuring the frames to receive the glass. All glass shall be factory labeled.

D. Glass shall be properly cut and set in accordance with the best practice of the trade.

E. Center glass in glazing rabbet to maintain recommended clearances at perimeter for expansion and contraction, each face of glass.

3.3 Protection

Immediately after installation, a marker letter shall be placed upon each pane of glass for protection against careless breakage. All broken, cracked, scratched, or otherwise damaged glass shall be replaced.

3.4 Cleaning

A. Upon completion of the project, all glass shall have paint, dirt, and other stains removed; glass shall then be washed clean and polished.

B. Labels on glass shall not be removed until final approval is obtained, and glass is ready for cleaning.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The work of this section consists of the furnishing and erection of all metal studs and gypsum wall board, finished ready for field decoration.

1.2 Submittals

A. Submit manufacturer data, samples and shop drawings.

1.3 Applicable Standards

Current editions or revisions of Federal and ASTM standards shall apply unless specifically noted otherwise.

1.4 Delivery and Storage

All materials shall be delivered to the job in original unopened containers or bundles and stored in a place protected from the elements and damage.

2.0 - PRODUCTS

2.1 Materials

A. Interior wall metal studs shall be cold rolled "Cee" design 25-gauge steel, prepared to receive self-drill, self-tapping screw fasteners. Metal studs web shall be punched to facilitate work of other crafts. At interior wall with plumbing, provide metal stud framing wide enough to fully conceal plumbing work.

B. Exterior wall metal studs shall be 3-5/8" 20-gauge metal studs and runners, welded system, unless noted otherwise. At all areas to receive masonry veneer, use 18-gauge metal studs and runners.

C. Track shall be of proper dimension to receive metal studs and provide a close friction fit.

D. Metal studs and track shall be hot-dipped galvanized.

E. Wall board shall be a mill fabricated gypsum board consisting of a core of processed gypsum rock encased in a heavy mineral finished paper on the face side and a strong liner paper on the back side. The face paper shall be folded around the long edges to reinforce and protect the core and the ends shall be square cut and smooth finish. Thickness shall be as indicated on the Drawings but not less than 5/8".

F. Fire resistant wall board shall be a board having a specifically formulated core which shall meet Underwriter's Laboratory tests for a one-hour fire resistant rating. Material shall be equal to USG Sheetrock® Brand Ultralight Panels Fire code® X as manufactured by U.S. Gypsum, Fire-Shield® LITE® as manufactured by National Gypsum, Fireguard® by Georgia-Pacific.

G. Moisture- and Mold-resistant, Fire-resistant Gypsum Core shall be 5/8" thick Fire code equal to SHEETROCK® brand MOLD TOUGH™ FIRECODE® .

Provide at all walls subject to moisture and/or at walls behind drinking fountains, sinks, lavatories, urinals, water closets, and all other plumbing fixtures where drywall is indicated.

H. For High Impact Areas as indicated provide USG Sheetrock® Brand Mold Tough® VHI Firecode® X Panels or pre-approved equal that meets testing requirements for High Impact. The main ASTM standard for abuse classification is **ASTM C1629** which specifies the levels of performance. Annex A1 describes test methods for testing products for Hard Body Impact Resistance.

> **ASTM C1629** makes reference to three other test methods for abuse resistance: **ASTM E695** for Soft Body Impact, **ASTM D4977** for Abrasion resistance, **ASTM D 5420** for Indentation Resistance.

I. Runner channels shall be hot-rolled or cold-rolled steel and shall be galvanized or given a coat of rust-inhibitive paint. Runner channels shall be one and one-half inches (1-1/2") with flange approximately one-half inch (1/2") deep, spaced not over forty-eight inches (48") on centers. Hot Rolled Channel shall weigh not less than 850 pounds per 1,000 lineal feet; cold rolled channel shall weigh not less than 475 pounds per 1,000 feet.

J. Fasteners shall be flat, countersunk head drywall screws, USG Type S or as approved, or annular nails for use with nailer bars or for wood.

K. Trim shall be hot dip galvanized steel, corner bead, casing, and expansion strips.

L. Joint tape shall be a heavy perforated cross fibered reinforced paper.

M. Joint cement shall be a bedding and finishing cement especially prepared for use with reinforcing joint tape.

N. Metal accessories shall be provided at all exterior corners, where a horizontal surface abuts a vertical surface or where an exposed edge of the wallboard abuts metal. Material shall be as manufactured by or as recommended by the manufacturer of the wall board used.

O. Control joints shall be provided at all corners, intersections, ceilings, etc., subject to movement. Install control joints in areas as recommended by manufacturer and/or as indicated on drawings.

2.2 Auxiliary Materials

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

3.0 - EXECUTION

3.1 A. Floor and ceiling tracks aligned accurately according to partitions layout and anchored securely into structural floor and overhead structure at maximum of 16" o.c. All walls shall extend to underside of deck above.

B. Studs spaced not greater than 16" o.c. for gypsum board, anchored securely to floor and ceiling tracks. Set studs approximately 2" from abutting partitions or walls at corners, openings and ends of partitions. Anchor door bucks to adjacent studs.

C. Partitions shall be rigid, sound and plumb with all necessary metal trim, clips and accessories for a complete installation.

D. Gypsum board shall be applied in single layer or multiple layers as indicated on the Drawings by screw application to metal studs with joints taped and filled with manufacturer's recommended joint compound.

E. Application of gypsum board and joint finishing shall not begin under cold or damp conditions. The temperature shall be a minimum of 35^0 before work is begun and shall be maintained at this level or above until the joint cement is set dry and hard. Adequate ventilation shall be provided at all times.

F. Installation shall be in full accord with the recommendations of the manufacturer. Workmanship shall be by competent workmen experienced in the installation of wall board and all work shall be done in accordance with the best practices of the trade to give a smooth, straight, aligned surface which is ready for the finish.

G. Apply metal trim at exposed edges.

H. Neatly cut all openings so that they may be covered by plates and escutcheons.

I. Vertical Furring - All vertical furring in ceiling shall be of 5/8" fire rated gypsum board on metal framing. DO NOT furr with acoustical panels.

3.2 Drywall Finish

A. Temperature and Humidity Conditions
Do not install joint treatment compounds unless installation areas comply with the minimum temperature and ventilation requirements recommended by the manufacturer and conditions are acceptable to the installer.

B. Finish exposed drywall surfaces with joints, corners, and exposed edges reinforced or trimmed as specified, and with all joints, fastener heads, trim accessory flanges and surface defects filled with joint compound in accordance with manufacturer's recommendation for a smooth, flush surface. Drywall finishing work will not be considered acceptable if corners or edges do not form true, level or plumb lines, or if joints, fastener heads, flanges of trim accessories or defects are visible after application of field-applied decoration.
1. Refer to ASTM 6840 for guidelines for acceptable levels of finish.
   a. Finish Level shall be no less than Level 3 for all exposed Gypsum Board.

C. Joint and Corner Reinforcing
1. Use joint tape to reinforce joints formed by tapered edges or butt ends of drywall units and at interior corners and angles. Set tape in joint compound then apply skim coat over tape in one application.

2. Where open spaces of more than 1/16" width occur between abutting drywall units (except at control joints), prefill joints with joint compound and allow prefill to dry before application of joint tape.

3. Provide control joints as recommended by manufacturer.

D. Reinforce external corners of drywall work with specified type of corner bead.

Securely fasten metal corner beads as recommended by the manufacturer. Do not use fasteners which cannot be fully concealed by joint compound fill applied over flanges.

E. Edge Trimming
Provide specified type of metal casing bead trim. Install in single unjointed lengths

unless run exceeds longest available stock length. Miter corners of semi-finished type trim. Coordinate installation of trim continuously with drywall installation.

F. Application of Joint Compounds
Use only compatible compounds from one manufacturer. After mixing, do not use joint compounds if recommended pot-life time has expired. Allow drying time between applications of joint compound in accordance with manufacturer's recommendations for the relative humidity and temperature levels at the time of application. In no case, allow less than 24 hours drying time between application to joint compound. Apply not less than 3 separate coats of joint compound over joints, fastener heads, and metal flanges. Joint compound treatment is not required at non-fire rated walls above suspended ceiling where partitions/walls are shown or specified to extend to structural deck or ceiling above suspended ceiling.

G. LEVELS OF FINISH. The following levels of finish are established as a guide for specific final decoration. The minimum requirements for each level shall be as described herein

1. Level 4:
All joints and interior angles shall have tape embedded in joint compound and shall be immediately wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles. Two separate coats of joint compound shall be applied over all flat joints and one separate coat of joint compound shall be applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Note: It is recommended that the prepared surface be coated with a drywall primer prior to the application of final finishes. See painting/wallcovering specification in this regard.

END OF SECTION

1.0 - GENERAL

1.1 Related Documents

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

1.2 Summary

A. Section Includes:

1. Acoustical ceiling panels.
2. Exposed grid suspension system.
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

B. Related Sections:

1. Section 09260 - Gypsum Board
2. Section 09910 - Painting
3. Division 15 Sections - Mechanical Work
4. Division 16 Sections - Electrical Work

C. Substitutions:

1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.

2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.
See Section 01360 – Product Substitution for submittal process information and Product Substitution Form.

1.3 References

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
8. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
9. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
10. ASTM E 1264 Classification for Acoustical Ceiling Products.
11. ASTM E 1477 Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
12. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
13. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

B. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"

1.4 Submittals

A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.

D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.

E. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 Quality Assurance

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
   a. Flame Spread: 25 or less
   b. Smoke Developed: 50 or less

2. Fire Resistance Ratings: As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which acoustical ceilings function as a fire protective membrane and tested per ASTM E 119.
   a. Protect lighting fixtures and air ducts to comply with requirements indicated for rated assembly.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.6 Delivery, Storage, and Handling

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.7 Project Conditions

A. Space Enclosure:

All ceiling products and suspension systems must be installed and maintained in accordance with Armstrong written installation instructions for that product in effect at the time of installation and best industry practice. Prior to and after installation, the ceiling product must be kept clean and dry, in an environment that is between 32°F (0°C) and 120°F (49°C) and not subject to Abnormal Conditions within the space or with interfacing construction such as walls or soffits. Abnormal conditions include exposure to chemical fumes, vibrations, moisture, excessive humidity, or excessive dirt or dust buildup.

HumiGuard Plus Ceilings: Installation of the products shall be carried out where the temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry. The ceilings must be maintained to avoid excessive dirt or dust buildup that would provide a medium for microbial growth on ceiling panels. Microbial protection does not extend beyond the treated surface as received from the factory, and does not protect other materials that contact the treated surface such as supported insulation materials.

1.8 Warranty

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
2. Grid System: Rusting and manufacturer's defects
3. Acoustical Panels with BioBlock Plus or designated as inherently resistive to the growth of micro-organisms installed with Armstrong suspension systems: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

B. Warranty Period Humiguard:

1. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max performance supplied by one source manufacturer is thirty (30) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 Maintenance

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

2.0 - PRODUCTS

2.1 Manufacturers

A. Ceiling Panels:
Armstrong World Industries, Inc. USG or pre-approved equal.

2.2 Acoustical Ceiling Units

A. Acoustical Panels Type L1 (without fire guard): Product:
Fine Fissured, 1728
1. Surface Texture: Medium
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24in X 24in X 5/8in
5. Edge Profile: Square Lay-In for interface with Prelude XL 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, 0.55.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 35
8. Emissions Testing: < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1- 2007, "Ventilation for Acceptable Indoor Air Quality"
9. Flame Spread: ASTM E 1264;
10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.85.
11. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
12. Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

B. Acoustical Panels Type ML: Product: Clean Room VL, 868

1. Surface Texture: Smooth
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24in X 24in X 5/8in
5. Edge Profile: Square Lay-In for interface with Prelude Plus XL Fire Guard 15/16" Exposed Tee.
6. Noise Reduction Coefficient (NRC): ASTM C 423; Classified with UL label on product carton, N/A.
7. Ceiling Attenuation Class (CAC): ASTM C 1414; Classified with UL label on product carton, 40
8. Emissions Testing: < 13.5 ppb of formaldehyde when used under typical conditions required by ASHRAE Standard 62.1- 2007, "Ventilation for Acceptable Indoor Air Quality"
9. Flame Spread: ASTM E 1264; Fire Resistive
10. Light Reflectance (LR): ASTM E 1477; White Panel: Light Reflectance: 0.80.
11. Dimensional Stability: HumiGuard Plus - Temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
12. Antimicrobial Protection: BioBlock Plus - Resistance against the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

2.3 Suspension Systems **(WITHOUT FIRE GUARD CEILING TILES)**

A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized aluminum as per ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized aluminum in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

1. Structural Classification: ASTM C 635 HD.
2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
3. Acceptable Product: Prelude XL 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

2.4 Suspension System for Use with Clean Room VL, 868

A. Components: All main beams and cross tees shall be commercial quality hot-dipped galvanized aluminum as per ASTM A 653. Main beams and cross tees are double-web steel construction with type exposed flange design. Exposed surfaces chemically cleansed, capping pre-finished galvanized aluminum in baked polyester paint. Main beams and cross tees shall have rotary stitching (exception: extruded aluminum or stainless steel).

1. Structural Classification: ASTM C 635 HD.
2. Color: White and match the actual color of the selected ceiling tile, unless noted otherwise.
3. Acceptable Product: Prelude Plus XL Fire Guard 15/16" Exposed Tee as manufactured by Armstrong World Industries, Inc.

B. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three design load, but not less than 12 gauge.

D. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

3.0 - EXECUTION

3.1 Examination of Adjoining Work

Do not proceed with installation until all wet work or work that has become wet such as concrete, CMU, terrazzo, plastering and painting has been completed and thoroughly dried out.

3.2 Preparation

A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.3 Installation

A. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

B. Suspend main beam from overhead construction with hanger wires spaced 4-0 on center along the length of the main runner. Install hanger wires plumb and straight. Main beams are to be supported with hanger wires within 8" of vertical surface terminations.

C. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

D. Vertical Wall or soffit surfaces intended to be paint finished shall receive the first coat of primer or block fill prior to installation of wall moulding.

E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border areas and vertical surfaces.

F. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

3.4 Adjusting and Cleaning

A. Replace damaged and broken panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

C. Ceiling Touch-Up Paint, (Item #5760, 8oz. bottles) (Item #5761, quart size cans), "global white" latex paint should be used to hide minor scratches and nicks in the surface and to cover field tegularized edges that are exposed to view.

D. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

1.0 – GENERAL

1.1 Description

A. Scope
1. The complete installation of modular sports surfacing system including the interlocking suspended high-impact polypropylene copolymer tile of proprietary formulation, supportive acoustical underlayment and striping.

B. Related work specified under other sections.
1. Concrete Subfloors - Section 03300
   a. The general contractor shall furnish and install the concrete subfloors.
   b. The slab shall be steel troweled to a medium-dense finish to a tolerance of ±1/8" (3.2mm) in any 10' (3m) radius. Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized. High spots shall be ground level and low spots filled with approved leveling compound.
2. Game Standard Inserts - Section 11480

1.2 References

A. ASTM (American Society for Testing & Materials)
1. ASTM D 648
2. ASTM G 21

B. NFPA (National Fire Protection)
1. NFPA 253

1.3 Submittals

A. Sport Court Response TM HGHR-FR Specifications.

B. One sample of specified system.

C. Sport Court Modular Sports Flooring Installation Guide.

D. Sport Court Modular Sports Flooring Care and Maintenance Guide.

E. Sport Court Response HGHR - FR Warranty.

1.4 Quality Assurance

A. Material Supplier:
1. Shall be Sport Court International, Inc. or pre-approved equal.
2. Manufacturer must be ISO 9001:2008 and ISO 14001:2004 Certified to assure proper quality and environmental control.
3. Manufacturer shall be a Zero Waste company.
4. Manufacturer shall have produces sports surfaces for a longer time period than their stated warranty.
5. Surfaces must be certified for competition by the international federations for basketball (FIBA), volleyball (FIVB), handball (IHF) and badminton (BWF).
6. Product must have factory applied urethane coating.

B. Installer:
   1. The complete installation of the flooring system, as described in these specifications, shall be carried out by an experienced installer (Flooring Contractor), and the work shall be performed in accordance with current installation instructions of Sport Court, International.
   2. Installer (Flooring Contractor) shall be liable for all matters related to installation for a period of one year after the floor has been substantially installed and completed.
   3. Successful bidder must submit a minimum of five (5) completed modular projects of similar magnitude and complexity within the last two (2) years.
   4. Bidder must provide all sample tile, accessory products, and documentation.

1.5 Delivery, Storage And Handling

A. Materials must be delivered in manufacturer's original, unopened and undamaged packaging with identification labels intact.

B. Store material on a clean, dry, and flat surface, protected from exposure to harmful weather conditions or possible damage.

C. Storage conditions shall be 55°F to 80°F (13°C to 27°C).

1.6 Site Conditions

A. In order to prevent damage and not void the warranty, installation of modular materials shall not commence until all other finishes and overhead mechanical trades have completed their work in the modular floor areas.

B. Permanent heat, light and ventilation shall be installed and operating during and after installation.

C. Subfloors shall be clean, dry and free from dirt, dust, oil, grease, paint, old adhesive residue, or other foreign materials.

D. Flooring installation shall not begin until the levelness requirements of concrete subfloors have been met.

E. The installation area shall be closed to all traffic and activity for a period to be set by the flooring contractor.

F. Product shall be conditioned at temperatures between 55°F to 80°F (13°C to 27°C) and shall be maintained for 72 hours prior to, during, and 72 hours after installation.

G. Environmental Limitations
   1. Comply with the Sport Court requirements.
   2. Adhere to all MSDS requirements for materials employed in the work.
   3. Protect all persons from exposure to hazardous materials at all times.

H. After modular floors are installed and the game lines painted, the area is to be closed to allow curing time for the system, typically 3-5 days. No other trades or personnel are allowed on the floor until it has been accepted by the owner.

1.7 Warranty

A. Sport Court provides a limited warranty of fifteen (15) years on the materials it has supplied. (A copy of the full warranty, with its Terms and Exclusions, is available from the authorized Sport Court Dealer.) This 15-Year Limited Warranty is subject to the Response HG Flooring Warranty and all of their provisions. This warranty is expressly

limited to the flooring materials (goods) supplied by Sport Court. During the period covered under this Response HG Flooring Warranty, Sport Court shall repair/replace any tile(s) with a defective Response HG Flooring with the same or substantially similar product according to the schedule in the Response HG Flooring Warranty. This warranty does not cover floor damage caused (wholly or in part) by fire, winds, floods, moisture, other unfavorable atmospheric conditions or chemical action, nor does it apply to damage caused by ordinary wear, misuse, abuse, negligent or intentional misconduct, aging, faulty building construction, concrete slab separation, faulty or unsuitable subsurface or site preparation, settlement of the building walls or faulty or unprofessional installation of Sport Court flooring systems.

B. Sport Court shall not be liable for incidental or consequential losses, damages or expenses directly or indirectly arising from the sale, handling or use of the materials (goods) or from any other cause relating thereto, and their liability hereunder in any case is expressly limited to the replacement of materials (goods) not complying with this agreement or, at their election, to the repayment of, or crediting buyer with, an amount equal to the purchase price of such materials (goods), whether such claims are for breach of warranty or negligence. Any claim shall be deemed waived by buyer unless submitted to Sport Court in writing within 30 days from the date buyer discovered, or should have discovered, any claimed breach.

2.0 - PRODUCTS

2.1 Materials

A. Sport Court Response HGHR-FR™ Patented Suspended Flooring shall be:
1. Solid-top design.
2. Metric-sized: 25cm x 25cm x 12.7mm (9.842" x 9.842" x ½").
3. High-impact polypropylene copolymer suspended modules.
4. 281 individual hexagonal cell support structure.
5. Proprietary Maple or solid color in-mold foil transfer, with a four layer factory applied, wear resistant polyurethane clear coat.
6. The tile shall have a patented positive locking system.

B. Standard Colors: Maple Select, Dark Maple Select, Pearl Gold, Pearl Burgundy, Pearl Royal Blue, Silver, Ultra Red, Black, Pearl Graphite, Pearl Beige, Pearl Evergreen, Pearl Navy Blue, Pearl Orange, Pearl Shamrock Green, Pearl Purple, Ice Blue, Pearl Silver Blue, Yellow

C. Color Consistency: E CMC < 1.0

D. Weight: 0.62 lbs. (280 grams)

E. Packaging: Product is shipped in pre-assembled sheets (2x4 modules per sheet, 6 sheets per box).

F. Product Test Results:
1. Force Reduction (DIN 18032-2): 0.12" (3mm) - 20% - 25%
   0.20" (5mm) - 25% - 30%
   0.35" (7mm) - 30% - 35%
2. Ball Rebound (DIN 18032-2): 0.12" (3mm)- >95%
   0.20" (5mm) - 95%
   0.35" (7mm) - >95%
3. Critical Radiant Flux: (ASTM E648 / NFPA 253) 0.52 Watts/cm ^{2} Class
4. Flatness: 0.0" +0.029" /-0.0" (0.0mm +0.74mm /-0.0mm)
5. Lateral Forgiveness™: +0.045" / -0.0" (+1.14mm / -0.0mm)

G. L oad Bearing Capacity: 220 psi

H. Dynamic Load
1. All systems must be able to show verification of passing a minimum 1,000,000 cycles in dynamic load testing with minimum 200 lbs. (91 kg) loading without deviation from flatness specification.

I. Underlayment
1. Multi-purpose recycled rubber underlayment
2. Thickness: 0.12" (1.5mm)
3. Durometer: 60 ±5 on the Shore M or Shore A scales.

J. Retrofit- existing floor systems, synthetic floors must not exceed a maximum thickness of 9mm.
Product must have a minimum durometer of 60 ± 5 on the Shore A scale. Flooring representative shall verify that the existing floor system meets these requirements by submitting core samples to the respective manufacturer for analysis and approval.

K. Sanitary Information
1. Resistance to fungi (when tested in compliance with ASTM G-21 and MIL standard 810-D procedure 508.3). All basic organisms tested (ATCC #6205-11797) and were found to have zero growth.
2. Resistance to the following:
   a. Bacteria and mildew resistance
   b. Gram-positive bacterial Staphylococcus Aureus
   c. Gram-negative Klebsiella Pneumoniae
   d. Pink-staining organism
   e. STV Reticulum
   f. Surface fungi growth prior to and following leaching

L. Game Line Paint
1. Paint: aliphatic polyurethane as supplied by Sport Court. Select from standard colors.

M. Bleacher Blocking
Blocking tile system must be used in areas where bleachers shall be stored or rolled onto suspended flooring system. This system must be integrally designed to be used with flooring tiles and helps to create a solid tile configuration for reinforcement of weight distribution. Blocking tile system must be manufactured by same flooring manufacturer being bid.

3.0 - EXECUTION

3.1 Inspection

A. Inspect concrete slab for contamination, dryness and levelness. Report any discrepancies to the general contractor.

B. Concrete slab shall be broom cleaned, mopped and dust free by the general contractor.

C. Installer (Flooring Contractor) shall document all working conditions as specified in 1.0 – GENERAL prior to starting installation. Report any discrepancies to general contractor. Commencement of work indicates acceptance of concrete slab condition.

3.2 Installation

A. Underlayment – Rubber underlayment shall be unrolled and allowed to relax. All butt joints shall be properly trimmed, fitted, and seamed together with an approved all-purpose tape.

B. Floor shall be installed to pre-approved layout.

C. Minimum clearance at all vertical obstructions of 3/4 inch (19mm) is required.

D. Floor surface shall be clean and dust free.

E. Game Lines
1. Use only high quality masking tape approved by Sport Court.
2. Lines shall be primed and painted using Sport Court proprietary adhesion promoter and recommended aliphatic polyurethane paint.
3. Provide game lines as indicated on drawings.
4. Room temperature shall be >55° F (13°C) and rising during paint installation.

F. Wall Base - Install cove base anchored to walls with base cement

G. Remove all excess and waste materials from the area of work. Dispose of empty containers in accordance with federal and local statutes.

3.3 Maintenance

A. Extra Materials: Deliver extra material to Owner. Furnish extra material described below that match products installed packaged with protective covering for storage and identified with appropriate labels.
1. 5% of main court color.
2. 3% of all other colors.

END OF SECTION 09625

1.0 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Construction Waste Management plan prepared by the Construction Manager for coordination of waste material recycling is hereby incorporated by the reference as requirement of this section. Work under this section shall conform to the provisions outlined in the Plan and shall conform with the local recycling Standards to provide a coordinated effort to maximize reuse of waste materials.

1.2 Submittals

A. Submit for the approval of the Architect samples of each color and type of material. Mark each sample with the manufacturer's name, type material, pattern, color, catalog number, thickness, name of contractor, and name of project.

1.3 Delivery and Storage

A. Deliver materials to site in manufacturer's original, unopened containers clearly marked with manufacturer's brand name, color, and pattern numbers, and production run color code. Care shall be taken to prevent damage and freezing during delivery, handling, and storage.

B. Store materials at site for at least 24 hours before installation.

C. Maintain temperature of spaces where materials are stored and are to be installed at not less than 60° for at least 24 hours before installation. Thereafter, maintain a minimum temperature of 60°F.

2.0 - PRODUCTS

2.1 General

A. Materials shall be uniform in thickness and size with accurately cut edges. No seconds, off-goods, or remnants will be allowed.

B. Colors shall be uniform throughout.

C. Materials within each area shall be from one production run as indicated by cartons bearing the same manufacturer's color code.

D. Interior finish materials shall comply with flame spread limitations and smoke production limitations as follows. Tests shall be performed by an independent testing laboratory.

Walls and Ceilings	Flame Spread	25 or less ASTM E-84.
	Smoke Production	350 or less ASTM E-84.
Floors	Flame Spread	75 or less ASTM E-84.
	Smoke Production	350 or less ASTM E-84.

2.2 Manufacturers

A. Rubber Base Manufacturers
   1. Tarkett (Basis of Design)
   2. Roppe

3. Flexco
4. Mannington

B. Transition Material Manufacturers:
1. Tarkett
2. Roppe
3. Flexco
4. Mannington

C. Requests for substitution shall be considered in accordance with provision of Section 01360 and received by Architect at least 10 days prior to bid.

2.3 Wall Base Materials

A. Rubber Base shall be 4" high x running length. Rubber base shall be Johnsonite, Roppe or approved equal. Base type and color as specified on Finish Legend.

B. Adhesives, including primer, shall be as manufactured or recommended by the manufacturer of the materials used.

C. Outside corners are to be mitered. V-cut back of base strip to two thirds of its thickness and fold. Use Tool # 532 cove base groover gunlach or equal. Inside corners are to be mitered.

4' lengths or less and pre-mitered corners are not acceptable

D. Provide caulk to fill in at bullnose corners.

2.4 Floor Transition Materials

A. Provide transition strips tapered to meet abutting materials on drawings.

2.5 Adhesives:

A. Wall Base Adhesives shall be as manufactured or recommended by the manufacturer of the materials used. Provide epoxy at "wet areas".
1. Wall Base Adhesives
a. Tarkett/Johnsonite 960 Wall Base Adhesive for porous surfaces
b. Tarkett/Johnsonite 946 Premium Contact Adhesive for non-porous surfaces
c. Tarkett/Johnsonite 965 Flooring and Tread Adhesive
d. Tarkett/Johnsonite 996 Two-Part Epoxy Adhesive
e. Tarkett/Johnsonite 975 Two-Part Urethane Adhesive
2. Caulk: Color Rite Inc.

B. Floor Transitions: Adhesives shall be as manufactured or recommended by the manufacturer of the materials used.

3.0 - EXECUTION

3.1 Inspection

Surfaces to receive rubber base shall meet the minimum requirements established by the rubber base manufacturer. Examine surfaces and correct defects before starting applications.

3.2 Precautions During Installations

A. Spaces in which rubber base material is being set shall be closed to traffic and to other work until the base is firmly set.

B. Where solvent-based adhesive is used, safety sparkproof fans shall be provided and operated when natural ventilation is inadequate. Smoking shall be prohibited.

3.3 Installation

A. Install rubber base materials only after all finishing operations have been completed. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by rubber base manufacturer.

B. Mix and apply adhesive in accordance with the manufacturer's instructions. Cover the area evenly and only to the extent which can be covered with rubber base material in the recommended working time of the adhesive.

C. Base shall be applied in such a manner that the entire under- surface shall be securely bonded in place. Base shall be laid tightly so that each piece is in contact with the adjoining pieces and all joints are in true alignment.

D. Apply resilient base to permanent walls, cabinets, and fixtures in rooms or areas as specified. Install base in as long lengths as practicable. Press down so that bottom cove edge follows floor. Scribe accurately to abutting materials.

3.4 Adjustments

Inspect and make necessary adjustments after heat is applied continuously in finished areas. Any portion of the rubber base which has not seated in a level plane with surrounding base and all damaged, imperfect, or improperly installed base shall be warmed, carefully removed, and new base of the same color and thickness substituted.

3.5 Cleaning and Waxing

Remove stains from base and clean as required and recommended by manufacturer.

3.6 Surplus Materials

Unused runs and one full carton of materials shall be left at the job and turned over to the Owners.

END OF SECTION

1.0 - GENERAL

1.1 Summary

A. Section Includes: Luxury Vinyl tile floor coverings.

B. Cement Based Finishing Underlayment

C. Related Sections:
   1. Division 5 Section: Miscellaneous Metals

1.2 References

A. ASTM International:
   1. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
   2. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   3. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   4. ASTM F970 Standard Test Method for Static Load Limit.
   5. ASTM F1700 Standard Specification for Solid Vinyl Floor Tile.

B. National Fire Protection Association (NFPA):
   1. NFPA 253 Standard Method of Test for Critical Radiant Flux for Floor Covering Systems Using a Radiant Energy Source.
   2. NFPA 258 Research Test Method for Determining Smoke Generation of Solid Materials.

1.3 System Description

A. Performance Requirements:
   1. Fire Performance:
      a. Critical Radiant Flux (NFPA 253 or ASTM E648): Class 1 (0.45 watts per square centimeter or greater).
      b. Smoke Density (NFPA 258 or ASTM E662): 450 or less.

1.4 Submittals

A. General: Submit listed submittals in accordance with Conditions of the Contract and Section 01360 - Submittals

B. Product Data: Submit product data for specified products.

C. Samples: Submit selection and verification samples of finishes, colors and textures.

1.5 Quality Assurance

A. Installer Qualifications: Firm with minimum five years successful experience completing resilient tile installation similar to that required.

B. Provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

C. Materials within each area shall be from one production run as indicated by cartons bearing the same manufacturer's color code.

D. Materials shall be uniform in thickness and size with accurately cut edges. No seconds, off-goods, or remnants will be allowed.

E. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:

1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

F. Pre-Installation Conference: Conduct meeting at site prior to commencing work related to resilient tile installation.

1. Require attendance of parties directly affecting resilient tile installation.
2. Review site conditions, procedures, and coordination required with related work.

1.6 Delivery, Storage & Handling

A. General: Comply with Division 1 Product Requirements Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

2.0 - PRODUCTS

2.1 Cement Based Finish Underlayment

A. Ardex Feather Finish as approved by Ardex Engineered Cements
1. Self-Drying
2. Waterbased

2.2 Vinyl Tile Floor Covering

A. Manufacturer: Interface

B. Other manufacturers seeking approval must submit product information and comply with Section 01360 - Product Substitution. Information must be received by Architect at least 10 days prior to bid date.

2.3 Materials

A. Level Set Collection LVT: Studio Set
1. Product No. A007
2. Product Construction: High performance luxury vinyl tile
3. Classification: ASTM F1700, Class III, printed vinyl plank.
4. Wear Layer Thickness: 22 mil
5. Total thickness: 4.5mm

6. Backing Class: Commercial Grade.
7. Finish: Ceramor Coating.
8. Installation Recommendation: Floating Floor with tactiles glue free installation system.
9. Nominal dimensions: 25cm x 1m (9.845in x 39.38in)
10. Installation Methods: Ashlar or Herringbone

3.0 - EXECUTION

3.1 Manufacturer's Instructions

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 Finishing Underlayment

A. Clean and prepare the full extent of the existing concrete floor scheduled to receive flooring under this section.

B. Provide new Ardex feather finish underlayment as recommended by the manufacturer to achieve a uniform, level substrate surface throughout the entire area to receive flooring products specified under this section.

3.2 Examination

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under this section, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 Preparation

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

3.4 Protection

A. Protect installed products until completion of project.

B. Repair or replace damaged products prior to Substantial Completion.

END OF SECTION

1.0 – GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This section includes the following:

1. Resinous flooring system as shown on the drawings and in schedules.

B. Related sections include the following:

1. Cast-in-Place Concrete, Section 03300

1.3 System Description

A. The work shall consist of preparation of the substrate, the furnishing and application of a seamless flooring system with decorative flake broadcast and chemical resistant topcoat.

B. The system shall have the color and texture as specified by the Owner with a nominal thickness of 60 Mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

C. 4 inch Cove base to be applied where noted on plans and per manufacturers standard details unless otherwise noted

1.4 Submittals

A. Product Data: Latest edition of Manufacturer's literature including performance data and installation procedures.

B. Samples: A 6 x 6 inch square sample of the proposed system. Color, texture, and thickness shall be representative of overall appearance of finished system subject to normal tolerances.

1.5 Quality Assurance

A. The Manufacturer shall have a minimum of 10 years' experience in the production, sales, and technical support of epoxy and urethane industrial flooring and related materials.

B. The Applicator shall have experience in installation of the flooring system as confirmed by the manufacturer in writing in all phases of surface preparation and application of the product specified. Qualifications of applicator must be submitted to Architect by the General Contractor for approval within 24 hours after acceptance of bid. Architect reserves the right to reject applicator if they do not meet the specified qualifications and/or cannot provide documentation from manufacturer.

C. No requests for substitutions shall be considered that would change the generic type of the specified System.

D. System shall be in compliance with requirements of United States Department of Agriculture (USDA), Food, Drug Administration (FDA), and local Health Department.

E. A pre-installation conference shall be held between Applicator, General Contractor, manufacturer and the Owner for review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.6 Product Delivery, Storage, And Handling

A. Packing and Shipping
All components of the system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the product type and batch number.

B. Storage and Protection

1. The Applicator shall be provided with a dry storage area for all components. The area shall be between 60 F and 85 F, dry, out of direct sunlight and in accordance with the Manufacturer's recommendations and relevant health and safety regulations.
2. Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Architect or other personnel.

C. Waste Disposal

1. The Applicator shall be provided with adequate disposal facilities for non-hazardous waste generated during installation of the system.

1.7 Project Conditions

A. Site Requirements

1. Application may proceed while air, material and substrate temperatures are between 60 F and 85 F providing the substrate temperature is above the dew point. Outside of this range, the Manufacturer shall be consulted.
2. The relative humidity in the specific location of the application shall be less than 85 % and the surface temperature shall be at least 5 F above the dew point.
3. The Applicator shall be supplied with adequate lighting equal to the final lighting level during the preparation and installation of the system.

B. Conditions of new concrete to be coated with specified flooring material.

1. Concrete shall be moisture cured for a minimum of 7 days and have fully cured for 28 days in accordance with ACI-308 prior to the application of the coating system pending moisture tests. Outside of these parameters manufacturer shall be consulted.
2. Concrete shall have a light steel trowel finish (a hard steel trowel finish is neither necessary or desirable).
3. Sealers and curing agents should not be used.

4. Concrete surfaces on grade shall have been constructed with a vapor barrier to protect against the effects of vapor transmission and possible delamination of the system.

C. Safety Requirements

1. Other trades shall be removed during the application of the product and 72 hours after completion

2.0 – PRODUCTS

2.1 Manufacturers

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

1. Basis-of-Design Product: Subject to compliance with requirements, provide BPI Spartacote Chip Pure Seamless Floor System. Not all manufacturers produce all categories and types of resinous flooring systems.
   a. Also pre-approved are:
      Stonhard – Stontec ERF

2. Other Products must be approved prior to Bid and must be submitted in compliance with Section 01360 - Product Substitution.

2.2 Flooring

A. Spartacote Chip Pure Seamless Floor System (60 mil floor system),
   1. System Materials:
      a. Primer: Primer/Scratch Coat 160 sq. ft/gal
      b. Base resin: Pigmented Body Coat 65 sq. ft/gal
      c. Broadcast Aggregate: Broadcast Chips
         (size and quantity determined by selection of architect)
      d. Grout Coat: MVT Tolerant UV Stable Glaze 160 sq. ft/gal
      e. Top Coat: Surface Build Top Coat UV- Finish to be selected by Architect
      f. Color: See Finish Legend

   2. Cove base (4 inch high with 2 inch diameter radius, smooth texture)
      a. Cove resin; Cove Gel, Spartacote Broadcast quartz mixed with resin and troweled in place
      b. Overlay Spartacote Chip Pure Floor System to match floor
      c. Cove termination strip: clear plastic with 1/8" lip

2.3 Product Requirements

Material: Spartacote Resin	2-component epoxy
Density	12.70 lbs./gallon
VOC Content, Mixed	
Volume Solids	59%
Flash Point: Part A Part B	>212°F 170 °F
Mixing Ratio	1:4 by Vol.

Pot Life, Approximate	60 minutes @ 75°F
Open to Foot Traffic	After 16 hrs. at 73°F
Curing Temperature	Minimum 50°F
Full Cure & Max. Resistance	7 days
Hardness, Shore D ASTM-D-2240	70-75
Compressive Strength ASTM-C- 579	6500 psi
Flexural Strength ASTM-C-580	2100 psi
Adhesion To: -New concrete (5 days) -Moist concrete (28 days) -Dry concrete (28 days)	110 psi 550 psi 580 psi

3.0 – EXECUTION

3.1 Examination

A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

B. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.2 Preparation

A. General

1. Existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products
2. Mechanical surface preparation
   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 3-5 as described by the International Concrete Repair Institute.
   b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
   c. Wherever a free edge will occur, including doorways, wall perimeters, expansion joints, columns, doorways, drains and equipment pads, a ¼ inch deep by 3/16 inch wide keyways shall be cut in.
   d. Cracks and joints (non-moving) greater than 1/4 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.

3. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 Application

A. General

1. The system shall be applied in six distinct steps as listed below:
   a. Substrate preparation
   b. Cove application
   c. Primer Application
   d. Topping/overlay application with flake aggregate broadcast.
   e. Grout coat application
   f. Topcoat application to thickness to reach even texture matching accepted sample
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Cove

1. Cove will be placed with the broadcast flake to match selected color and size at 4 inches in height unless otherwise noted on drawing with a 1 inch radius
2. The cove will be smooth with no texture above mid-radius

C. Topping

1. The topping shall be applied as a self-leveling system as specified. The primer must be applied and will not be a lift coat. The topping shall be applied in one to two lifts with a minimum thickness of 60 mils.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means.
4. The topping shall be applied over horizontal surfaces using a pin rake, trowels or other systems approved by the Manufacturer.
5. Flake shall be broadcast into the wet material to excess.
6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Grout coat and Topcoat

1. The grout coat shall be mixed and applied per manufacturer recommended procedure.
2. The grout coat shall be comprised of two components, a resin, hardener.
3. The grout coat will be applied at the rate of 160 sf per gallon.
4. The top coat shall be mixed and applied per manufacturer recommended procedure.
5. The top coat shall be comprised of two components, a resin, hardener.
6. The top coat will be applied at a rate to achieve selected texture.
7. The finish floor will have a uniform texture free of dry or smooth areas that do not match the selected texture. The finished thickness shall be 60 mils.

3.4 Field Quality Control

A. Tests, Inspection

The following tests shall be conducted by the Applicator:

1. Temperature
   Air, substrate temperatures, relative humidity, and, if applicable, dew point.
2. Perform moisture tests on concrete as follows:
   a. Perform calcium chloride moisture tests in accordance with ASTM D1869 a minimum of twice for the first 1000 sq. ft and once for each additional 1000 sq. ft of area to be coated. Provide a written report of these test results including a letter of acceptance from the manufacturer.
   b. Perform PH tests alongside each calcium chloride moisture tests. Provide a written report of these test results including a letter of acceptance from the manufacturer.

B. Coverage Rates
Rates for all layers shall be monitored by checking quantity of material used against the area covered.

C. Provide daily reports including detailed days activities, materials used with batch numbers and environmental conditions

3.5 Cleaning And Protection

A. Cure flooring material in compliance with manufacturer's directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION

1.0 – GENERAL

1.1 Scope

A. The work under this section consists of all painting, finishing work and related items.

B. Paint or Painting shall include sealers, primers, stains, and oil, alkyd, latex and enamel paints and the application of these materials on surfaces prepared to produce a complete job whether or not every item is specifically mentioned. Where items are not mentioned they shall be furnished as specified for similar work. **Only work specifically noted as being excluded shall be left unfinished.**

C. This specification includes field painting of all exposed piping, metal, ductwork, conduit, hangers, mechanical and electrical equipment in finished spaces. A finished space is one listed in the Finish Schedule as having finish materials on walls and/or ceiling.

1.2 List of Proposed Materials

A. The contractor shall either verify in writing that he intends to apply the products listed in the Paint Schedule, or shall submit for approval a list of comparable materials of another listed approved manufacturer. This submittal shall include full identifying product names and catalog numbers.

1.3 Submittals

A. As soon as practicable after contract is let, submit for approval a detailed schedule of the paint proposed, listing the name of each product, and the surface to which it will be applied. Omission of any item from the approved schedule shall not relieve Contractor of his obligation.

B. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
3. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer / supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product / color / finish was used, product data pages, Material Safety Data Sheet (MSDS), care and cleaning instructions, Touch-up procedures.

1.4 Storage of Materials

A. Deliver all painting materials to job site at least three (3) days before beginning painting in original unbroken containers showing manufacturers name and type of paint, subject to Architect's inspection and approval.

B. All materials used on the job shall be stored in a single place. Such storage place shall be kept neat and clean, and all damage thereto or its surroundings shall be made good. Any soiled or used rags, waste, and trash must be removed from the building every night, and every precaution taken to avoid the danger of fire.

1.5 Protection of Other Work

A. The painting contractor shall furnish and lay drop cloths in all areas where painting is being done to protect floors and other work from damage. He shall be responsible for any damage to other work and shall replace any materials which have been damaged to such an extent that they cannot be restored to their original condition. All damage must be repaired to the satisfaction of the Architect.

1.6 Job, Weather, and Temperature Conditions

A. Maintain temperature in building at constant 65° F. or above and provide adequate ventilation for escape of moisture from the building in order to prevent condensation mildew, damage to other work, and improper drying.

B. Exterior painting shall not be done when the temperature is below 50° F., while the surface is damp, or during cold, rainy, or frosty weather, or when the temperature is likely to drop to freezing within 24 hours. Avoid painting surfaces while they are exposed to hot sun.

C. Before painting is started in any area, the area shall be broom cleaned and excessive dust shall be removed from all areas to be painted. After painting operations begin in a given area, clean only with commercial vacuum cleaning equipment.

D. Adequate illumination shall be provided in all areas where painting operations are in progress.

1.7 Inspection of Surfaces

A. Before starting any work, surfaces to receive paint finishes shall be examined carefully for defects which cannot be corrected by the procedures specified under paint manufacturers recommended "Preparation of Surfaces" and which might prevent satisfactory painting results. Work shall not proceed until such damages are correct.

B. At areas of existing previously painted surface, the painting contractor shall field verify to assure compatibility between existing paint / coating material and the proposed new paint / coating material prior to procuring such new materials or products. Should a material or product compatibility conflict be discovered, the Contractor shall immediately notify the Architect for direction prior to proceeding with procuring such materials or products.

C. The beginning of work in a specific area shall be construed as acceptance of the surfaces and the Contractor shall be fully responsible for satisfactory work.

1.8 Quality Assurance

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats. An inspection is required by manufacture in between prime coat and finish. Per the request of the Architect.

C. Coordination of Work: Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

D. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1.9 Cooperation With Other Trades

A. This work shall be scheduled and coordinated with other trades and shall not proceed until other work and/or job conditions are as required to produce satisfactory results.

B. The contractor shall examine the specifications for the various trades and shall thoroughly familiarize himself with all provisions regarding painting. **All surfaces that are left unfinished by the requirements of other sections shall be painted or finished as part of the work covered by this section.**

1.10 Maintenance Material

The contractor shall turn over to the Owner at the final inspection one gallon of each type and final color of the paint used on the project.

2.0 – PRODUCTS

2.1 Materials

A. Except where otherwise specifically stated hereinafter, painting materials shall be products of one of the following manufacturers without substitution of "Equal", and shall be in that manufacturer's top grade of the respective type: Benjamin Moore, PPG, or Sherwin-Williams (Basis of Design). The term "top grade" refers to the manufacturers advertised line of best quality and not to "Professional" or "maintenance" lines. Any deviations from the requirements of this article shall only be by written change order with contract price adjusted accordingly.

B. If job-mixed paints are used, submit proposed formulas for approval before proceeding with work. Thinning and tinting materials shall be as recommended by the manufacturer of the material used.

C. Paints and finishing materials shall be free from skins, lumps, or any foreign matter when used, and pigments, fillers, etc., shall be kept well stirred while being applied.

D. Interior finish materials shall comply with flame spread limitations and smoke production limitations as follows:

Walls and Ceilings - Flame Spread - 25 or less ASTM E-84.
Smoke Production - 350 or less ASTM E-84.

2.2 Colors

A. Not limited to "stock" ready-mixed colors. Bring to directed shades or tones by mixing.

B. In two-coat or three-coat work use slightly different colors for different coats to avoid skipping.

C. Accent or feature areas when indicated shall be colors as selected. Color spacing and pattern shall be as indicated and/or directed. Maximum three (3) colors per area.

D. Complete color scheme shall be as indicated on Finish Legend and Schedule.

2.3 Accessory Materials

Provide all required ladders, scaffolding, drop cloths, maskings, scrapers, tools, sandpaper, dusters, cleaning solvents, and waste as required to perform the work and achieve the results specified herein.

3.0 – EXECUTION

3.1 Workmanship

A. Surfaces shall be clean, dry, and free of oil, grease, dirt, mildew, loose or peeling paint, loose wood particles, and in proper condition for painting. All work shall be carefully done by skilled mechanics. Finished surfaces shall be uniform in coverage, gloss, finish and color, and free from brush marks. All coats shall be thoroughly dry before applying succeeding coats.

B. Do all work in strict accordance with manufacturer's label directions.

C. Hand sand woodwork until smooth and free from raised grain and other surface imperfections. First coat shall be applied before erection, to all surfaces, front and back. After woodwork is primed, fill nail holes, cracks, etc., full and smooth with putty. Lightly sand between coats where necessary in accord with good practice. Fully finish the top and bottom edges of doors and other woodwork edges not normally visible. Shellac knots and pitch streaks before painting.

D. On concrete or masonry, do no painting until the surface has dried to the equivalent of eight days drying time under well ventilated conditions in good drying weather.

E. Vertical surfaces to Interface with suspended acoustical panel ceiling shall be primed/filled to a minimum of 8" about finish ceiling elevation prior to the installation of the acoustical panel ceiling perimeter wall edge molding/trim.

F. Wash metal surfaces with mineral spirits to remove any dirt, grease, before applying materials. Where rust or scale is present, use wire brush, or sandpaper clean before painting. Clean shop coats of paint that become marred and touch up with specified primer.

G. Treat galvanized metal surfaces chemically with compound designed for this purpose, apply as per manufacturer's directions before applying first paint coat.

H. Remove and protect hardware panels, accessories, device plates, lighting fixtures, factory finished work, and similar items; or provide ample in-place protection. Upon

completion of each space, carefully replace all removed items.

I. Exterior doors shall have tops, bottoms, and side edges finished the same as the exterior faces of these doors. Interior door shall have vision windows, louvers, grilles, etc. Finished to match door frame.

J. All closets and the interior of all cabinets shall be finished the same as adjoining room paint or stain unless otherwise scheduled. All other surfaces shall be finished the same as nearest or adjoining surfaces unless otherwise scheduled or directed.

3.2 Schedule

A. Exterior Metals

1. Galvanized metal shall be solvent clean with VM&P Naphtha.
Primer: S-W: Procryl B66 - 1310
Finish: Apply two coats
B66-600 Series

2. Non-primed metal shall be cleaned and etched with approved acid and washed with water.
Primer: S-W: Procryl B66 - 1310
Finish: Apply two coats
S-W: Pro Industrial DTM Acrylic Coating

3. Primed metals shall be inspected, scuffs, and abrasions sanded free of rust and receive full coat of primer. Concealed metal surfaces shall be spot primed.

Primer: S-W: Procryl B66 - 1310
Finish: Apply two coats
S-W: Pro Industrial DTM Acrylic Coating

B. Interior Metals

1. Non-primed metal shall be primed under this section.
Primer: S-W: Procryl B66 - 1310

Finish: Apply two coats
S-W: Pro Industrial DTM Acrylic Coating, Gloss

2. Primed metal shall have scratches and abrasions sanded free of rust and receive one full coat of primer.
Primer: S-W: Procryl B66 - 1310

Finish: Apply two coats
S-W: Pro Industrial DTM Acrylic Coating

C. Interior Gypsum Board and Plaster

1. Latex Finish system:
Primer: S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600
Finish Apply Two Coats:
S-W: ProMar 200 Zero VOC Interior Latex

2. High Performance System: (All areas not ceiling) ***

Primer: S-W: ProMar 200 Zero VOC Interior Latex Primer, B28-2600
Finish Apply Two Coats:
S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy
Provide at all wet areas
S-W: Pro Industrial Waterbased Catalyzed Epoxy

D. Interior Concrete and Concrete Masonry

1. Concrete Masonry Surfaces shall be filled unless noted otherwise.
Prime: Pro Industrial Heavy Duty Acrylic Block Filler, B42W151
Finish Apply Two Coats:
S-W: Pro Industrial Pre-Catalyzed Waterbased Epoxy

Provide at all wet areas
S-W: Pro Industrial Waterbased Catalyzed Epoxy

a. Note: Block Filler should achieve a smooth pinhole free appearance.
b. This is necessary for proper protection before top coat is applied.
c. Apply at recommended film thickness and spread rate as indicated by manufacturer.
d. Architect requires manufacturer' inspection between block filler and top coat.

2. **Concrete Sealer:** Concrete MUST be etched, with H&C® Concrete Etcher or muriatic acid, following label directions.

Reducer/Cleaner --- Aromatic 100, R2K5, or R7K65
Brush – Use natural bristle brushes
Roller – Use a ¼" – 3/8" nap woven or other solvent-resistant cover
Freshly stained or painted surfaces will require cure time before any application of this H&C® High Performance Industrial Clear. Follow manufacturer's instructions and recommendations.

E. Interior Wood Doors and Natural Finish Wood

One (1) coat - Stain, of selected color, S-W: Wood Classics "250" Interior Wood Stain, A49-800
Or One (1) coat – S-W: Wood Classics Waterborne Polyurethane

Re: Semi-Gloss, Gloss, Egshel, Satin, Flat, etc.
All finish sheens to be selected and approved by Architect.

F. Stenciled Wall Identification

Provide one coat red color stencil identification on walls above ceilings of corridor, Smokestop, Horizontal Exit, enclosures and Firewalls. Wording shall be:

1. Wording for fire walls shall indicate the rating and:
Fire Barrier - Protect All Openings
Both sides of wall are to be stenciled above the ceiling with one stencil sign to be placed above ceilings on all separate areas and maximum of 20'-0 o.c.
2. Wording for smoke barriers:
Smoke Barrier - Protect All Openings
Both sides of wall are to be stenciled above the ceiling with one stencil sign to be placed above ceilings on all separate areas and maximum of 20'-0 o.c.

G. Exposed Ceiling Painting (Dryfall)
Primer: Pro Industrial Pro-Cryl Primer (1 coat)
Finish: Waterborne Acrylic Dry Fall Flat (1-2 coats)
B42W00001

3.3 Material Application

A. All materials shall be applied in complete accordance with manufacturer's printed instructions.

B. All coats shall be thoroughly dry before the succeeding coat is applied.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work under this section consists of all markerboards and tack boards.

1.2 Submittals
Submit for approval completely detailed shop drawings including dimensions, construction details, materials, finish, and details of adjacent construction.

1.3 Manufacturer
The specifications and drawings are based on products of Claridge Products and Equipment Company to illustrate the standard of quality. Equivalent products by American Visual Display Products, LLC and PolyVision will be acceptable.

1.4 Guarantee
The Markerboards and Tack boards Contractor shall guarantee all materials and workmanship covered by this section for a period of one (1) year from date of final acceptance of the Contract, or from occupancy of the building, whichever is earlier.

2.0 - PRODUCTS

2.1 Markerboards

A. Markerboards shall be Claridge LCS 24-gauge Porcelain Enamel steel skin with 3/8" particle board core and .015" thick aluminum sheet backing, typical 4'-0" high x 12'-0" long. (other sizes as indicated). Color to be #32 LCS White. ("MB" as designated on plans.) Nontypical sizes shall be indicated.

2.2 Sliding Markerboards

A. Metal Trim and Accessories: Provide aluminum extrusions as manufactured by Claridge Products and Equipment, Inc. Frame and exposed members shall be heavy gauge extruded aluminum and shall meet or exceed ASTM B221 Alloy Standards.
   1. Finish: Etched and anodized satin finish.
      a. Optional Finishes: Color Anodize or Powder Coat finishes available

   2. Chalk trough: Standard continuous, solid type aluminum accessory tray with ribbed section and injection molded end closures.

B. Colors: As selected from manufacturer's standard colors.
C. Adhesive: As recommended by manufacturer.

2.3 Tack board
A. Tack board shall be Claridge Fabricork Vinyl, 1/2" two-ply with 1/4" cork and 1/4" backing, 4'-0" high x 4'0" wide. Colors as selected. ("TB") as designated on drawings)

2.4 Trim
A. Provide concealed mounting for Factory Built Units with Series #3, 1-1/4" trim as indicated, using a hollow marker tray at markerboard only. Provide premoulded end covers at all markertrays.

B. Provide full length map rail No. 74 with cork insert at top of markerboard with end stops. Provide 76M display hooks, 76-R.B. roller brackets, and 76-F.H. flag holders for each section.

C. Standard end and mullion trim between marker and tack boards.

D. All trim to be extruded aluminum with satin anodized finish.

2.5 Map and Display Rail

A. Rail shall be No. 74 extruded aluminum with 1/4" thick cork insert, 1" wide, length required by drawings.

B. Provide 74ES end caps for each section, No. 76M metal display hooks (24" o.c.).

3.0 - EXECUTION

3.1 Installation

A. Installation shall be mechanically anchored in accordance with the manufacturer's recommendations. All joints flush and neatly joined. No Glue shall be used.

B. Wash markerboards with water and detergent cleaner.

C. Contractor shall affix manufacturer's instructions to each Marker/Tack board unit which includes complete instructions on proper BREAKING IN of the markerboard.

D. Mounting heights shall be verified by the Owner prior to installation.

END OF SECTION

1.0 - GENERAL

1.1 Summary

A. Section Includes:
Solid plastic toilet compartments and urinal screens.

B. Related Sections:
Division 01: Administrative, procedural, and temporary work requirements.

1.2 References

A. ASTM International (ASTM)
1. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 System Description

A. Compartment Configurations:
1. Toilet partitions: Floor mounted, overhead braced.
2. Urinal screens: Floor mounted.

B. Solid Plastic Panels: Maximum flame spread/smoke developed rating of 75/450, tested to ASTM E84.

1.4 Submittals

A. Submittals for Review:
1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
3. Samples: 3 x 3 inch samples showing available colors.

1.5 Quality Assurance

A. Manufacturer Qualifications: Minimum 5 years' experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum 5 years' experience in work of this Section.

1.6 Warranties

Provide manufacturer's 25-year warranty against breakage, corrosion, and delamination under normal conditions.

2.0 - PRODUCTS

2.1 Manufacturers

A. Contract Documents are based on products by Scranton Products.

B. Other Manufacturers wishing to submit product, must do so at least 10 days prior to bid and comply with Section 01360 - Product Substitution.

2.2 Materials

A. Doors, Panels and Pilasters:
1. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.
2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
3. 1 inch thick with edges rounded to 1/4 inch radius.
4. Color: To be selected by Architect from manufacturer's full color range.

B. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Stainless Steel: ASTM A167, Type 304.

2.3 Hardware

A. Hinges: Continuous Aluminum Hinge from door and pilaster material with exposed metal parts on interior of stall.

B. Door Strike and Keeper:
1. 6 inches long, fabricate from heavy-duty extruded aluminum with bright dip anodized finish, with wrap-around flanges secured to pilasters with stainless steel tamper resistant Torx head sex bolts.
2. Bumper: Extruded black vinyl.

C. Latch and Housing:
1. Heavy-duty extruded aluminum.
2. Latch housing: Bright dip anodized finish.
3. Slide latch and paddle.

D. Coat Hook/Bumper:
1. Combination type, chrome plated Zamak.
2. Equip outswing handicapped doors with second door pull and door stop.

E. Door Pulls: Chrome plated Zamak.

2.4 Components

A. Doors and Dividing Panels: 55 inches high, mounted 14 inches above finished floor, with aluminum heat-sinc fastened to bottom edges.

B. Pilasters: 82 inches high, fastened to pilaster sleeves with stainless steel tamper resistant Torx head sex bolt.

C. Pilaster Sleeves: 3 inches high, 20 gage stainless steel, secured to pilaster with stainless steel tamper resistant Torx head sex bolt.

D. Wall Brackets: 54 inches long, heavy-duty aluminum, bright dip anodized finish, fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts.

E. Headrail: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant Torx head sex bolt and at top of pilaster with stainless steel tamper resistant Torx head screws.

F. Headrail Brackets: 20 gage stainless steel, satin finish, secured to wall with stainless steel tamper resistant Torx head screws.

3.0 - EXECUTION

3.1 Installation

A. Install compartments in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install rigid, straight, plumb, and level.

C. Locate bottom edge of doors and panels 14 inches above finished floor.

D. Provide uniform, maximum 3/8 inch vertical clearance at doors.

E. Not Acceptable: Evidence of cutting, drilling, or patching.

3.2 Adjusting

Adjust doors and latches to operate correctly.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The work required under this section consists of room & wall signage.

1.2 Existing Conditions

A. It is the general contractor's responsibility to field verify existing signage before a bid and provide signage that shall match all existing signage types and styles currently installed to provide a continuity of design to the owner as required.

1.3 Submittals

A. Submit a sample of signs, including size, lettering style, materials, and finish.

B. Provide mounting templates.

C. Signs shall conform to requirements as set forth by the AMERICANS WITH DISABILITIES ACT Accessibility Guidelines.

D. Submit the schedule indicating each room name and number indicated on Architectural Drawings with a corresponding space for the Owner's markup for the actual room name and number per school system of each room name and number along with sign type to the Architect for review.

2.0 – PRODUCTS

2.1 Manufacturers

Subject to compliance requirements. Provide products by the following.

1. Leeds Architectural Letters, Inc. (Basis Of Design)
2. Devaney Sign Service, LLC
3. Bellco Sign & Engraving Specialists

2.2 Room and Wall Signs Standards

A. Provide photopolymer signs with Grade II Braille 3/4" numerals and 5/8" Letters to comply with ADA (American Disability Act). Signs shall be color selected from the manufacturer's full line of colors.

B. Room signs with message insert to have 1/16" front plate, minimum 1/32" solid spacer (no tape spacer), and 1/8" back plate.

C. Room Signs (no message slot)- minimum 1/8" thick with 1/32" raised letters.

D. Elevator and Stair Signs to be 6 x 6 and 1/8" thick with 1/32" raised letters.

E. Exterior Signs - Exterior Aluminum .040 thick, factory painted, and text to be silkscreened or inkjet print.

F. Edge Condition - Square Cut.

G. Corners - Round.

H. Mounting:
   1. Sheet Rock – double-sided tape
   2. Block or Brick – double-sided tape and silicone
   3. Signs to be mounted with screws and anchors if specified.
   4. Signs mounted on the wall adjacent to the latch side of the door 60" from floor to centerline of signs and 2" from the edge of the door frame to edge of the sign.

2.3 Typical Signage Schedule (refer to Architectural Signage Plan in construction documents)

A. All Offices, Classrooms, and Instructional Areas shall be 6" x 8" with a 2-1/2" x 8" changeable clear message insert unless otherwise indicated. **Refer to Item 1.2, Item A for existing signage conditions**

B. All other interior door signs except corridor and vestibule doors shall be a 6" x 6" with no message strip.

C. All restrooms shall have a minimum 6" x 8" sign with pictogram area with an additional area for raised copy and Braille.

D. 6" x 6" signs at all elevators on all floors. (Use Stairs in Case of Fire...etc.) if applicable.

E. 6" x 6" Stair Sign at every stair on all floors with pictogram if applicable.

F. 3" x 7" area of refuge sign with raised copy and Braille as indicated on the Life Safety Plans

G. Provide Framed Signage with Clear View Window. Frame to Match Interior Signage Cover) to accommodate an 8.5 x 11 Landscape Floor Plan. Provide two (2) per Classroom and Assembly Area.

H. 6" x 6" tactile exit sign at all interior exit doors leading directly to the exterior with raised copy and Braille. (Identified as **EXIT** on signage plan)

I. Occupant Load Sign to be provided at every Auditorium, Gymnasium, and Cafeteria (**Assembly Areas**) as required by IBC Section 1004.3

J. Storm Shelter Signage (**See Life Safety Plan if applicable**)

   1. Provide the following Storm Shelter Signage as required by ICC 500-2014 and as indicated on the storm shelter plan located within architectural drawings.
      a. Provide a 12" x 16" storm shelter plaque which shall be located within each storm shelter, as indicated.
      b. Provide 8" x 8" storm shelter sign, location as indicated.
      c. Provide 4" x 7" storm shelter instruction signs on each face of all storm doors as indicated.
      d. Provide an 8"x8" sign adjacent to all doors leading to electrical equipment rooms containing stationary battery systems indicating "APPLY NO WATER," along with the type of battery system and current maintenance contact information

2.4 Project Sign - Specification requirements are listed in Section 01030.

3.0 - EXECUTION

3.1 Installation of Signs
Install signs on surfaces and at heights as directed.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work required under this section consists of exterior directional signage.

1.2 Submittals
A. Submit a sample of signs including size, style of lettering, materials, and finish.

B. Signs shall conform to requirements as set forth by the AMERICANS WITH DISABILITIES ACT Accessibility Guidelines.

2.0 - PRODUCTS

2.1 Directional Signs
A. Fabricated Post and Panel Way-finding Sign

B. Material: Fabricated Painted Aluminum with Applied Vinyl Graphics

C. Mount: Posts in Concrete

D. Size: 3' x 5'

3.0 - EXECUTION

3.1 Installation of Signs
Install signs on surfaces and at heights as directed.

3.2 Install "Physically Handicapped Parking Only" sign at Handicapped Parking Spaces as indicated.

3.3 Install Traffic Control Signs in accordance with State of Alabama Highway Department Manual on Uniform Traffic Control Devices.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work of this section shall include all labor, material, and equipment necessary to furnish and install Walkway Cover and accessories hereafter specified and/or indicated on the Drawings.

1.2 Manufacturer
Walkway Cover shall be Tennessee Valley Metals, Peachtree Protective Covers, Inc., Superior Metals, Mitchell Metals or approved equal as long as they meet or exceed specifications and adhere to drawing details.

1.3 Shop Drawings
Shop drawings shall be generated under the services of a structural engineer licensed in the State of Alabama, sealed and signed and submitted to the architect for approval before fabrication. These drawings to show: size, arrangement, foundation and type of material, connections and relationship to adjacent work and compliance with applicable codes.

1.4 Guarantee
The Walkway Cover Contractor shall guarantee all materials and workmanship covered by this section for a period of one (1) year from date of final acceptance of the Contract, or from occupancy of the building, whichever is earlier.

2.0 - PRODUCTS

2.1 General
A. Structural roof system for walkway shall be complete with all required components and accessories as shown on the Drawings and as required.

B. The system shall be designed to structurally withstand severe icing, heavy hail, and 110 mph wind loads. Minimal structural capacity for all components shall meet the latest edition of the IBC as adopted by the Authority having jurisdiction.

2.2 Concealed Drainage
Water shall drain internally from deck to beams and/or to columns, spouting out at ground level through columns.

2.3 Materials
A. Roof Panel: The self-supporting aluminum Roof Panel shall be an alloy accurately roll formed to the deep channel design shown on the Drawing. It shall have a depth required for span and be furnished with an interlocking design to provide a weathertight load-bearing deck. The gauge of the panels shall be as required to support the load in accordance with engineering prints and calculations provided by the manufacturer. Material to be baked enamel acrylic. Color as selected by Architect.

B. Roll-formed Fascia: The fascia shall be accurately roll formed from an aluminum alloy to the sculptured design shown on the drawing so that it will serve as a built-in gutter for roof drainage and as a structural frame member with a height of not less than 6-1/4" and a gutter width of not less than 2-3/8".

Gutter cross sectional area shall be 4 square inches. Fascia gauge shall be as required for the load to be supported in accordance with engineering prints and calculations provided by the manufacturer. Materials to be baked enamel acrylic. Color as selected by Architect.

C. Finish: The enameled finish on roof panels, roll-formed fascia and related enameled components shall be designed for optimum performance in exterior installations under all environmental conditions. The finish shall be applied in accordance with and conform to, or exceed the Painted Sheet "Quality Standards" and recommended ASTM, Military and/or Federal Test Methods specified by the Aluminum Association in their publication "Aluminum Standards & Data".

All exposed materials shall be pre-finished. Color choices shall include industry standard bronze, dark bronze, medium bronze, white, cream, etc.

Galvanized metal shall be solvent clean with VM&P Naphtha.
Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310

Finish: Apply two coats
S-W Pro Industrial HP Acrylic Coating, S/G, B66-650
OR S-W Pro Industrial HP Acrylic Coating, Gloss, B66-600

Non-primed metal shall be cleaned and etched with approved acid and washed with water.
Primer: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310

Finish: Apply two coats
S-W Pro Industrial HP Acrylic Coating, S/G, B66-650
OR S-W Pro Industrial HP Acrylic Coating, Gloss, B66-600

Primed metals shall be inspected, scuffs, and abrasions sanded free of rust and receive full coat of primer. Concealed metal surfaces shall be spot primed.

Spot Primer Coat – S-W Pro Industrial Pro-Cryl Universal Primer, B66-310
Finish: Apply two coats
S-W Pro Industrial HP Acrylic Coating, S/G, B66-650
OR S-W Pro Industrial HP Acrylic Coating, Gloss, B66-600

D. Component Accessories: Roof Brackets, Post Brackets, Flashing, etc., shall be of same materials and finishes as specified for prime components. Each part and its use is described in the engineering prints and calculations provided by the manufacturer. Each part shall be used as specified in the aforementioned prints. Posts shall be used as specified. All components must match finish color as selected by Architect.

E. Hardware: All bolts, nuts, washers, and screws used in joining the members of the canopy together shall be stainless steel up to 1/4" diameter nominal size. Any hardware 1/4" diameter and larger shall be hot dip galvanized to withstand 200 hours' salt spray test of maximum resistance to rust and corrosion. Provide concealed fasteners where possible. All hardware must match finish color as selected by Architect.

3.0 - EXECUTION

3.1 Installation

A. Installed units shall have the following minimum pitch for water drainage of the roof.
Minimum pitch for all panels and fascia:
Up to 10'-1/8" ft.
Over 10'-1/4" ft.

B. Installed unit shall be properly caulked with a suitable, high quality material where needed and where specified.

C. Installed unit shall meet local building code requirements and conform to the engineering prints provided by the manufacturer.

3.2 Erection

A. Columns and beams shall be aligned with care before columns are grouted. Downspout columns shall be filled to the discharge level to prevent standing water, and downspout deflectors installed after grouting.

B. Grout shall be #2000 compressive strength. Mix by volume, 1 part Portland cement and 3 parts masonry sand. Add water to make pouring consistency and vibrate with a small rod to fill voids.

C. Extreme care shall be taken to prevent damage or scratching. All workmanship must be of the very best, with neat miters and fitted joints.

3.3 Flashing

At adjoining construction, as indicated or required.

3.4 Clean Up

Remove all debris from the site as it accumulates. Clean Protective Walkway Cover at completion of installation and leave in as new condition.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work under this section consists of all toilet accessories.

1.2 Samples
Returnable samples to be furnished upon request.

1.3 Manufacturer
Catalog numbers indicated in the schedule are from Bobrick Company catalog unless indicated otherwise. Equivalent products as manufactured by American Specialties, Inc., or Bradley, will be acceptable.

2.0 - PRODUCTS

2.1 List of Fixtures

A. The following list of accessories is essentially complete; however, the contractor shall examine the drawings carefully and shall supply such items not specifically called for to provide a complete installation.

B. Fixtures shall be supplied as follows:

1. Feminine Napkin Disposal - Model B-270, surface mounted, stainless steel finish. One per toilet compartment. (Female Only. Mount on opposite wall of toilet paper dispenser.) Provide at all Unisex Toilet locations.

2. Toilet Tissue Dispenser - Model B-4288. Surface Mounted, Stainless Steel dispensing. Holds two rolls up to 5-1/4" diameter. One per stall as indicated on drawings.

3. Framed Mirror - Model B-165-1830, surface mounted, stainless steel finish. One per lavatory where noted. Custom mirrors are specified under Section 08810 - Glass and Glazing.

4. Soap Dispenser (Surface Mount) - Model B-4112, liquid valve, surface mounted, stainless steel finish, vandal resistant. One per regular lavatory and as indicated on drawings.

5. Grab Bars - Model B6806 (or 6861 at Shower Stall as indicated), 1-1/2" diameter, surface mounted with B-2571 anchors at masonry walls, stainless steel finish. Provide per ADA requirements at Handicapped Toilet Compartment and Shower Stall.

6. Mop and Broom Holder - Model B-223 x 36" surface mount, stainless steel, Type 302 (18-8) satin finish. Holders spring loaded, rubber cam with plated steel retainer. Mounting height 6'-0" floor to top. One per service and/or mop sinks.

7. Coat hook with bumper - Model B-212, surface mount aluminum casting with satin finish to match stainless steel. Bumper is hard rubber secured with drive screw. Note: provide one (1) in toilet rooms without stalls.

8. Shower Curtain and Rod - Model B-6047 x width required. Extra heavy-duty stainless steel, Type 304, 18 gauge, 1-1/4" diameter. Vinyl shower curtain: Model # 204-2, white, with Hooks: Model 204-1. One each per

shower compartment.

9. Folding Shower Seat – Model B-5181, Stainless Steel with 1/2" phenolic seat as indicated on drawings.

10. Electric Hand Dryers - Model XL-SB Excel Xclerator Automatic Stainless Steel, 120V. Installation as per manufacturer's recommended mounting height and per ADA requirements.

2.2 Finishes

A. All fixtures specified or cataloged to be stainless steel shall be type 302 (18-8) with satin finish.

B. All fixtures specified or cataloged to be chrome finish shall be triple plated with heavy chrome over nickel and copper.

C. Mirrors shall be 1/4" electro-copper backed plate glass.

3.0 - EXECUTION

3.1 Attachment

A. All fixtures shall be secured to walls or partitions in the most secure method possible. Fixtures mounted singly against concrete block shall be secured with toggle bolts.

B. The proper mounting accessories shall be furnished with each item.

C. Contractor shall verify with Architect, the mounting locations and heights before installing accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work under this section consists of First Aid Kit and accessories as indicated to provide for a storm shelter facility.

First Aid Cabinets
Metal Cabinet with door and of sufficient size to handle contents and accessories for mounting. Clearly label cabinet.

1.2 Color shall be any of manufacturers standard as indicated or as selected by Architect. Paint to be high gloss finish.

1.3 Submittals
Submit for approval completely detailed shop drawings including dimensions, construction details, materials, finish and details of adjacent construction.

1.4 Manufacturer
The specifications and drawings are based on products of The American Red Cross to illustrate the standard of quality. Other Manufacturers may submit for pre-bid approval by the architect prior to bid in accordance with Specification Section 01360.

2.0 - PRODUCTS

2.1 Provide First Aid Kits for 678 Person Minimum ICC500 Approved

Contents to include but not be limited to:

Adhesive fabric bandages, 1" x 3"
Adhesive plastic bandages, 3/4" x 3"
Knuckle fabric bandages
Fingertip fabric bandages
Triangular sling/bandage, 40" x 40" x 56"
Gauze dressing pads, 3" x 3"
Conforming gauze roll, 2"
Conforming gauze roll, 3"
Trauma pad, 5" x 9"
Antiseptic cleansing wipes (sting free)
First aid burn cream pack, 0.9g each
First aid tape roll, 1/2" x 10" yds
Scissors,
Stainless steel tweezers,
Latex-free exam-quality vinyl gloves,
American Red Cross Emergency First Aid Guides

Quantities shall be in accordance with ICC500 requirements.

3.0 - EXECUTION

3.1 Installation

A. Installation shall be made in accordance with approved shop drawings and manufacturer's instructions.

B. Erect in a rigid substantial manner, straight, and plumb, with all horizontal lines level.

C. All evidence of drilling, cutting and fitting to room finish shall be concealed in the finish work.

3.2 Final Clean-up and Adjusting

A. Hardware shall be adjusted and left in good working order.

B. After all other work in the area, including painting, is complete, exposed surfaces, hardware, fittings and accessories shall be cleaned.

C. Any surfaces which have become damaged and cannot be touched up to match and give adequate protection will be rejected.

END OF SECTION

A. 1.0 - GENERAL

1.1 Summary

A. The Work required under this Section consists of providing gymnasium equipment complete with, accessories and necessary mounting, and installation hardware.

B. Related Work Specified Elsewhere

1. Division 3, Concrete; set the volleyball sleeves.
2. Division 5, Metals Sections: Structural steel and steel joints
3. Division 7, Waterproofing
4. Division 9, Finishes; install volleyball sleeve cover plates.
5. Division 16, Electrical; coordinate all electrical.

1.2 Submittals

A. Comply with Section 01350 – Submittal Procedures.
B. Product Data: Submit manufacturer's product data, including materials, components, fabrication, finish, and installation instructions.
C. Shop Drawings:
   1. Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating locations, quantities, dimensions, tolerances, materials, fabrication, connections, hardware, fasteners, finish, electrical wiring diagrams, options, and accessories.
   2. Show location and detail of attachment to building structure.
D. Samples: Submit manufacturer's color samples
E. Design Data:
   1. Basketball Backstops:
      a. Submit manufacturer's design data, indicating static loads and point reactions.
      b. Submit calculations complete, showing hanger and hoist pulley points.
      c. General load charts or generic product laboratory test data will not be considered sufficient data.
F. Test Reports: Submit manufacturer's certified test reports from testing performed by accredited independent testing laboratory, indicating compliance of materials with requirements as specified.
G. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
H. Manufacturer's Project References: Submit manufacturer's list of recently completed projects, including project name and location, name of architect, and type and quantity of gymnasium and play field equipment installed.
I. Warranty: Submit manufacturer's standard, lifetime, and additional warranties.

1.3 Project Conditions

A. Loose items of equipment shall be turned over to the Owner after un-packaging or uncrating, and checking for proper type, material, size and fit of each accessory. Obtain receipt from Owner for items turned over. No claim may be made for items turned over to the Owner without obtaining a receipt.

1.4 Coordination

A. Coordinate with Divisions 15 and 16 contractors for installation of the gymnasium equipment. Also coordinate with the Architect for exact locations.

B. Field Verify existing conditions and coordinate the work of the section accordingly.

1.5 Warranty

A. Provide 1-year warranty against defects in materials and workmanship, unless otherwise specified.

1.6 Quality Assurance

A. Single Source Responsibility: Provide gymnasium and play field equipment from single manufacturer.
B. Manufacturer's Qualifications: Minimum of 5 consecutive years' experience manufacturing gymnasium and play field equipment similar to that specified.
C. Installer's Qualifications: Trained and approved by manufacturer.
D. Regulatory Requirements: Gymnasium and play field equipment shall conform to latest rules and regulations.
   1. Federation International de Football Association (FIFA).
   2. International Basketball Federation / Federation International de Basketball (FIBA).
   3. National Association for Girls and Women in Sport (NAGWS).
   4. National Basketball Association (NBA).
   5. National Collegiate Athletic Association (NCAA).
   6. National Federation of State High School Associations (NFHS).
   7. USA Volleyball (USAV).

2.0 - PRODUCTS

2.1 Materials

A. Products of the following manufacturers are acceptable, providing their products equal or exceed the quality specified. Minor differences in construction and products are recognized to exist and may be acceptable. These variations must be submitted to the architect at least 10 days prior to bid date. Acceptance will be established by addendum.
   1. Basis of Design: Porter Athletic

2.2 General

A. Equipment shall be provided complete as per manufacturer's standard catalog description and specifications for the numbers indicated in the schedule. Equipment to be permanently installed shall be complete and ready for use.
B. Materials and finishes shall be non-corrosive in type and quality of finish noted or as a part of the manufacturer's printed description or specifications.

2.3 Ceiling Suspended Backstops

A. Basketball Backstops: Model No. 90949000 Forward Fold Front Braced overhead-supported basketball backstop.
   1. Frame: Fully welded, vertical front frame assembly consisting of main center Mast of 6-5/8-inch O.D. heavy-wall structural steel tube with diagonal side sway braces of 2-1/2-inch rectangular steel tube. Bolt-together frames are not acceptable.
   2. Structure: Supported from 3-1/2-inch O.D. pipe or tube anchored to overhead framing members with heavy formed-steel support fittings. Fittings must be capable of supporting load exceeding 10,000 pounds with sufficient attachment points and meeting safety factor of 60 to 1. Furnish certified test results with submittals.
   3. Goals: Mount directly through backboard and into heavy structural steel weldment Center-Strut, clamped to vertical 6-5/8-inch O.D. center support to eliminate strain on backboard, should player hang on front-mounted goal and to be in compliance with NCAA and NFSHSA requirements.
   4. Pipe Ends: Cap when exposed.
   5. Finish: Metal Parts, Pipes, and Fittings shall be powder coated, color specified at later time
   6. Attachments: Clamping devices used in attaching backboards and other components shall be of saddle clamp design providing uniform clamping force around mast, Clamps that provide non-uniform clamping will not be considered equal.
   7. Safety Indicator Clamp Required: Mast Attachment Indicator must be capable of supporting backboard and all weight attached to the mast with a minimum safety factor of 4, with visible indication if indicator clamp is supporting weight or if any attachments have moved.
   8. Frame Hangers: Tested to 20,000 pounds maximum breaking point to achieve safety factor of 50 to 1. Furnish certified test results with submittals. Minimum of 2-inches of adjustability for precise plumbing of backstop.
   9. Frame Hangers: Offset minimum of 1-1/2 inches from center line of main center mast to properly weight lock unit in playing position
   10. Brace: Operate with 1-7/8-inch O.D. brace with folding mechanism that locks backboard in playing position with internal torsion spring that must be mechanically disengaged by the hoist cable.
   11. Warranty: 25 Year warranty on backstop structure

2.4 Rectangular Glass Backboards

A. Basketball Backboards: Model No: 208 - Rectangular Glass Backboard
   1. Backboards: 2-5/16-inch thick frame, 72 inches by 42 inches, 1/2-inch tempered plate glass cushioned in unitized steel-tubing frame.
   2. Perimeter: Glare-free aluminum.
   3. Standard White Borders and Target Area: Fired into glass permanently.
   4. Warranty: Limited lifetime warranty against breakage.

B. Basketball Backboard Padding: Model No. 326 Pro Pad bolt-on positive-attachment backboard pad.
   1. Provide for each rectangular glass backboard, along bottom of backboard and up 15 inches on each side, meeting NCAA and NFSHSA rules.
   2. Pads: 2-inch thick, molded from 9-pound density polyurethane foam with integral skin.
   3. Color: To be selected by Architect from manufacturer's standard color. offerings

4. Warranty: 8 years.

2.5 Basketball Goals

A. Basketball Goals: Model No: 236154 - Powr-Flex II Goal
1. Goal: Shock-absorption feature by offset-hinge arrangement goal ring, back-plate mounting housing, and concealed molded-rubber shock absorber. 5/8-inch diameter cold-drawn alloy steel.
2. Front of Goal Rim: Deflect downward when static load of 230 pounds is applied, and return to playing position when load is released.
3. Cover: Conceal mounting bolts and entire spring mechanism, and protect against finger entrapment.
4. Net Attachment: Tube-tie net attachment system on rim to eliminate conventional wire-formed net locks.
5. Braces: Rigidly braced by formed die-cut steel braces on underside for maximum support.
6. Net: Anti-whip, white net.
7. Finish: Official orange powder coated.

2.6 Electric Winch

A. Basketball Backstop Winches, General:
1. Hoist Cable: Of sufficient length to each backstop. 1/4-inch diameter galvanized aircraft-type cable, minimum of 7,000 pounds ultimate.
2. Swivel Pulleys: 4-inch diameter cast ductile iron pulley sheave with maintenance-free, oil-impregnated bearing for proper hoist cable routing to winch.
3. Pulley Assembly and Attachment to 3-1/2-Inch O.D. Support Structure: Rated at minimum 9,000-pound load rating. Furnish certified test results with submittals.

B. Wiring: Install electric power and hook-up of electric controllers.
1. Materials: Conduit, wire, and boxes for power and control of key switches, touch pad, and motors to be furnished and installed as specified in Division 16 (Division 26) electrical section.
2. Hook-Ups: Complete and final hook-up of motors and electrical devises as specified in Division 16 (Division 26) electrical section.

C. Key Switch: For each backstop, Incorporate rotary up and down limit switches and flush wall-mounted dual-key switch to prevent improper operation of system.

2.7 Backstop Auto Lock Safety Strap

A. Safety Locks: Model No. 797 Saf-Strap safety lock.
1. Lock: Inertia sensitive to automatically lock basketball backstop in position at any time in storage or during raising or lowering cycle, due to sudden surge of speed created by possible malfunction of hoisting apparatus.
3. Reset: Fully automatic reset requiring no poles, ropes, levers, or buttons.

2.8 Electric Basketball Backstop Height Adjuster

A. Height Adjuster - 00902506 - POWR-STICK Height Adjuster

1. For each backstop, height adjustment unit for adjusting goal height to any position between 8'-0" and 10'-0" above floor, with Center-Strut direct-goal attachment to eliminate strain on backboard.
2. Height Scale: Located on side of slide tube to visually determine height settings.
3. Integral Limit Switches: Automatically shut off when goal height reaches 8'-0" and 10'-0".
4. Motor: Controlled by Power-Stick portable electric control.
5. Power-Stick: Include rotary control switch with up and down positions and center off position. Plug into matching receptacle mounted on height adjuster frame, while standing on floor. Provide 1 Power-Stick for each project site. Power-Stick shall plug into standard 3-wire extension cord.

2.9 Volleyball Floor Plate/Sleeves

A. Floor Sleeves and Cover Plates: Model No. 00870200 floor sleeve.
1. Floor Sleeve: 3-3/4-inch O.D. heavy-wall steel tubing, extending 9 inches into grout footing.
2. Cover Plate: Brass plated. 5-inch O.D. by 1/2-inch thick recessed collar, cork gasket, and cover.
3. Swivel Retainer Pin in Collar: Prevent theft.
4. Cover removal key.

2.10 Volleyball Standards

A. Volleyball Systems: Model No. 01971-000 Powr-Rib II volleyball system.
1. Standards: 3-1/2-inch O.D., high-strength, lightweight, aluminum Alloy 6063-T6, with 2 internal reinforcing ribs for maximum rigidity and minimum deflection. Include height-marking labels.
2. Volleyball Upright: Equipped with sliding-collar devices with spring-loaded pin to guide height setting collar up and down standard without rotating. Height settings secured with pressure-locking T-handle assembly.
3. Collar: Allow volleyball standard to be infinitely height adjustable for instant net height setting for volleyball, badminton, and tennis. Lock in place with pressure-locking T-handle.
4. Each System: 1 winch post and 1 end post.
5. Winch Post: Equipped with heavy-duty power winch.
6. End Post: Collar assembly for net tie-off.
7. Power Winch: Heavy-duty, self-locking ratchet with disc-brake release mechanism for safest tensioning system. 1-3/4-inch wide, high-tensile, nylon strap and durable snap hook. Removable handle to prevent unauthorized use.
8. Cap: Molded cap on top and bottom to protect against gymnasium floor damage.
9. Finish of Post: Clear anodized.
10. Warranty: limited 5 year warranty

2.11 Protective Padding

A. Model No. 00839-000 protective padding
1. Compliance: Meet current competition requirements as prescribed by USAV, NFHS, and NCAA for player protection and safety.
2. Padding: Extend to height of 6'-0".
3. Construction: Firm, 1-1/4-inch thick, closed-cell protective filler. Covered in durable, vinyl-reinforced fabric. Velcro closure.

4. Each Pad: Tailored with 4 vertical, miter cuts to fold around upright and store compactly.
5. Pads Installed on Uprights: Narrow profile of 7-1/2 inches by 11-1/4 inches, to provide for maximum visibility for judges and spectators.
6. Color: To be selected by Architect from Porter Athletic's standard color offerings
7. Net Attachment: One side of pad has cut-out to accommodate net attachment.

2.12 Volleyball Nets

A. Model No. 02295-xxx volleyball net.
1. Compliance: Meet requirements of USAV, NCAA, NFHS, and NAGWS.
2. Nets: 32 feet by 39 inches with 42'-6", 1/8-inch diameter galvanized cable along top.
3. End Hems: 4-inch width with 1/2-inch diameter fiberglass dowel to provide rigidity and tailored square hanging net.
4. Each End Hem: Equipped with three 1-inch wide polypropylene web-tension straps and quick-adjust tension clips.
5. Netting: 4-inch square, heavy-duty, #24 black nylon mesh with 2-inch wide, vinyl-coated, polyester hem double-stitched across top of net.

2.13 Net Antenna / Boundary Markers

A. Model No. 02296-100 Powr-Line net antenna with clamp.
1. Antenna Clamps: Included with net antenna. As 1 complete unit, clamps shall snap easily and securely into place.
2. Antenna Size: 3/8-inch diameter by 6-foot long fiberglass dowels.
3. Antenna Markings: Alternately marked red and white.

B. Boundary Markers: Model No. 02297 boundary markers.
1. 2-inch wide, durable, white, polyester-reinforced vinyl material with white Velcro attachment strips sewn in place for securing to competition volleyball net.

2.14 Volleyball System Storage

A. Volleyball Storage and Transport Carts: Model No. 00956-100 volleyball storage/transport system.
1. Capacity: Store and transport 6 sleeve-type volleyball standards, 1 judge's stand with pads, 3 nets including antennae, and 3 sets of upright pads.
2. Overall Size: 4'-3/8" in length, 3'-2-1/4" in height, and 2'-6-1/4" in width, to allow transporter to pass through typical 3-foot wide doorway.
3. Frame: Heavy-duty steel transport frame. Heavy-wall, 2-1/2-inch by 1-1/2-inch rectangular steel tubing.
4. Hooks: Heavy-formed steel hooks. Provided on side diagonal frame members for storage of standards. Covered in vinyl material to protect finish on upright posts.
5. Storage Pouch: Large vinyl nylon net storage pouch. Provided with tunnel loops and Velcro flaps for attaching to transport frame.
6. Casters: Bottom of transport on four, 3-1/2-inch diameter, heavy-duty, swivel casters.

2.15 Protective Wall Padding

A. Non-fire Retardant Wall Padding: Model No. 00560-0XX HiNRG SAFPAD.
1. Shock Absorption: ASTM F 2440, meet minimum standard.
   a. Maximum Drop Height: 5 feet.
   b. gmax: 166.5.
   c. HIC: 656.5.
2. Cover Material: Designated as flame resistant in accordance with NFPA 701 and State of California, Registered Fabric No. F-140.
3. Wall Pad Dimensions: 2'-0" wide by 6'-0" high.
4. Nailing Margin: 1-inch nailing margin top and bottom for securing panels to wall.
5. Foam: 2-inch thick, rebonded foam.
6. Interior Foam: Bonded to 7/16-inch OSB to minimize warping.
7. Entire Face of Panel, Including Nailing Margins: Upholstered in 14-ounce, fire-retardant, high-tensile, vinyl-coated polyester fabric material with leather-like embossed finish.
8. Cover Material Tear Strength: 100 psi.
9. Cover Material Properties: Mildew resistant, rot resistant, with infection-combating fungicide.
10. Fold and securely staple cover to backside of OSB.
11. Color: To be selected by Architect from Porter Athletic's standard color offerings

3.0 - EXECUTION

3.1 Preparation

A. Make such arrangements as necessary to provide scaffolding to perform Work under this Section. Damage to floors, walls, equipment and the like shall be corrected at the expense of Contractor under this Section.

3.2 Installation, General

A. Install equipment in accordance with manufacturer's printed instructions, drawings, specifications and approved shop drawings. Complete equipment field assembly, where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.

C. Permanent Gymnasium Equipment: Rigid, level, plumb, square and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.
1. Floor Insert Location: Coordinate location with application of game lines and markers.
2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation and field finishing of finish flooring and type of floor plate.

D. Floor Insert Setting: Grout sleeve for post standards in oversized, waterproofed recessed voids in concrete slabs. Clean holes of debris. Position sleeve and fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Verify that sleeves are set plumb, aligned and at correct height and spacing and held in position during placement and finishing operations until grout is cured. Set insert so top of unit is flush with finished flooring surface.

E. Portable Gymnasium Equipment: Assemble in place to verify equipment and components are complete and in proper working order. Disassemble portable gymnasium equipment after assembled configuration has been approved by Architect and store units in location indicated on Drawings.

3.3 Demonstration

A. Work under this Section shall include demonstrating the proper use and operation of equipment to the Owner as required. Instruct Owner's designated authorized personnel in properly handling, assembling, adjusting, disassembling, transporting, storing and maintaining units.

END OF SECTION

1.0 - GENERAL

1.1 Section Includes

A. Four-face electronic scoreboard Model 2665 -4 and control console for indoor use.

B. Single-face electronic scoreboard Model 2350 and control for indoor use.

C. Accessories for both models.

1.2 References

A. Standard for Electric Signs, UL-48, 14th Edition.

B. Standard for Control Centers for Changing Message Type Signs, UL-1433, 4th Edition.

C. Federal Communications Commission Regulation Part 15.

D. National Electric Code.

1.3 Submittals

A. Provide Scoreboard owner's handbook including drawings, sample warranty and other information needed for installation, operation, and maintenance of the scoreboard and accessories.

1.4 Quality Assurance

A. Source limitation: Provide all components including scoreboard, control console, data cable, mounting hardware, and other accessories from a single manufacturer for a complete and fully functional system.

B. Manufacturer qualifications: Require company specializing in manufacturing electronic scoreboards with a minimum of ten years experience.

C. Installation shall be done by manufacturer's authorized installers.

D. Adherence to nationally recognized standards.
   1. ETL listed to UL Standards 48 and 1433.
   2. NEC compliant.
   3. FCC compliant.

E. For indoor use only.

1.5 Delivery, Storage, And Handling

A. Product delivered to installation site unless otherwise specified.

B. Scoreboard and accessories to be stored in a clean, dry environment.

C. Special precautions for the scoreboard face.

1. Each scoreboard section will be protected during shipment by a layer of cardboard or other sheet material. Avoid removing this protective sheet until the installation begins.

2. Never lay a scoreboard face down or stack other objects on a scoreboard lying on its back.

3. Avoid sliding objects (like another scoreboard) along the plane of the scoreboard face even if the protective sheet is in place. This can result in LEDs being sheared.

1.6 Project Conditions

A. Scoreboard and accessories should not be installed until the area has been made weatherproof.

B. The architect shall determine location of scoreboard, control console, and other accessories.

C. The Installing Contractor shall be responsible for making certain the placement of the scoreboard does not violate local building codes or league rules regarding overhead clearance or interfere with play on the court, visibility from the stands, or lighting.

D. The Installing Contractor shall verify that the mounting structure is capable of supporting the weight of the scoreboard, additional panel, and other accessories.

E. The scoreboard location requires four standard grounded 120 VAC electrical outlets.

F. The control console location requires one standard grounded 120 VAC electrical outlet.

1.7 Warranty

A. Five year limited warranty includes factory labor and material costs for repairing or replacing defective parts. Provide sample of the warranty document with shop drawing submittal.

B. Warranty coverage period shall be effective from Date of Substantial Completion.

1.8 Maintenance

A. Replacement parts and factory repair options available from manufacturer.

B. Product support provided by experienced technicians and online documentation available via phone, web, and email at no cost to customer.

2.0 - PRODUCTS

2.1 Manufacturer

A. Basis of Design - Electro-Mech Scoreboard Co.

2.2 Scoreboards

A. Provide two (2) wall mounted Model 2350 scoreboard units as indicated for Gymnasium D100 as indicated.

1. Functions and Features: Model 2350 Indoor Scoreboard is designed to present information pertinent to basketball, volleyball, wrestling and other indoor sports. This scoreboard unit shall be provided to interface and operate in conjunction with other scoreboard units located within the same gymnasium. Presentation on each face includes:
   a. Four-digit Clock with illuminated colon/decimal indicator that can count up in MM:SS format, count down in MM:SS or SS.T format, or show time of day in HH:MM format. Clock digits are 12 inches tall and made from red LEDs.
   b. Guest and Home Scores to 199. Score digits are 12 inches tall and made from amber LEDs.
   c. Period to 9. The Period digit is 9 inches tall and made from green LEDs.
   d. Guest and Home Bonus indicators made from green LEDs.
   e. Guest and Home Next Possession indicators made from red LEDs.
   f. Integrated Horn
   g. Two dedicated 120 VAC outputs for optional visual horn indicators.
   h. One data output for daisy chaining additional scoreboards or shot clocks. Typically the four scoreboard sections are synchronized by bringing data cable from the console to the data input jack one section, running a provided jumper cable from the data output jack of that scoreboard section to the data input jack of the next scoreboard section, and so on until all four sections are connected.

2. Cabinet Size
   a. Standard model (with no side ID panel): 9 feet wide, 35 inches tall, 6 inches deep.
   b. With optional ID panel on left: 12 feet wide, 35 inches tall, 6 inches deep.
   c. With two optional ID panels (left and right): 15 feet wide, 35 inches tall, 6 inches deep.

3. Cabinet Weight (of each scoreboard section).
   a. Standard model (with no side ID panel): 85 pounds.
   b. With optional D panel on left: 100 pounds.
   c. With two optional ID panels (left and right): 115 pounds.

2.3 Accessories

A. Standard Accessories to be provided for Model 2350

1. Control Console.

a. Supports all features of Electro-Mech 2000 series basketball scoreboards without the need to enter codes or other information to configure the device. Player stat panels require separate custom control consoles.

b. Provides direct data outputs for up to four scoreboards and shot clocks all synchronized to the data (including the time) generated by the control console. Additional displays may be controlled in synchronization by daisy chaining from the data outputs of scoreboards connected to the control console.

c. Constructed of a heavy-duty ABS plastic housing holding a 0.1-inch thick keypad panel with stainless steel metal dome switches that provide tactile feedback and are rated for one million actuations.

d. Requires one standard grounded 120 VAC electrical outlet.

2. Extension Cables: 10-foot long shielded data cable with male stereo connectors at each end allows control console to be connected to a junction box (or ScoreLink transmitter) at the point of operation and later unplugged for storage.

3. Junction Box: Provides a point of termination for the data cable with a stereo socket for quick connection to the control console.

4. Stereo Plug With Pigtail: Provides a connector to be spliced onto the data cable at the scoreboard end.

5. Mounting hardware: The scoreboard cabinet is shipped with two keyhole plates attached to the top rear frame designed to allow the scoreboard to be suspended from lag bolts mounted in the wall. Two eyebolt mounted in the top of the frame may be used to lift the scoreboard cabinet and may also provide a permanent attachment points for suspension cables.

B. Other Accessories to be provided:

1. Data Cable: A shielded two-conductor cable with a drain line is the typical means of providing a path for data from the control console to the scoreboard.

2. ID Panels: This scoreboard may be ordered with an ID panel integrated into the cabinet on the left side or with two integrated panels flanking the scoreboard. An additional panel shipped as a separate cabinet, may be added along the bottom. These panels may be purchased blank or with simple text, multi-colored text and graphics, or screen-printed processed-color logos applied to their faces.

3. Carrying Case For Control Console: Included with the ScoreLink system, this option is also available for scoreboards with hard-wired data cables.

4. Handheld Clock Start/ Stop Control: Provides a hand-held pendant that allows the clock operator to start and stop the Game Clock without touching the control console.

5. Visual Horn Indicators: Designed to illuminate whenever the scoreboard horn sounds. These indicators must attach to receptacles provided on the scoreboard cabinet.

6. Team Name In Place of "HOME".

2.4 Finish

A. Standard scoreboard faces, digit masks, and the exposed areas of the corner pieces are coated with low gloss black polyester resin paint for maximum contrast and resistance to scratches.
   1. Baked on automotive grade low gloss paint in a selection of standard colors is available from the manufacturer for the scoreboard faces and corners.

   2. Non-standard colors and finishes may be applied to the scoreboard faces and corners at the customer's request.

B. Scoreboard and corner framing and back are mill-finished aluminum.

C. Captions and other decorative elements on the face of the scoreboard are vinyl.

2.5 Source Quality Control

A. Provide the following Tests and Inspections.
   1. Manufacturer requires sub-contracted printed circuit board subassemblies to undergo functional testing at the point of manufacture.
   2. Manufacturer inspects incoming components prior to installation in scoreboard and accessories.

   3. Manufacturer functionally tests major electrical subcomponents prior to installation in scoreboard and accessories.

   4. Manufacturer inspects and tests scoreboards and accessories at full power prior to shipment.

   5. Manufacturer performs a test assembly on all scoreboard sections and corner sections prior to packaging to ensure proper fit.

3.0 - EXECUTION

3.1 Examination

A. Verify 120 VAC outlets at scoreboard and control console locations are properly grounded.

B. If data cable is used, verify continuity from scoreboard to control console locations.

C. Verify data cable and AC power cable are not run in the same conduit or wire tray.

D. Verify data cable and AC power cable are secure and run in conduit where they might be exposed to abuse or where local, state, or national codes require.

E. Verify location of scoreboard, junction box (or boxes), and accessories with customer.

F. Test each scoreboard section and control console by attaching units to power and plugging console output into scoreboard data input prior to hanging the complete assembly.

3.2 Installation

A. Installing Contractor shall install scoreboards in accordance with Manufacturer's written installation instructions.

B. Scoreboard Manufacturer's representative shall provide training to Owner's representative(s) to demonstrate proper operation and maintenance of scoreboards and accessories.

C. Installing Contractor shall remove all packaging materials and other installation related debris from site upon completion of installation.

3.3 Close Out Procedures

A. Provide three (3) sets of Operating and Maintenance Manuals along with (3) copies of Manufacturer's Warranty. See Section 01910.

3.4 Protection (Post Installation)

A. The most common sources of damage to scoreboards and accessories are electrical surges running through power or data connections. The usual causes are lightning, power equipment problems (floating neutrals, bad transformers, etc.), and improper connections. To minimize these problems:

1. Ensure electrical wiring is properly grounded.

2. Unplug control console from power outlet and from data cable when not in use.

3. Turn off the breaker to disconnect scoreboard from power when not in use.

4. Label scoreboard data cable junction box and all connectors near junction box, scoreboard, and accessories so that public address systems and other devices with similar connections are not accidentally plugged into the scoreboard.

5. Avoid loss or damage of control console, extension cable, and other accessories by storing when not in use.

END OF SECTION

1.0 - GENERAL

1.1 Scope
The work of this section consists of furnishing and installing complete, all miscellaneous furnishings and fixture items as indicated.

1.2 Submittals
Shop drawings shall be submitted.

1.3 Warranty
Provide Manufacturer's Standard Warranty where manufacturer warrants that the Goods delivered hereunder shall be of the kind described within this agreement and free from defects in material and workmanship under conditions of normal use for a period of six (6) years. Halotron, CO2 and Water/Water based extinguisher will be warrantied for a period of five (5) years.

2.0 - PRODUCTS

2.1 Fire Extinguisher Cabinets (FEC)
Recessed or semi-recess U.L. approved baked enamel 18 gauge steel cabinet, 24" h. x 10-1/2" w. x 6" d. with 2-1/2" trim. Cabinet door to be baked enamel or epoxy coated with stencil lettering "Fire Extinguisher" equal to J. L. Industries-Panorama #1017 Identity Q horizontal, white w/red letters - type break glass w/cly. lock; Larsen's Mfg. Co.; Amerex Corporation; or approved equal.

Provide comparable fire rated fire extinguisher cabinets in fire rated walls as per rating indicated.

2.2 Fire Extinguisher (FE)

A. Cabinet Mounted - U.L. approved, 10 pound, tri-class dry chemical for Class A, B, & C fires. Equal to J. L. Industries - Cosmic 10E with hose; Larsen's Mfg. Co.; Amerex Corporation. Provide one with each cabinet.

B. Wall Mounted - 10 pound, Tri-Class Dry Chemical for Class A, B, C fires, U.L. approved, Model 10 ABCS-1. Manufacturers: J.L. Industries, Larsens, Amerex Corporation.

3.0 - EXECUTION

3.1 Installation
Installation of all items shall be in full conformity with manufacturer's specifications, recommendations, ADA and approved details.

3.2 Fire Extinguishers shall be cabinet mounted in areas as indicated. Height shall be 4' from floor to extinguisher handles.

3.3 Fire Extinguishers shall be wall mounted in areas as indicated or required so that distance of travel between units does not exceed 75 feet. Each separate area shall have a minimum of one unit. Mounting height shall be 4' from floor to handle.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The work of this section consists of furnishing and installing complete, all miscellaneous furnishings, fixtures, and signage items as indicated.

1.2 Existing Conditions

A. It is the general contractor's responsibility to field verify existing signage before a bid and provide signage that shall match all existing signage types and styles currently installed to provide a continuity of design to the owner as required.

1.3 Submittals

Shop drawings shall be submitted.

2.0 - PRODUCTS

2.1 Building Letters

Cast aluminum letters, equal to Leeds Architectural Letters, Inc., Select from all available fonts Size: As indicated on drawings, lay-out as indicated. Colors as selected by Architect. Provide flush concealed stud mounting.

2.2 Building Plaque

A. Dedication plaque shall be of cast aluminum. Furnish and install a 24" x 42" plaque with approximately 500 raised letters and raised border. Field shall have stipple finish. Face of letters and borders shall have ground satin finish surface.

B. Plaque layout and designation shall be furnished by the Architect.

2.3 Wall Corner Protective Guards (Op.2)

A. General

Furnish and install 8'-0" high (or cut to fit) corner guards as indicated on the drawings. Surface mounted corner guards VA Series as manufactured by CS Acrovyn.

B. Corner guards to be surface mounted with self adhesive tape backing. Provide 2-1/2" CS Acrovyn # VA-250 or pre-approved equal. Color to be selected.

2.4 Appliances

A. Washer/Dryer (Standard)

1. **Washer:** Speed Queen -TR5 Product #TR5000WN; Model # AWN63RSN115TW01, 3.2 cu. ft.
2. **Dryer:** Speed Queen - DR5 Product # DRS000WE; Model # ADE4BRGS175TW01; Electric
3. See Electrical/Plumbing drawings and provide equipment with all required electrical and plumbing rough-ins, hook-ups, and installations.
4. Warranty: Provide manufacturer's 5-year warranty.
5. Provide Operation/Maintenance Demonstration for Owner.

B. **Under-Counter Ice Maker (ADA)**

1. Manufacturer – MAXX ICE
2. Model # MIM50P-ADA
3. See Electrical/Plumbing drawings and provide equipment with all required

electrical and plumbing rough-ins, hook-ups, and installations.
4. Warranty: Provide manufacturer's limited warranty.
5. Provide Operation/Maintenance Demonstration for Owner.

C. **Refrigerator** - GE Appliances Model # GDE25EYKFS

1. See Electrical/Plumbing drawings and provide equipment with all required electrical and plumbing rough-ins, hook-ups, and installations.
2. Warranty: Provide manufacturer's 1-year warranty.
3. Provide Operation/Maintenance Demonstration for Owner.

2.5 KnoxBox
Provide one Standard Capacity Model 3274 KnoxBox 3200 - Location as directed by the Architect
* Color: (Dark Bronze)
* Mount Type: (Standard Mount)
* Tamper Switch Type: (None)

2.6 Chemical Toilet
Provide Serene Life Portable Toilet (s) SLCATL320 or pre-approved equal as required in the Storm Shelter. Provide Maintenance and Instructions with Closeouts.

2.7 Project Sign - Specification requirements are listed in Section 01030.

3.0 - EXECUTION

3.1 Installation
Installation of all items shall be in full conformity with manufacturer's specifications, recommendations, and approved details.

3.2 Installation of Building Letters
Install building letters on surfaces and at heights as directed. Install in accordance with manufacturer's recommendations.

3.3 Installation of Plaque(s)
Install plaque(s) where directed.

3.4 Installation of Appliances
Install appliances as directed. Install in accordance with manufacturer's recommendations.

END OF SECTION

1.0 – GENERAL

1.1 Section Includes

A. Fixed modular laminate clad casework and components.

B. Countertops.

C. Mobile storage units, tables and components.

1.2 Related Sections

A. Blocking within walls where indicated: Division 6.

B. Millwork, trim, and custom cabinetry: Division 6 and 12.

C. Glass: Division 8.

D. Base molding: Division 9.

E. Sinks and service fixtures, service waste lines, connections, and vents: Division 15.

F. Electrical service fixtures: Division 16.

1.3 Quality Assurance

A. Manufacturer: Minimum of 5 years' experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. All manufactured casework systems, countertops and related items herein specified shall be furnished by one contractor to insure single source responsibility, and integration with other building trades.

1.4 Submittals

A. Comply with Section 01350, unless otherwise indicated.

B. Product Data: Manufacturer's catalog with specifications and construction details.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Include production drawings for all casework systems and section drawings of all casework, work surfaces and accessories.

2. Indicate locations of plumbing and electrical service field connection by others.

3. Include layout with units in relation to surrounding walls, doors, windows, and other building components.

4. Coordinate production drawings with other work involved.

D. Casework Samples:
1. Component samples: Two sets of samples for each of the following: Decorative laminate color charts / PVC and ABS edgings.

1.5 Product Handling

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 25 percent to 55 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

C. General Contractor shall be responsible for protection of all casework and tops after installation is complete.

1.6 Job Conditions

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.

2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.
1. Flooring required to be placed under casework and equipment must be installed prior to installation.

2. Wood or metal blocking (wall grounds) shall be installed within partitions prior to delivery of casework and furnishings to allow for immediate installation on delivery.

3. Walls and openings shall be plumb, straight and square. Concrete floors shall be level within acceptable trade tolerances. Specifically the floor must be within 1/8" of level per 10 foot run, non-accumulative, when tested with a straight edge in any one direction.

4. All overhead mechanical, electrical or plumbing rough-in work shall be complete

5. Ceiling grids (with or without ceiling tiles), overhead soffits, duct work and lighting shall be installed.

6. Painting shall be complete.

7. General Contractor shall provide a secure storage area within the building that is clean, dry, well ventilated, protected from direct sunlight and broom clean.

1.7 Warranty

All materials and workmanship covered by this section will carry a five (5) year warranty from date of acceptance.

2.0 – PRODUCTS

2.1 Manufacturers:

A. Manufacturer:
Casework shall be Stevens, Advanced Cabinet Systems, Case Systems, TMI, or pre-approved equal. Each manufacturer must be able to provide casework (including selected plastic laminate colors) as specified and detailed in drawings and specifications.

B. Substitutions:

1. Casework of other manufacturers will be considered for pre-approval, providing written request is received and approved at least ten (10) days prior to announced bid date and approved by Addendum. Bidder shall state in writing any deviations from requirements and specifications. The casework shall conform to the configuration, arrangement, design, material quality, joinery, panel thickness, and surfacing of that specified and shown on drawings.

2. Manufacturer must be Architectural Woodwork Institute (AWI) Premium Certified.

3. Requests for product substitutions must comply with Section 01360 – Product Substitution Procedures.

2.2 Materials

A. Core Materials:

1. Particleboard up to 7/8 inch thick: Industrial Grade average 47-pound density particleboard, ANSI A 208.1-1999, M-3.

2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particle-board, ANSI A 208.1-1999, M-2.

3. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A208.2.

4. MR Moisture Resistant Particleboard: Average 47-pound density particleboard, ANSI A208.1 1-1999, M-3.

B. Decorative Laminates: GREENGAURD Indoor Air Quality Certified

1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.

2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.

3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.

4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.

5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.

6. Thermally fused melamine laminate, NEMA Test LD 3-2005, color to be selected by architect.

C. Laminate Color Selection: Nevamar, Wilson Art, Formica, Laminart, Arbonite, and Pionite are approved manufacturers. Manufacturer, colors, and pattern shall be selected from premium grade laminate and indicated on finish legend and schedule.

D. Edging Materials:
1. 1mm PVC banding, machine applied; match laminate as schedule
2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius; match laminate as scheduled

E. Glass:
1. Wall unit full sliding glass doors: 1/4 inch thick laminated safety glass.

2. Glass insert doors, hinged or sliding wall cabinets: 1/4 inch thick laminated safety glass.

3. Glass insert doors, hinged or sliding tall or base cabinets. 1/4 inch thick laminate safety glass.

4. Sliding doors mounted in aluminum track.

5. Trim glass inserts: Extruded rigid PVC channel and self-locking insert retainer strip.

2.3 Specialty Items

A. Support Members:
1. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.

2. Undercounter support frames: Epoxy powder coated.

3. Legs: Epoxy powder coated.

4. Brackets must support minimum of 600 lbs. without use of cross brace.

2.4 Cabinet Hardware

A. Hinges:
1. 270 degree five knuckle - epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1..
   a. Doors 48 inches and over in height have 3 hinges per door.
   b. Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.
   c. Finish to be selected by Architect.
   d. location for installation shall be noted on schedules on the drawings.

B. Pulls:
One pull shall be: located at the centerline of the drawer, regardless of width, to ensure ease of operation and maximize drawer slide life. Pull design shall comply with the Americans with Disability Act (ADA). Finish to be selected by Architect.
   a. Anodized aluminum wire pull, 8mm diameter with 96mm O.C. mounting holes

C. Drawer Slides:
1. Regular, knee space and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.

2. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:
1. Removable core, disc tumbler, cam style lock with strike. Lock for sliding 3/4 inch thick doors is a disc type plunger lock, sliding door type with strike. Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.

2. Keying:

a. Alike Per Room & Master** (100 maximum combinations) Provide 2 Master keys to owner.

3. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

F. Sliding Door Track: Anodized aluminum double channel.

G. Coat Rods: 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

H. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

I. Mirrors: 1/4 inch thick polished mirror plate.

2.5 Fabrication:
A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown. Tall Cabinets: All wardrobe cabinets are to be to be 29" deep unless noted otherwise on architectural drawings

B. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and squared to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:
1. All cabinet body construction shall be secured utilizing concealed interlocking mechanical fasteners. Construction must meet requirements in the AWS Manual, Edition 2, including errata through 2016 and appendix section.

a. Tops, bottoms and sides of all cabinets are particleboard core.

b. Tops, bottoms and sides of sink base units are moisture resistant particleboard core.

c. Sink Base Countertop substrate shall be 3/4" MR particleboard. Which shall run entire length of sink base unit. Joints or breaks at sink opening shall not be accepted. If necessary breaks shall only be allowed 4' to the right or left of the centerline of the drain.

2. Cabinet backs: Minimum 1/4 inch thick particle board core (maximum of 1/2 inch thick particle board)

   a. Exposed back on fixed: 3/4 inch thick particleboard with the exterior surface finished in VGS laminate as selected.

   b. Exposed back on fixed: 3/4 inch thick moisture resistant particleboard with the exterior surface finished in VGS laminate as selected.

3. Cabinet base and tall units shall have a site-built toe base, constructed of 3/4-inch (minimum) lumber unless otherwise shown on the drawings. Base is 96mm (nominal 4 inch) high unless otherwise indicated on the drawings.

4. Base units, except sink base units: Full sub-top. Sink base units are constructed of 3/4 inch moisture resistant particleboard and the base shelf shall be laminated both sides with cabinet liner.

5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.

6. Exposed and semi exposed edges.
   Edging: 1mm PVC.

7. Adjustable shelf core: 3/4 inch thick particleboard up to 36 inches wide, 1 inch thick particleboard over 36 inches wide.
   Front edge: 1mm PVC.

8. Interior finish, units with open Interiors: (exposed areas)

   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces that are exposed to receive thermally fused melamine to match exterior laminate.

   b. Laminate color to be selected by architect.

9. Interior finish, units with closed Interiors:

   a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine to match other laminate.

   b. Laminate color to be selected by architect.

10. Exposed ends:
    Faced with VGS high-pressure decorative laminate.

11. Wall unit bottom:
    Faced with thermally fused melamine laminate. (non-exposed areas only)

12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

13. All wardrobe cabinets are to be 29" deep unless noted otherwise on architectural drawings

D. Drawers:

1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 3mm PVC.

2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.

3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

E. Door/Drawer Fronts:

1. Core: 3/4 inch thick moisture resistant particleboard at sink units.

2. Provide double doors in opening in excess of 24 inches wide.

3. Faces:

a. Exterior: VGS High-pressure decorative laminate.

b. Interior: High-pressure cabinet liner CLS.

c. All exposed areas to receive matching laminate color as face.

4. Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

F. Miscellaneous Shelving:

1. Core material: 3/4 inch or 1 inch thick particleboard.

2. Exterior: VGS High-pressure decorative laminate.

3. Edges: 3mm PVC (at open storage shelving on metal standards), external edges and outside corners machine profiled to 1/8 inch radius.

2.6 Decorative Laminate Countertops:

A. All laminate clad countertops shown on drawings for fixed casework shall be constructed with minimum 1-1/6"" solid particleboard, except at sink and wet areas.
Furnish plywood core tops and splashes, two and a half feet each side of center line of all sinks. All tops shall be laminated on the top face with GP50 (.050) high pressure decorative laminate and shall also have BK20 backer sheet creating balanced construction. The plastic laminate tops required for the rail mounted casework shall be constructed the same as the fixed laminate tops in the lengths indicated on the drawings. The rail mounted tops mounted

over brackets shall be 1-1/4 inches from the wall to create a continuous grommet behind the back of the top. The rail mounted tops shall be supplied with 3mm PVC on all four edges. Provide tight joint fasteners where needed. All exposed edges, including edges of backsplash where used, shall have 3mm PVC banding, machine applied with waterproof hot melt adhesive. Exposed edges and corners shall be machine profiled to 1/8" radius for safety. Edging shall be available in colors as listed in Specification. Furnish 4" high backsplashes behind all sinks and as indicated on architectural drawings.

3.0 - EXECUTION

3.1 Inspection

The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 Preparation

Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.3 Installation

A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.

C. Repair minor damage per plastic laminate manufacturer's recommendations.

3.4 Cleaning

A. Remove and dispose of all packing materials and related construction debris.

B. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.

3.5 Color Selection:

Laminate Color Selection: See Finish Legend and Schedule for color selections.

END OF SECTION

1.0 - GENERAL

1.1 Scope

The pre-engineered steel building package shall consist of primary and secondary structure, metal roof panel or deck, exterior wall cover, fascia panel, trim and flashing, closures, caulking, fasteners and other miscellaneous metal building components or accessory items as shown or called for in the drawings or specifications and as required.

1.2 Related Sections

A. Section 07610 – Standing Seam Roof and Sheet Metal System

B. Section 08110 - Hollow Metal Doors and Frames

1.3 Qualifications

A. A complete structural analysis of the design is to be made to demonstrate that requirement of design and load criteria are met.

B. A copy of manufacturer's calculations and analysis shall be furnished to the Architect.

C. Metal building manufacturer shall be accredited by the International
Accreditation Services' IAS Accreditation for Inspection Programs for Manufacturers of Metal Building Systems (AC472). Metal Building Manufacturer shall be currently enrolled in an IAS accreditation program and shall maintain such throughout the course of the project.

D. Metal building shall be designed in accordance with "The Metal Building Manufacturers Association's Design Practice Manual."

E. The metal building design engineer is responsible for the complete design of the metal building system.

1.4 Submittals

A. Shop Drawings for approval. Drawings and design analysis shall bear the seal of a registered professional engineer registered in the State of Alabama. Submittal shall include layout of all members, connections, and accessories and associated details for erection.

B. Documentation of manufacturer's current (up-to-date) IAS certification shall be submitted to the Architect. If accreditation expires during the course of the project renewed certificate shall be submitted as well.

C. Record or certificate of erector training for metal building system being erected.

D. Building exterior components samples.

E. Color samples for approval.

1.5 Warranties

All materials and workmanship covered by this section shall be guaranteed from date of final acceptance of the Contract, or from occupancy of the building whichever is earlier.

A. Wall Paint Warranty
All wall panels shall be guaranteed for a period of ten (10) years against chalk, fade, crack, check, blister or peel.

B. Roof Paint Warranty
All roof panels shall be guaranteed for a period of twenty (20) years against chalk, fade, crack, check, blister, or peel.

C. Standard manufacturer's roofing guarantees (or warranties) which contain language regarding the governing of the guarantee (or warranty) by any state other than the State of Alabama, must be amended to exclude such language, and substituting the requirement that the Laws of the State of Alabama shall govern all such guarantees (or warranties).

1.6 General

A. All components including, but not limited to the following will be furnished and installed for the complete steel structural framework: anchor bolts, wall and roof panels, downspouts, gutters, fascias, insulation, all necessary closures, trims, flashing and fasteners to provide a weather proof building, and miscellaneous accessories as specified.

B. All steel shall be new, clean and straight. Welding shall be done by qualified operators and the specifications of the American Welding Society adhered to. Workmanship on all parts will be equal to that of best modern shop practices.

C. Walk-thru doors and hardware furnished and installed under Hollow Metal Doors and Frames - Section 08110 And Finish Hardware - Section 08710.

D. Rolling Service Doors - Section 08360.

2.0 - PRODUCT

2.1 General

A. All structural mill sections or welded up plate sections shall be designed in accordance with the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", latest edition.

B. All Cold-formed steel structural members shall be designed in accordance with the AISI "Specification for the Design of Cold-formed Steel Structural Members", latest edition.

2.2 Design Loads

A. The design loads for the building shall be, in addition to their own dead load, the live, wind, snow and seismic loads required of the following as specified:
1. 2021 International Building Code.
2. Low Rise Building Systems Manual, by the Metal Building Manufacturers

Association.

B. The building components shall be designed to meet the most severe conditions of load combinations set by the specified building code, but in no case be less than that produced by the following load combinations:

1. Building dead load plus roof live load (or snow).
2. Building dead load plus wind load.
3. Building dead load plus wind load plus one-half roof snow load.
4. Building dead load plus roof snow load plus one-half wind load.

C. Roof live and snow loads shall be applied on the horizontal roof projection. Wind loads shall be assumed to act horizontally and shall be applied as pressure and suction perpendicular to the building surface.

D. Design load requirements shall be determined by local conditions, applicable codes, building end use, etc. Application of design loads shall be in accordance with the Design Practices sections of the Metal Building Manufacturers Association (MBMA) Building Systems Manual, unless specified otherwise. NOTE: See all drawings for additional point loading on the roof structure (including but not limited to roof top mechanical units, hanging equipment loads, continuous heavy piping loads, etc.).

E. Minimum design collateral loads supported on or hung from the roof structure shall be as follows:

Minimum Design Collateral Load (MDCL) ..... 10 psf

These collateral loads shall be applied in addition to self-weight of building frame, roof decking and roof covering weights.

F. Deflection Limits:
- Roof Purlins and Rafters: DL Span/360, LL Span/360, TL Span/240.
- Girts Supporting Metal Panels: Horizontal deflection Span/120.
- Overall Building Drift: H/200 where "H" is the building eave height.
- Note specific deflection requirements and expansion joints noted on drawings.

2.3 Primary Framing Steel

A. Steel for hot-rolled structural sections shall conform to the requirements of ASTM specification A 36.

B. Steel for all built-up sections shall meet as applicable the physical and chemical properties of ASTM A 572 modified to 55,000 psi minimum yield and 70,000 psi minimum tensile strength, or ASTM A 607-85, Grade 55, or ASTM A 570-88, Grade 55.

C. Steel for all endwall "C" sections shall meet the physical and chemical properties of ASTM A 570-88, Grade 55.

D. Rigid Frame: All rigid frames shall be welded, built-up "I" sections. The columns shall be straight or sloped with a minimum depth of 12" for primary frame members. Bases of frames are to be pinned.

E. Endwall Frames: All endwall roof beams and endwall columns shall be cold-formed "C" sections, mill-rolled sections, or built-up "I" sections as required for

future bay addition.

F. Plates, Stiffeners, etc.: All base plates, splice plates, cap plates, and stiffeners shall be factory welded into place on the structural members.

G. Bolt Holes, etc: All base plates, splice plates and flanges shall be shop fabricated to include bolt connection holes. Webs shall be shop fabricated to include cable brace or rod brace holes and flange brace holes.

2.4 Secondary Framing Steel

A. Steel used to form purlins, girts, eave struts and "C" sections shall meet the physical and chemical properties of ASTM A 570-88, Grade 55.

B. Steel used to form zinc-coated (galvanized) rolling service door frames shall meet the physical and chemical properties of ASTM A 446-87, Grade D and G 90 Coating designation as described in ASTM A 525-87.

C. Purlins and Girts: Purlins and girts shall be cold-formed "Z" or "C" sections with stiffened flanges. They shall be prepunched at the factory to provide for field bolting to the primary framing. They shall be simple or continuous span as required by design.

D. Bracing Struts: Provide bracing struts of round HSS or pipe sections sized as required to transfer lateral forces into primary structural frame system.

E. Eave Struts: Eave Struts shall be unequal flange, cold-formed "C" sections.

F. Base Angle: A base member will be supplied by which the base of the wall covering may be attached to the perimeter of the slab. This member shall be secured to the concrete slab with concrete anchors.

G. Provide attachment and support framing for wall mounted gymnasium equipment.

2.5 Bracing

A. Diagonal Bracing: Diagonal bracing in the roof shall be used to resolve horizontal loads (wind, seismic, crane, etc.) from the roof structure into the longitudinal bracing frames or transverse rigid frames. This bracing will be furnished to length and equipped with bevel washers and nuts at each end. It may consist of rods threaded each end or galvanized cable with suitable threaded end anchors.

B. Flange Braces: The compression flange of all primary framing shall be braced laterally with angles connecting to the webs of purlins or girts so that the flange compressive stress is within allowable limits for any combination of loadings.

C. Longitudinal and Special Bracing: **Diagonal bracing is not permitted in the sidewall**, a rigid frame type portal with pinned bases must be used. Coordinate load path of sidewall bracing frames with load path of wind/seismic bracing in the roof. Provide additional bracing as required to transfer all horizontal loads into the primary structural system.

D. Coordinate trades with locations of bracing. Bracing shall not be removed or cut to facilitate installation of other trades unless approved in writing by the metal building design engineer.

2.6 Wall Panel Material

Panel material as specified shall be 24 gauge zinc-coated (galvanized) steel, coating designation G 90, conforming to the requirements of ASTM A 446 Grade D. Minimum yield stress shall be 50,000 psi.

2.7 Connections

A. All field connections shall be bolted (unless otherwise noted).

B. All shop connections shall be welded using either submerged or shielded arc process, and welding shall be in accordance with the applicable sections, relating to design requirements and allowable stresses, of the latest editions of the American Welding Society "Structural Welding Code."

C. Metal building designer shall size anchor rods and provide details for required anchorage to the foundations.

2.8 Roof Covering

A. The roof system shall be provided under Section 07610.

B. The roof system shall carry a UL wind uplift Class 90 rating. Comply with FM I-90 and the 2021 International Building Code.

C. Purlins shall be insulated so as to eliminate "thermal short circuits" between purlins and roof panels, with continuous thermal spacer blocks.

2.9 Wall Covering

The Exterior wall covering shall be first quality 24 gauge galvanized steel architectural type panels (A.S.T.M. Galvanized Specifications). Panels will be precision roll-formed 36" panels with ribs at 12" o.c. The interior liner panels shall be minimum 3/4" thick 24 gauge - panel profile to be approved by architect.

2.10 Panel Fasteners

Panel fasteners will be galvanized self-tapping hex head screws. A self sealing washer will be used under the head of all panel fasteners. Galvanized screws will be used on the sidewalls of all colored buildings. Fasteners shall be pre-finished to match wall panel color.

2.11 Weather Sealing

A. Sealant

Sealant to be used in all end panel laps on roofs and all other locations recommended by the manufacturer or required for weathertightness.

B. Weather Seal Strips

Sealer strips to be moulded from first grade high quality polyurethane to ensure long life.

2.12 Paint

A. Exterior Paint and Interior Paint (For Exterior Wall Panels and , Interior Liner Panels)

A 70% minimum Kynar 500 finish shall be applied over galvanized steel and shall be given a chemical conversion treatment prior to painting. See paragraph 1.4 for Warranty requirements. Color shall be approved by the Architect to match existing.

B. Structural Paint

1. All fabricated structural steel to be shot blast cleaned to remove loose rust, mill scale, etc. After inspection for accuracy of fabrication, it shall receive one shop coat of manufacturer's standard gray finish.

2. Any field touch-up necessary shall be the responsibility of the erector.

2.13 Gutters, Downspouts, and Flashings

A. Gutters and Downspouts: Gutters and downspouts to be furnished by Metal Building Manufacturer. Members to be fabricated from galvanized steel with supporting brackets properly spaced. Gutters shall be 24 gauge and downspouts 28 gauge. Finish shall match roof/wall panels.

B. Flashings: Roof, gables and eaves will be flashed with 26 gauge galvanized fascia trim. Corners of the building will be provided with 26 gauge galvanized steel corner trim. Door, window and sill trim will be provided in 26 gauge galvanized steel. Painted galvanized steel flashings will be fabricated from prefinished steel using the same paint specifications as wall and roof sheets.

2.14 Glass Fiber Insulation

Glass Fiber Insulation to be fabricated from first grade high quality glass fiber blanket and faced with white vinyl reinforced polyester film. Insulation shall have Underwriter's Label. Glass fiber insulation shall be .60 density - 6" thick - 25 flame spread - "R" value of R19. All insulation shall be protected and maintained dry. Wet Insulation shall be rejected.

2.15 Framed Openings This contractor to provide framed openings with pre-finished flashing to accommodate mechanical equipment such as louvers, grilles, piping, conduit furnished by other trades.

2.16 Roof and Wall Penetrations

All roof penetrations shall be flashed by building manufacturer/installer. All circular roof penetrations shall be made of a one piece construction from an EPDM membrane with aluminum base. Roof curbs shall be provided by building manufacturer/installer.

3.0 - EXECUTION

3.1 Erection

All components herein specified and indicated shall be furnished and erected in accordance with details and manufacturer's instructions. Erection shall be performed by a qualified erector who has attended training by the building manufacturer of the system being installed using proper tools and equipment. It shall be the responsibility of the erector to comply with all applicable legal and safety requirements. It shall further be the responsibility of the erector to determine and provide any and all temporary bracing, bridging, blocking, shoring, and/or securing of components, etc. as required for stability during the entire erection process.

3.2 Coordination

All components herein specified and indicated shall be coordinated with other trades that effect components including but not limited to the following:

- Concrete – Section 03300

- Standing Seam Metal Roofing – Section 07610
- Hollow Metal Doors and Frames - Section 08110
- Finish Hardware - Section 08710
- Mechanical - Division 15
- Electrical - Division 16

END OF SECTION

I. GENERAL

A. Work included: Provide 2-Triple 10x48 and 1- 10x56, above ground, pre-engineered, pre-manufactured, 1/4" steel plate material tornado storm shelter with rolled rounded roof and ceiling, installed on a monolithic concrete foundation system with #4 rebar reinforcements on an 18" grid and shall include a vapor barrier, as needed for a complete and proper installation.

1. Performance criteria for tornado and storm shelters will be built on the design criteria in the ICC 500 2020 STANDARD ICC/NSSA Standard for the design and construction of storm shelters and the manuals and publications listed therein, and the ASCE 7-05.
2. ICC 500 Standard and ASCE 7-05 present the information necessary for the computation of wind pressures and the loads imposed by winds on the walls, roof, windows, and doors of a tornado storm shelter. The walls, ceiling, floor, foundation, and all connections joining these elements will be designed to resist the pressures and loads calculated from the design wind speed without localized element failure and without separating from one another.
3. The entire tornado storm shelter must resist failure from wind pressures and debris impacts. For community shelters, the structural elements and the building envelope must be designed to resist wind-induced loads as well as impacts from debris.

B. Submittals

1. Product data: Contractor will submit the following in accordance with the "Qualifications for Storm Shelter Design" acceptance:
   a. Manufacturer's specifications and other data needed to prove compliance with the specified requirements of ICC 500 2020 STANDARD, ASCE 7-05.
   b. Show drawings in sufficient detail of fabrication, installation, and anchorage;
   c. Manufacturer's recommended installation procedures;
   d. Layouts of foundation and anchor bolt specifications;
   e. Paint and coatings;
   f. Ventilation, providing a minimum of 15 cu. ft. per person per minute;
   g. Door(s) and door frame(s). This storm shelter shall have a total of two (2) handicap accessible entryways with the door opening to the outside having a 2" overlap and 1" hinge and lock materials.
   h. Third party independent peer reviews for structural, HVAC, plumbing and electrical design.

2. Definitions
   a. Building Width: Measured from outside to outside of sidewall frame.
   b. Building Length: Measured from outside to outside of end wall frame.
   c. Building Height: Measured from the intersection of the top of the roof framing to the top of the concrete floor slab.

II. DESIGN REQUIREMENTS

A. Design structural systems according to professionally recognized methods and Standards, and legally adopted building codes.

B. Design under supervision of Professional Engineer licensed in Alabama.

C. The approved design by the Professional Engineer will include the foundation/floor slab design as well as the Storm Shelter itself.

III. PERFORMANCE CRITERIA

A. Resistance to loads from wind pressure for Storm Shelters

1. Wind pressures are to be determined using ASCE 7-05 Minimum Design Loads for Buildings and Other Structures (or revisions to this Standard). Pressures for the Main Wind Force Resisting System (MWFRS) are to be used for the walls, ceiling, structural attachments and foundation system. Pressures for Components and Cladding are to be used for the door and other attachments to the exterior of the Storm Shelter. For computing wind pressures to be used as a service load, the wind velocity (V) shall be minimum of 250 mph (3-second peak gust).
2. The Storm Shelter walls, ceiling and floor will withstand design pressures such that no element shall separate from another (such as walls to floor, ceiling to walls). Such separation shall constitute a failure of the Storm Shelter.
3. The entire Storm Shelter structure must resist failure from overturning, shear (sliding), and uplift from design pressures.
4. The Allowable Stress Design (ASD) method shall be used for the Storm Shelter design for any of the construction materials selected. Unfactored load combinations shall be used in accordance with ASCE 7-05 for allowable stress design. Because of the extreme nature of this design wind speed, other environmental loads, such as flood or earthquake loads, should not be added.
5. No importance factor shall be added to the pressure calculations because the extreme nature of the design event already accounts for critical nature of the Storm Shelter. Therefore, the importance factor (1) used in the design computations shall equal one. The internal gust coefficient (GCPi) shall be for buildings with no openings.
6. In the event that the roof of the Storm Shelter is exposed at grade, the roof of the Storm Shelter shall be able to resist wind pressures as determined in sections 1(a) through (e).

B. Windborne Missile Impact Resistance on Storm Shelter Walls and Ceiling.
1. Loads from windborne missile impacts must be considered. For design purposes, it is assumed that the design wind speed of 250 mph propels a 15-lb. missile horizontally at 100 mph. The design missile is a nominal 2x4 wood board, 12 feet long, weighing 15 lbs., striking the Storm Shelter enclosure on end 90° to the surface. The vertical missile design speed is 2/3 of the horizontal speed, or 67 mph.
2. The walls and ceiling of a Storm Shelter must resist perforation by the design missile such that the missile does not perforate the inside most surface of the Storm Shelter. Only Storm Shelter wall openings used for access are permitted. Windows, skylights, or other similar openings shall not be used unless they have been laboratory tested to meet the missile impact criteria of section 2(a). Note: The Wind Engineering Research Center at Texas Tech University has tested numerous materials and material combinations and should be contacted regarding performance of those materials.

C. Other Loads
1. The designer should assess whether an adjacent structure is a liability to the Storm Shelter; that is, if it poses a threat to the Storm Shelter from collapse. If the adjacent structure is deemed a liability, the loads imposed upon the Storm Shelter due to the collapse of this adjacent structure shall be considered as an additional impact load on the Storm Shelter.

D. Storm Shelter Access Door(s) and Door Frame(s)
1. The Storm Shelter entry door(s) and frame(s) shall resist the design wind pressures for components and cladding of this criteria and the missile impact loads of ICC 500 2020 STANDARD. Only doors and their frames that can resist calculated design wind pressures and are constructed of materials tested and passed by Texas Tech WISE Research Center for missile impacts are acceptable. All doors shall have sufficient points of connection to their frame to resist design

wind pressure and impact loads. Unless specifically designed for, each door shall be attached to their frame with a minimum six points of connection. Note: See the design specifications and details for Storm Shelter doors in ICC 500 2020 Standard for additional guidance. Door designs and materials of construction included in ICC 500 2020 Standard were developed through calculations and laboratory testing at Texas Tech University.

2. The doorway shall provide a minimum clear opening width of 32" for wheelchair accessibility. The transition from the concrete sidewalk into the Storm Shelter must not exceed 1/4" vertical rise. If a threshold is provided, it must be wheelchair accessible.

E. Storm Shelter Ventilation (ICC 500 2020 Standard)
1. Forced air ventilation for the Storm Shelter shall be provided. A protective shroud or cowling, meeting the missile impact requirements of ICC 500 2020 STANDARD, must protect any ventilation openings in the Storm Shelter and have interior baffles to prevent debris intake. The ventilation system must be capable of providing the minimum number of air changes for the Storm Shelter's occupancy rating of 15 cubic feet per person per minute and have interior louvers to prevent insects from entering when not in use.
2. All mechanical, electrical and other equipment providing this ventilation must be protected to the same Standard as the Storm Shelter.

F. Emergency Lighting and Lighted Exit Signs
1. Emergency lighting shall be provided for this Storm Shelter.
2. A lighted EXIT sign shall be installed over each door.

G. Storm Shelter Accessibility
1. The needs of persons with disabilities requiring Storm Shelter space must be considered, and the appropriate access for such persons must be provided in accordance with the Americans with Disabilities Act (ADA). Entrance ramps, doors, aisles, restrooms and restroom or water fixtures must be handicap accessible.

H. Submittals
1. Design data: Provide detailed Design Criteria and Calculations. Design shall be certified by a Professional Engineer who is licensed in the State of Alabama.
2. Certification: Manufacturer certification that the building conforms to the contract documents and manufacturer's Standard design procedures.
3. Shop Drawings: Show building layout, primary and secondary framing member sizes and location, cross-section, and product and connection details.
4. Product Data: Information on manufactured products to be incorporated into the project.
5. Color: As selected by Architect
6. Anchor Bolt Drawings: Layouts with bolt diameters.
7. Anchor Rod System (Bolt Pull Test) Data: Testing data by an Independent Laboratory on pull strength of anchor bolts in foundation.
8. Emergency Back-Up Generator: If a generator is used, it must have a protective housing. The housing should be designed and manufactured using like materials as the Storm Shelter and be certified by an Alabama PE.

IV. PRODUCT – THE TORNADO STORM SHELTER

A. Storm Shelter shall be a pre-manufactured above-ground 1/4" steel plate, with rolled rounded roof and ceiling.
1. For purposes of this project the Storm Shelter shall consist of a steel enclosure that is permanently attached to a concrete slab/foundation. The slab/foundation system

and its reinforcement are to be designed as part of the Storm Shelter by the manufacturer's structural engineer.

a. The manufacturer will be responsible for preparation of the subgrade as required to accommodate the foundation system and set the floor elevation of the Storm Shelter as indicated or required to provide wheelchair access and positive drainage away from the Storm Shelter.

B. Metal Materials
1. Select materials and material yield strengths based on building design requirements:
2. Shop Coat: Sandblasted, primed and painted white inside and outside.
   a. This above-ground Storm Shelter, if berming is optioned, requires an additional asphalt or tar-based coating on the outside lower 40" of the sidewalls, as an approved means of protection from corrosion and also a detail showing how water will be prevented from entering the Storm Shelter.

C. Framing Components
1. Primary Framing: Provide a welded steel frame as required to meet the design criteria.
2. The frame shall be anchored to a cast-in-place concrete monolithic slab/foundation system that is reinforced as required by the manufacturer's design engineer.

D. Roof and Wall Panel Components
1. Steel walls, rounded roof panels, doors and ventilation guards shall be constructed of 1/4" thick steel materials, which have been tested and passed by Texas Tech WISE Research Center, to meet the design criteria.
2. Panel construction shall form a weather-tight barrier and shall be attached to the primary framework as required by the design engineer.

E. Door(s) and Door Hardware
1. The door(s) shall have an additional dead bolt lock that is key operated for security.
2. The door(s) shall be operable with a minimum of force. Latches shall be operated with level type handles that comply with the ADAAG. The door(s) shall swing out and have a 2" minimum overlap and 1" hinge and lock materials.
3. The doorway(s) shall provide a minimum clear opening of 32" for wheelchair access.
4. The threshold shall comply with the ADAAG for wheelchair accessibility.

V. EXECUTION

A. Examination
1. Verify that the size accommodates the number of occupants stated.
2. Verify that the foundation complies with the Design Criteria and is installed correctly.
3. Verify that the anchor system hold down plates and/or bolts/rods have been tested and are the indicated size and installed as specified on the anchoring system shop drawings.

B. Erection/Installation
1. Erect or install building system in accordance with manufacturer's instructions, engineer's drawings, and other documents.
2. Make sure the entire building system works as required by engineer's recommendations and specifications.

QUALIFICATIONS FOR STORM SHELTER DESIGN ACCEPTANCE

The qualified vendor must be able to accomplish the following tasks with the construction and placement of the Community Tornado Storm Shelter.

1. Deliver and install above-ground, 2-Triple 10x48 Quanset Hut Style and 1-10x56 Quonset Hut Style, pre-engineered, pre-manufactured, modular 1/4" steel plate material Storm Shelter with rolled rounded roof and ceiling, including a solar battery UPS system for each Quonset hut that will automatically switch to battery power if main power is lost. The system shall be capable of maintaining power to unit for at least 120 minutes, which complies with ICC 500 2020 Standard for the design and construction of storm shelters and is certified by an Alabama Licensed Professional Engineer.

2. Vendor must submit with his bid proposal the drawings and specifications by the same PE for the Storm Shelter and the foundation, including Wind Analysis and Impact Calculations for an above-ground Community Tornado Storm Shelter, prepared in accordance with referenced design Standards in ANSI/ASCE 7-05 - Wind Loads, and ICC 500 2020 Standard. Drawings, specifications, and Wind Analysis/Impact Calculations must be certified with an Alabama Licensed Professional Engineer's Seal of Approval for both the Storm Shelter and the foundation. Documentation of testing performed by an independent testing laboratory on the anchoring system used to secure the Storm Shelter to the foundation shall be submitted as certification of compliance. Independent Peer review documentation indicating compliance with ICC 500 2020 standard for structural, electrical, plumbing, mechanical and architectural designs.

3. This Storm Shelter installation shall be a 2-Triple 10x48 Quanset Hut Style and 1-10x56 Quonset Hut Style, with rolled rounded roof and ceiling, and be constructed of 1/4" solid steel plate materials with two (2), six (6) point locking door(s), with one (1) being a keyed lock for security. Door(s) must be fully handicap accessible. Storm Shelter shall have a minimum 3"x 3" angle frame ribbing on 48" centers, 3/8" x 4" x 4" angle anchor frame using 3/4" anchor bolts a minimum of eight (8) inches in length with bolt holes on 24" center. Storm Shelter/Shelter hull to be anchored directly to concrete foundation and grounded, using materials required as stated in anchoring system.

4. The Storm Shelter shall have a single 16" in depth seat down both sides and normally a double row 22" in depth seat in the center, maintaining wheelchair passable space. Seats and brackets are to be constructed of at least 3/16" steel material.

5. Vendor will provide breaker box mounting brackets, with a welded receptacle box for light and switch installations, mounting brackets for fluorescent lights and emergency lighting. Vendor shall provide a lighted EXIT sign with emergency light over each door. Storm Shelter must be grounded at multiple locations, including the center row of seats, w/copper wire and grounding rods to meet national and local electric code requirements.

6. Vendor must provide a powered forced air ventilation system to provide a minimum of 15 cubic feet of fresh air per person per minute. All ventilation system exterior intake/exhaust ducts must have a protective shroud or cowling that meets the same missile impact requirements as the Storm Shelter. Intake and exhaust ducts must have interior baffles to prevent debris from entering into Storm Shelter.

7. Storm Shelter shall be sandblasted, primed and painted inside and outside color as selected by Architect. An additional protective coating of asphalt-based material to be rolled on or sprayed on the lower 40 inches of the exterior Storm Shelter sidewalls if the Storm Shelter is to be bermed.

8. Vendor will provide a monolithic concrete foundation with #4 rebar reinforcements on an 18" grid, and shall include a vapor barrier. Purchaser may provide the concrete for the foundation as "in-kind" services. Vendor will form and finish concrete.

9. Vendor will provide Storm Shelter transportation to the site.

10. Vendor will supply crane services. For safety reasons, only a Professional Crane Service Company and operator may be used for off-loading of the Storm Shelter.

11. Vendor will provide a solar battery UPS system for each Quonset hut that will automatically switch to battery power if main power is lost

12. Vendor will make appropriate discount allowances for any "in-kind" work/services that may be provided by purchaser. Any discount allowances will be in accordance with the itemized bid costings.

13. If the project involves "in-kind" work by the purchaser that could cause delays in the completion of the job, payment to the vendor will not be delayed. If the bid includes more than one unit, a purchase order or contract will be issued for each unit.

END OF SECTION

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SAFE ROOMS & STORM SHELTERS

10' X 56' COMMUNITY STORM SHELTER MODEL #:STS1056

CONSTRUCTION DOCUMENTS: DESIGN INFORMATION

THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THEAPPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS, APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DEISGNED TO WITHSTAND 250 MPH WINDS.

1. DESIGNATION: TORNADO SHELTER
2. WIND DESIGN CONFIRMS TO FEMA 361-2021/ICC 500-2020ICC/NSSA STANDARD FORTHE DESIGN AND CONSTRUCTION OF STORM SHELTERS
3. SHELTER DESIGN WIND SPEED: 250 MPH
4. SHELTER FLOOR DESIGN LIVE LOAD: 150 PSF
5. SHELTER ROOF DESIGN LIVE LOAD: 100 PSF
6. SHELTER DESIGN DEAD LOAD: 20 PSF
7. MISILE IMPACT COMPLIANCE:
   PROTECTED OCCUPANT AREAS:
   WALLS: ¼" STEEL PLATE
   ROOF STRUCTURE: ¼' STEEL PLATE
   PROTECTED OCCUPANT AREA DOORS: FEMA 361COMPLIANT
   PROTECTED OCCUPANT AREA LOUVERS: FEMA 361 COMPLIANT
   VENTILATION LOUVER: FEMA 361 COMPLIANT
8. SHELTER NOT TO BE CONSTRUCTED WITHIN AN AREA SUSCEPTIBLE TO FLOODING

STEEL MATERIALS LIST AND NOTES

1. ALL CHANNEL, ANGLES, AND PLATES TO BE A36 U.N.O
2. ALL STEEL TUBE SECTIONS TO BE A500 GRADE B
3. ALL STEEL PIPE SECTIONS TO BE SCH 40 GRADE A501 OR A53
4. TYPICAL SHELTER WALLS ARE ¼" THICK SOLID PLATE STEEL
5. ALL CHANNEL, 3x3 & 2 ½ x2 ½ ANGLES, AND PLATE TO BE ¼" THICK STEEL. TUBE 3/16" THICK STEEL
6. ALL 4x4 ANGLES TO BE 3/8" THICK STEEL
7. SEAT MATERIAL AND GENERATOR PROTECTIVE HOUSING MATERIAL TO BE 3/16" THICK STEEL
8. ALL DIMENSIONS ARE NOMINAL AND ARE SUBJECT TO CONVENTIONAL INDUSTRY TOLERANCES.

DRAWING INDEX

CONCRETE

1. CONCRETING OPERATIONS SHALL COMPLY WITH ACI STANDARDS.
2. MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS (PSI).
3. STRENGTH: 3500 PSI
4. TYPE: NORMAL WT.
5. W/C: 0.513
6. AIR: 3% - 5%
7. SLUMP: 3" TO 5"
8. REINFORCING BARS; ASTM A615 GRADE 60
9. REINFORCING STEEL SHOWN IN SECTIONS AND DETAILS ARE A SCHEMATIC INDICATION THAT REINFORCING EXISTS. SEE SECTION NOTES AND GENERAL NOTES FOR ACTUAL REINFORCING REQUIRED.
10. REINFORCING BAR PLACING ACCESSORIES IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE.
11. DETAIL REINFORCEMENT IN ACCORDANCE WITH ACI 315.
12. ALL SPLICES SHALL BE CLASS "B" TENSION LAP SPLICE OR PROPERLY SELECTED MECHANICAL SPLICES, PROPERLY INSTALLED PER MANUFACTURING SPECIFICATIONS.
13. MINIMUM CONCRETE COVERAGE OF REINFORCEMENT: SLAB FOUNDATION ----------2" TOP & 3" BOTTOM & SIDES

FOUNDATION QUALITY CONTROL DURING CONSTRUCTION

1. FOOTINGS SHALL BE NEATLY EXCAVATED WHERE POSSIBLE WITH SIDES AND TOP EDGES FREE OF LOOSE OR WET MATERIALS. WHERE NEAT EXCAVATION IS NOT POSSIBLE, FOOTING EXCAVATION SHALL BE OPEN CUT WITH EDGES FORMED AND BRACED. THE BOTTOM EXCAVATION SHALL BE CLEAN AND DRY WITH ALL LOOSE MATERIAL REMOVED FOR AN ESSENTIALLY FLAT BEARING SURFACE. WHERE SOFT OR UNSUITABLE BEARING SURFACES ARE ENCOUNTERED, THE AREA SHALL BE UNDERCUT AS REQUIRED AND REPLACED WITH LEAN CONCRETE OR COMPACTED DENSE GRADED CRUSHED STONE AS DIRECTED BY THE ARCHITECT OR ENGINEER.

BUILDING CODE DATA

ICC 500-2020, FEMA 361-2021, FEMA 320-2021, NEC-2020, IBC 2021

OCCUPANCY TYPE:	ASSEMBLY A-3
CONSTRUCTION TYPE:	I B
BUILDING AREA:	560 SF
PROPOSED HEIGHT:	8'0"
PROPOSED LENGTH:	56'0"
PROPOSED WIDTH:	10'0"

EGRESS REQUIREMENTS SUMMARY

OCCUPANCY LOAD:	110 PERSONS
WITH (1) RESTROOM:	106 PERSONS
WITH (2) RESTROOMS:	103 PERSONS

OCCUPANCY LOAD & EGRESSCALCULATIONS
ICC 500 – COMMUNITY SHELTER USE
USABLE FLOOR AREA = 560 SF – 5 SF (ICC 501.1.2.2 – FIXED/MOVABLE) = 555 SF
555 SF – 10 SF (ONE WHEELCHAIR SPACE) = 545 SF
545 SF / 5 SF/PERSON = 109 STANDING/SEATING
109 STANDING/SEAT + 1 WC = 110 TOTAL

WITH ONE (1) REST ROOM:
USABLE FLOOR AREA = 560 SF – 17.5 SF = 542.5 SF
542.5 SF – 5 SF (ICC 501.1.2.2 – FIXED/ MOVABLE) = 537.5 SF
537.5 SF – 10 SF (ONE WHEELCHAIR SPACE) = 527.5 SF
527.5 SF / 5 SF/PERSON = 105 STANDING/SEATING
105 STANDING/SEAT + 1 WC = 106 TOTAL

WITH TWO (2) REST ROOM:
USABLE FLOOR AREA = 560 SF – 35 SF = 525 SF
525 SF – 5 SF (ICC 501.1.2.2 –FIXED/ MOVABLE) = 520 SF
520 SF – 10 SF (ONE WHEELCHAIR SPACE) = 510 SF
510 SF / 5 SF/PERSON = 102 STANDING/SEATING
102 STANDING/SEAT + 1 WC = 103 TOTAL

ALABAMA MANUFACTURED HOUSING COMMISSION
Daniel G. White
7/9/2023

4/1/23

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SCALE: N.T.S.

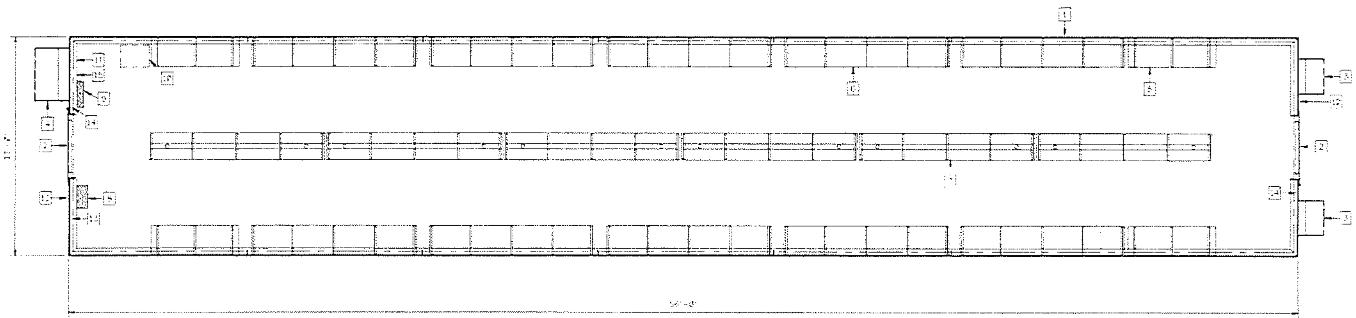
TITLE: SHELTER CODE SUMMARY, DESIGN PARAMETERS STRUCTURAL LOAD LIMITATIONS & PLAN INDEX

UNLESS OTHERWISE SPECIFIED

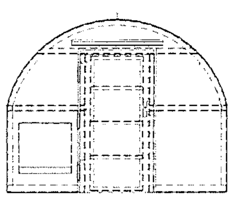
04/01/23

DRAWING NUMBER: STS1056 Page 1

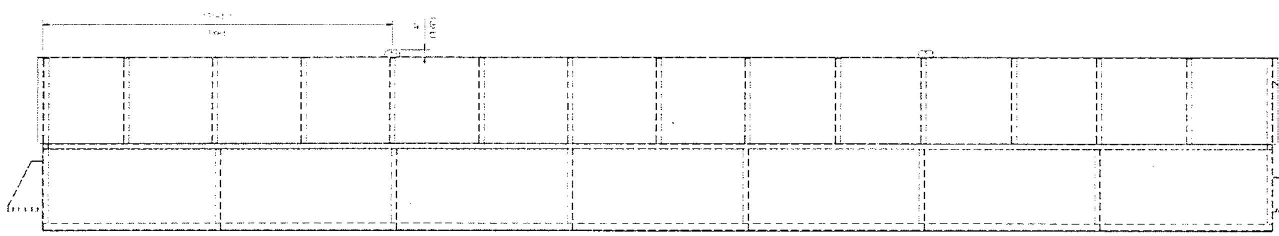
1	PREFABRICATED STEEL STRUCTURE ANCHORED AND SEALED TO SMOOTH CONCRETE FLOOR
2	ICC-500 COMPLIANT STEEL DOOR ASSEMBLY
3	ICC-500 COMPLIANT VENTILATION LOUVERED INTAKE HOOD
4	ICC-500 COMPLIANT VENTILATION LOUVERED EXHAUST HOOD
5	TYPICAL PREFABRICATED WALL BENCH, 4'-0"
6	TYPICAL PREFABRICATED WALL BENCH, 7'-6"
7	TYPICAL PREFABRICATED CENTER BENCH, 8'-0"
8	TRANSFER SWITCH/LOAD CENTER 'A'
9	ELECTRICAL PANEL 'P'
10	DEHUMIDIFIER W/ 5/8"x6'-0" RUBBER HOSE DISCHARGE THRU SHELTER SIDE WALL
11	EXHAUST FAN
12	TORNADO SHELTER SIGNAGE
13	TORNADO SHELTER SIGNAGE, MANUFACTURER DESIGN WIND SPEED & MAXIMUM OCCUPANT LOAD
14	FIRE EXTINGUISHER
15	FIRST AID KIT



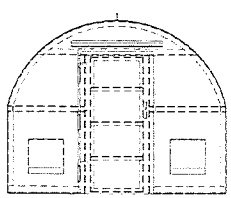
FLOOR PLAN



BACK ELEV.



SIDE ELEV.



FRONT ELEV.

ALABAMA MANUFACTURED HOUSING COMMISSION

Daniel G. White

7/9/2023

4/11/23

THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THE APPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DESIGNED TO WITHSTAND 250 MPH WINDS.

UNLESS OTHERWISE SPECIFIED

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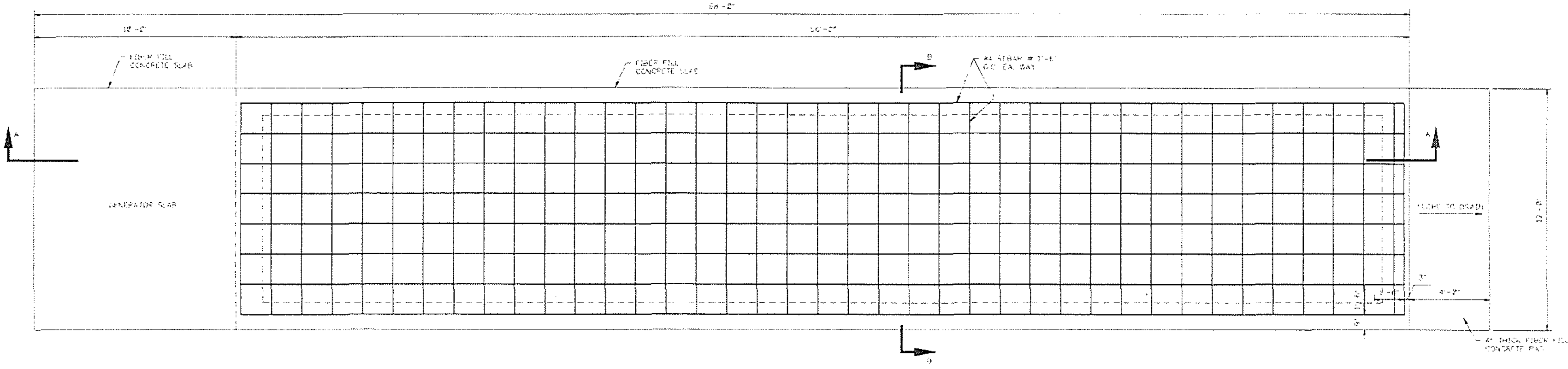
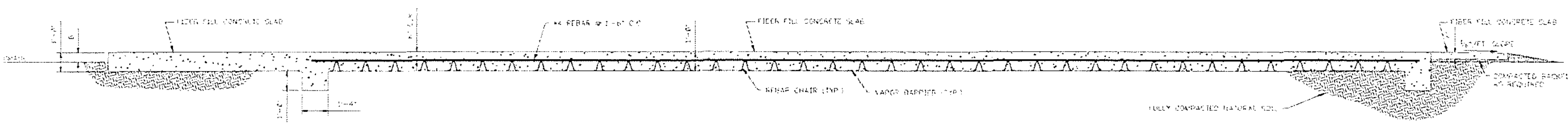
SCALE 3/8"=1'-0"		DRAWN BY D. STOVER	
TITLE SINGLE 10x56 SHELTER UNIT FLOOR PLAN & ELEVATIONS			
DATE 04/01/23	SIZE D	DRAWING NUMBER STS1056 Page 2	REV 1

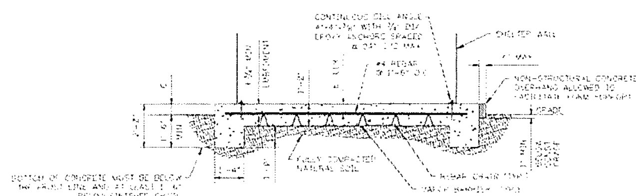


FOUNDATION PLAN



SECTION A-A

NOTES:
MINIMUM CONCRETE STRENGTH (f'c) = 3000 PSI @ 28 DAYS
MINIMUM REINFORCING STRENGTH (fy) = 60 KSI
MINIMUM CONCRETE COVER OVER REINFORCING:
CONCRETE CAST AGAINST EARTH 3"
CONCRETE EXPOSED TO WEATHER 2"



SECTION B-B

ALABAMA MANUFACTURED HOUSING COMMISSION
These MODULAR PLANS are approved and deemed to comply with all ordinances or regulations enacted by any local government. (AL Act No. 31-705)
Daniel G. White
7/9/2023

ALABAMA REGISTERED PROFESSIONAL ENGINEER
4/1/23

THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THE APPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021AND ICC-500-2020 THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DESIGNED TO WITHSTAND 250 MPH WINDS.

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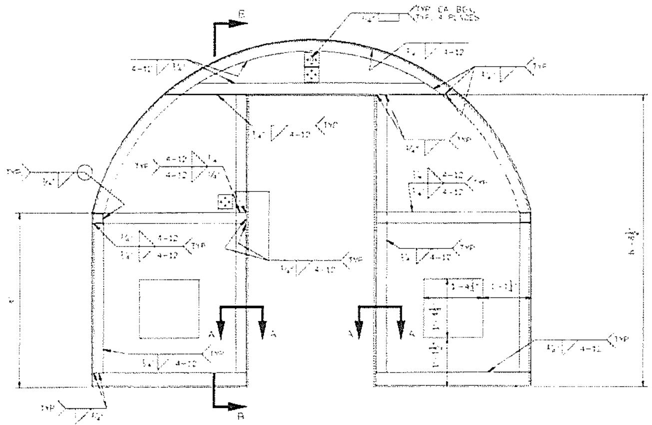
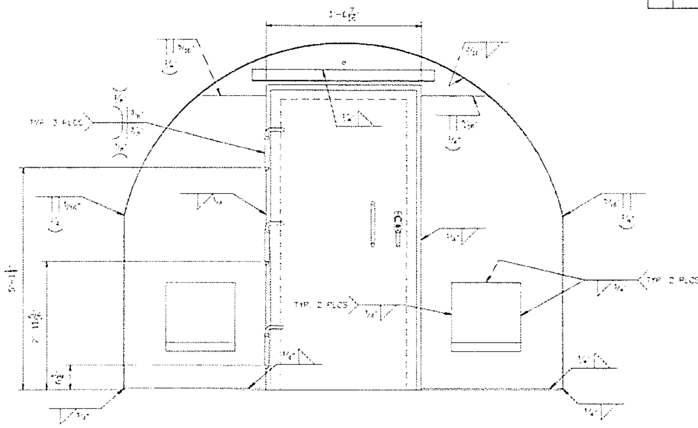
SCALE: 3/8" = 1'-0"
DRAWN BY: D. STOVER

SINGLE 10x56 SHELTER UNIT
FOUNDATION PLAN & ELEVATIONS

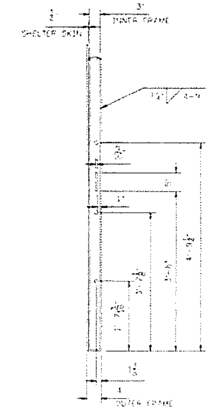
DATE	SIZE	DRAWING NUMBER	REV
04/01/23	D	STS1056 Page 3	1



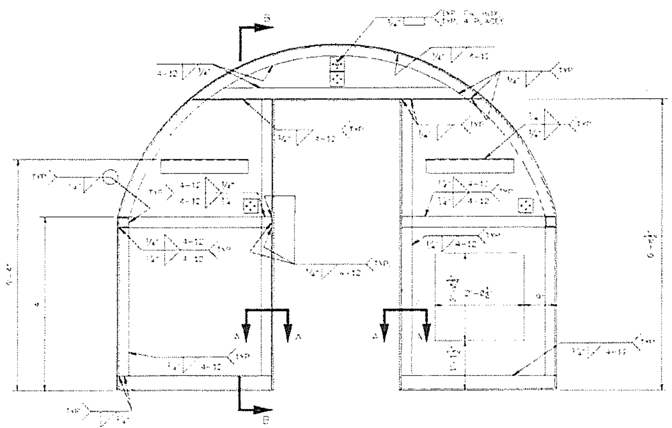
INTERIOR ELEV. OF END ASSEMBLY



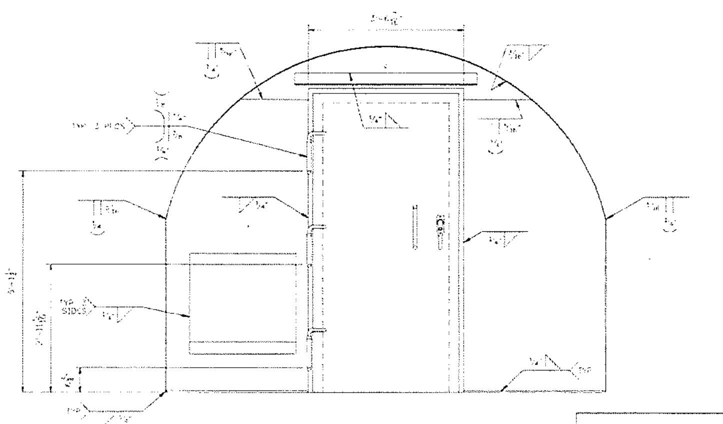
EXTERIOR ELEV. OF END ASSEMBLY



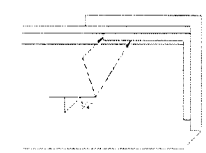
SECTION B-B



INTERIOR ELEV. OF END ASSEMBLY



EXTERIOR ELEV. OF END ASSEMBLY



SECTION A-A

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SAFE ROOMS & STORM SHELTERS

ALABAMA MANUFACTURED HOUSING COMMISSION
Daniel G. White
7/9/2023

4/1/23

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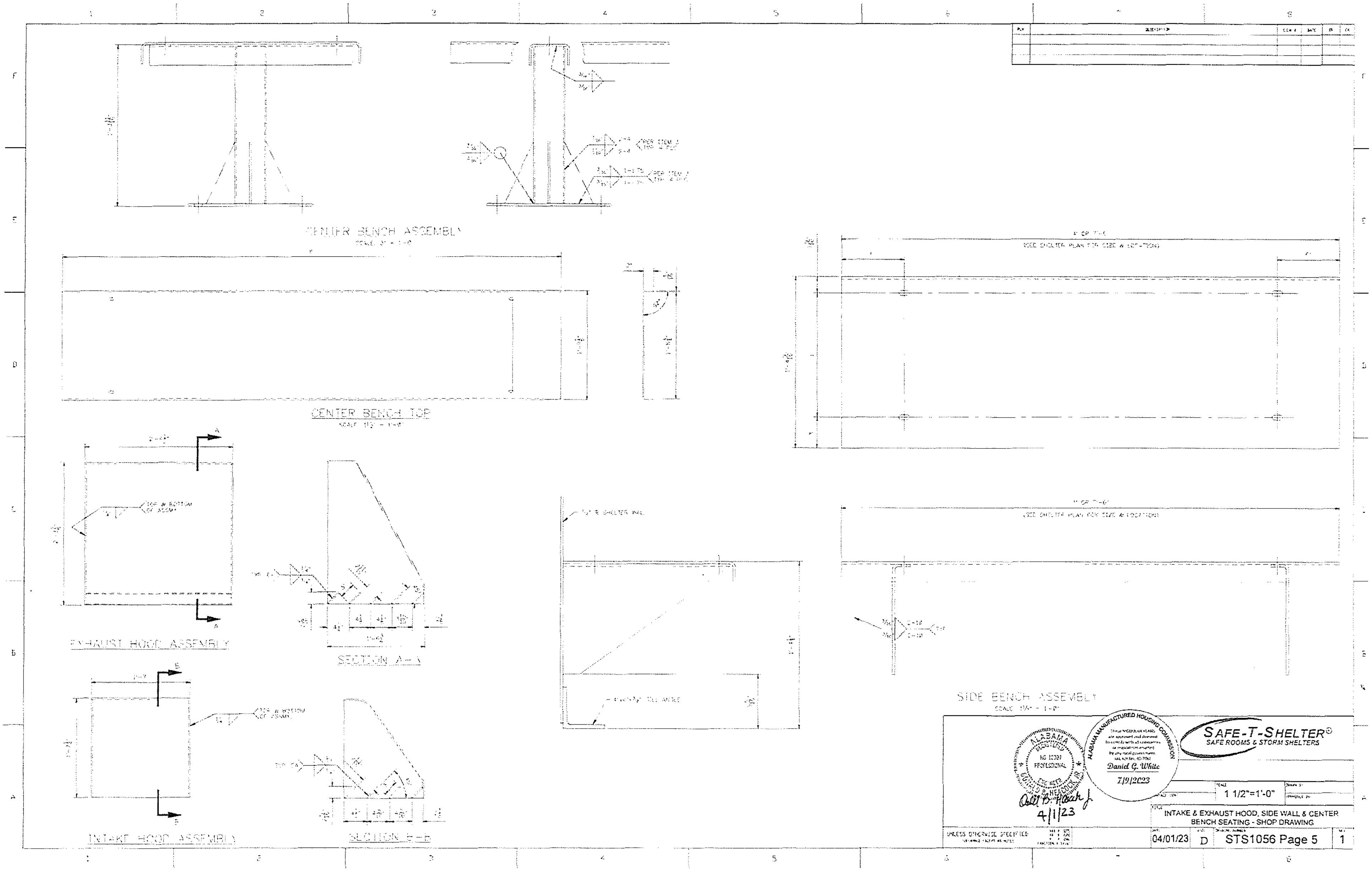
SCALE	AS NOTED
TITLE	TYPICAL ELEVATIONS & SECTIONS SHOP DRAWING
DATE	04/01/23
DRAWING NUMBER	STS1056 Page 4
REV	1



CENTER BENCH ASSEMBLY
CENTER BENCH TOP
EXHAUST HOOD ASSEMBLY
SECTION A-A
INTAKE HOOD ASSEMBLY
SECTION B-B
SIDE BENCH ASSEMBLY
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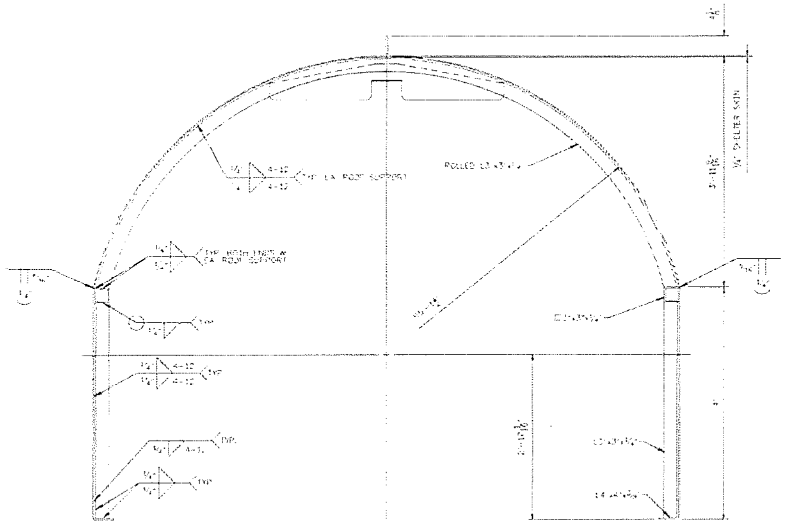
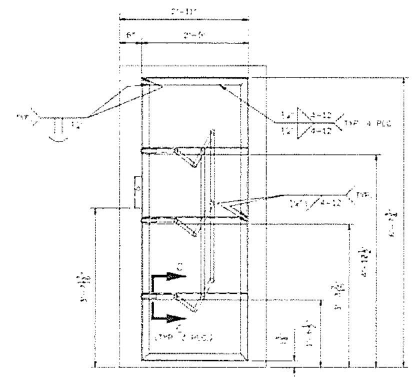
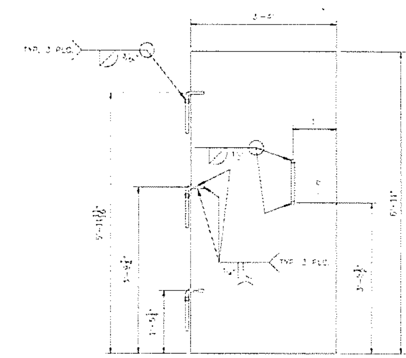
Daniel G. White
7/9/2023
4/1/23
1 1/2"=1'-0"
INTAKE & EXHAUST HOOD, SIDE WALL & CENTER BENCH SEATING - SHOP DRAWING
04/01/23
D
STS1056 Page 5
1



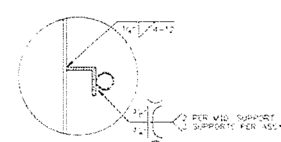
TYPICAL INTERMEDIATE SUPPORT ELEVATION



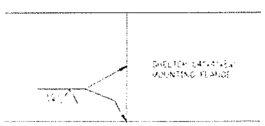
TYP. DOOR ASSY.-INTERIOR VIEW



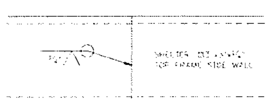
TYP. DOOR ASSY.-EXTERIOR VIEW



SECTION C-C



SHELTER MOUNTING FLANGE WELD DETAIL



SHELTER TOP FRAME WELD DETAIL

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Daniel G. White
7/9/2023

4/1/23

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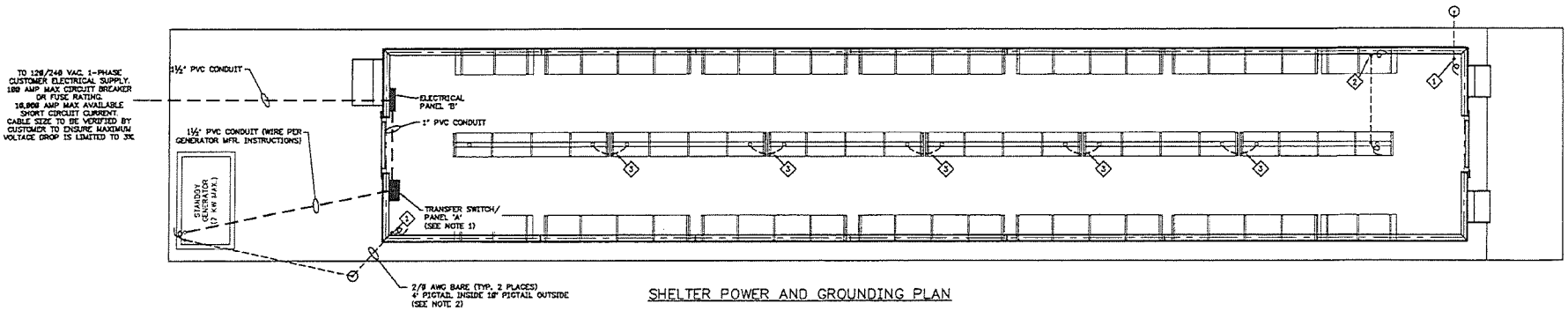
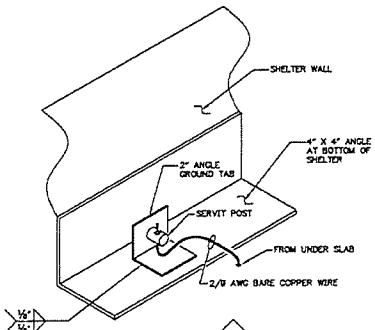
UNLESS OTHERWISE SPECIFIED

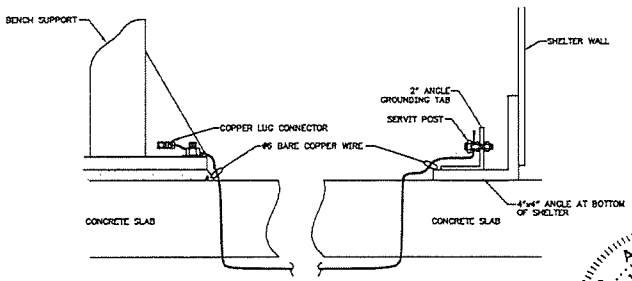
SCALE	AS NOTED
TITLE	TYPICAL INTERMEDIATE SECTION, DOOR ELEVATIONS AND WELD DETAILS - SHOP DRAWING
DATE	04/01/23
DRAWING NUMBER	STS1056 Page 6
REV	1



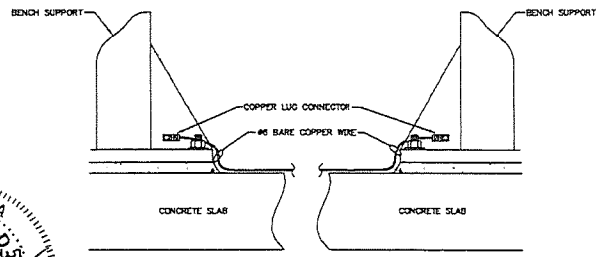
SHELTER POWER AND GROUNDING PLAN



DETAIL 1
GROUND BAR INSTALLATION (THIS DWG.)



DETAIL 2
BENCH GROUND DETAIL (THIS DWG.)



DETAIL 3
BENCH GROUND DETAIL (THIS DWG.)

LEGEND

- BELOW GRADE
- DETAIL NUMBER (SEE THIS DWG.)
- GROUND ROD, ⅝" x 8' COPPER CLAD

NOTES:

1. TRANSFER SWITCH/PANEL 'A' TO BE INSTALLED AFTER SHELTER IS SET IN PLACE.
2. GROUNDING SYSTEM TO BE COMPLETED AFTER SHELTER IS SET IN PLACE.

ALABAMA LICENSED P.E. No. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY 3/10/17

ALABAMA MANUFACTURED HOUSING COMMISSION

Daniel G. White
7/9/2015

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353-1972

HCS JOB NUMBER: 14100061

REV.	DESCRIPTION	ECN #	DATE	BY	CK.
0	ORIGINAL ISSUE (DRS/JFC)		06/04/15	HCS	
1	UPDATE NOTES AND GROUNDING ARRANGEMENTS		1/22/16	HCS	
2	GENERAL REVISIONS		3/10/17	HCS	

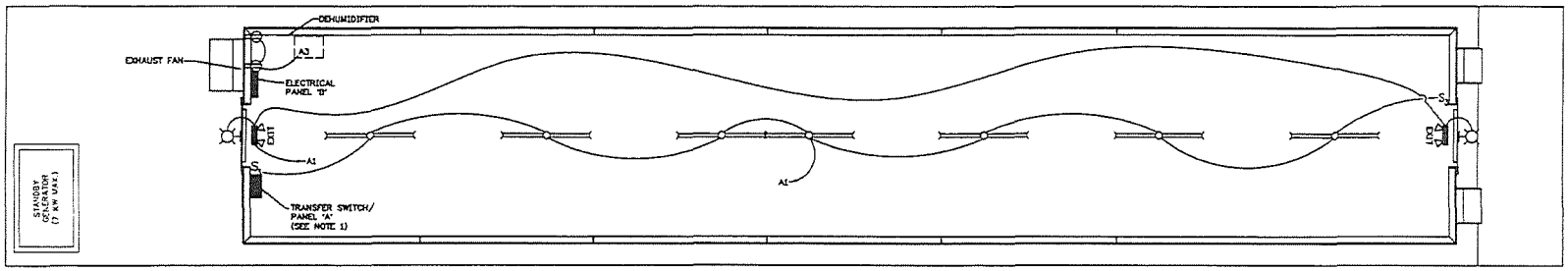
SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

PROJECT

MATERIAL	SCALE	DRAWN BY
SURFACE CONT	3/8"=1'-0"	D. STOVER
		APPROVED BY

TITLE: SINGLE 10x56 SHELTER UNIT
ELECTRICAL POWER & GROUNDING PLAN & DETAILS

DATE	SIZE	DRAWING NUMBER	REV
06/04/15	D	D-11056-E1	2



SHELTER LIGHTING AND RECEPTACLE PLAN

LEGEND

- 4' FLUORESCENT STRIP LIGHT W/ WIRE GUARD
- EXIT SIGN W/ LIGHTS
- OUTDOOR, WALL MTD. LIGHT
- S_3 THREE-WAY SWITCH
- —XX— HOME RUN CONDUIT (CIRCUIT NUMBER)
- DUPLEX RECEPTACLE

NOTES:

1. TRANSFER SWITCH/PANEL 'A' TO BE INSTALLED AFTER SHELTER IS SET IN PLACE.

ALABAMA MANUFACTURED HOUSING COMMISSION
These MODULAR PLANS are approved and stamped To comply with all ordinances or regulations enacted by any local government. Act Act No. 93-709
Daniel G. White
7/9/2023

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY
7/10/17

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353 - 1972

HCS JOB NUMBER: 14100001

REV.	DESCRIPTION	E&E #	DATE	BY	CK.
0	ORIGINAL ISSUE (JFC/DRS)		05/04/15	HCS	
1	CHANGE CIRCUIT ASSIGNMENTS		1/22/16	HCS	
2	GENERAL REVISIONS		3/28/17	HCS	

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

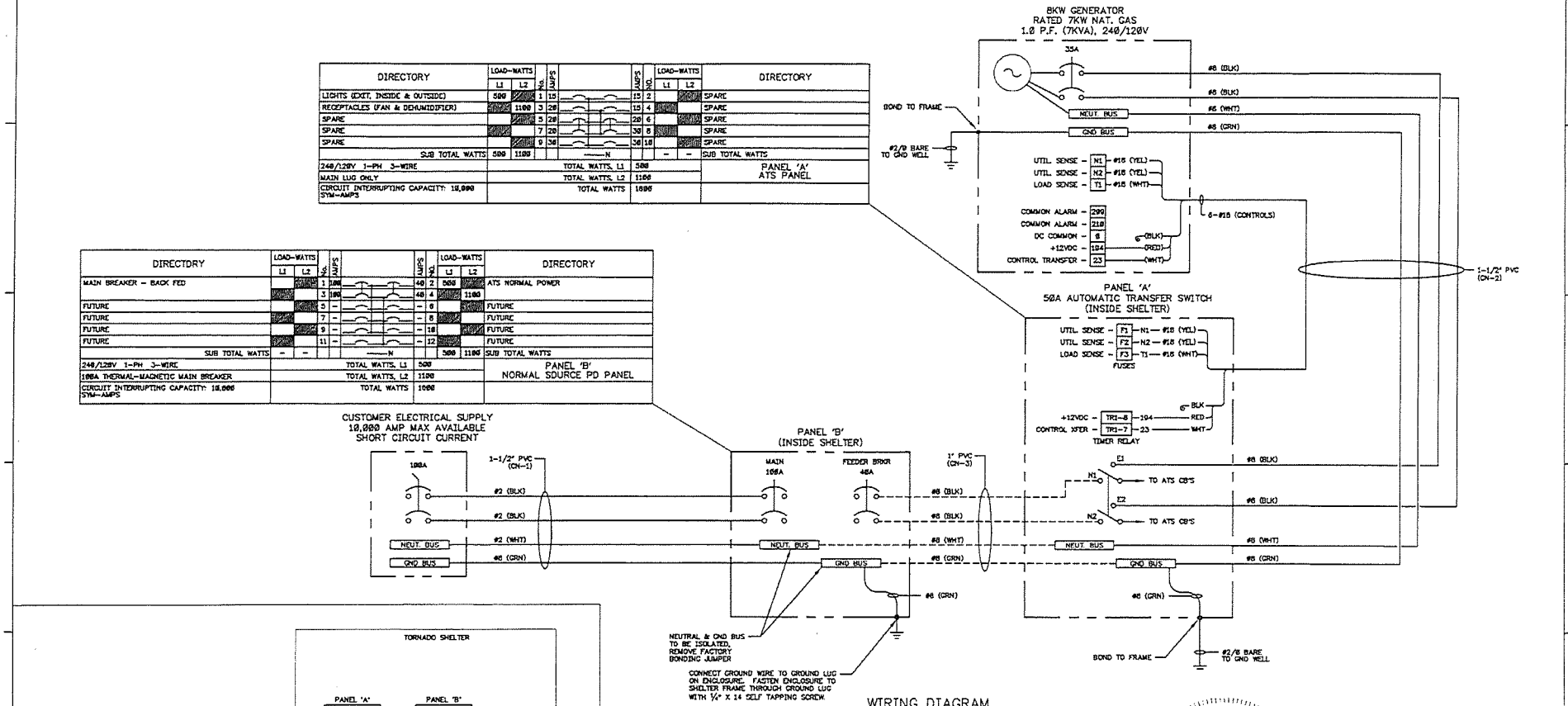
MATERIAL: SURFACE QUAL:
SCALE: 3/8"=1'-0"
DRAWN BY: D. STOVER
APPROVED BY:

TITLE: SINGLE 10x56 SHELTER UNIT
ELECTRICAL LIGHTING & RECEPTACLE PLAN

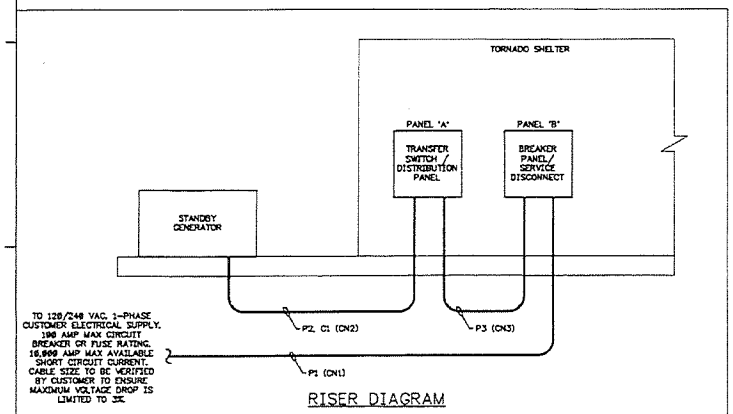
DATE	SIZE	DRAWING NUMBER	REV.
06/04/15	D	D-11056-E2	2

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	No.	AMPS		AMPS	No.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
LIGHTS (EXIT, INSIDE & OUTSIDE)	500		1	15		15	2			SPARE
RECEPTACLES (FAN & DEHUMIDIFIER)		1100	3	20		15	4			SPARE
SPARE			5	20		20	6			SPARE
SPARE			7	20		30	8			SPARE
SPARE			9	30		30	10			SPARE
SUB TOTAL WATTS	500	1100			N			–	–	SUB TOTAL WATTS
240/120V 1-PH 3-WIRE					TOTAL WATTS, L1	500				PANEL 'A' ATS PANEL
MAIN LUG ONLY					TOTAL WATTS, L2	1100				
CIRCUIT INTERRUPTING CAPACITY: 10,000 SYM-AMPS					TOTAL WATTS	1600				

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	No.	AMPS		AMPS	No.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
MAIN BREAKER – BACK FED			1	100		40	2	500		ATS NORMAL POWER
			3	100		40	4		1100	
FUTURE			5	–		–	6			FUTURE
FUTURE			7	–		–	8			FUTURE
FUTURE			9	–		–	10			FUTURE
FUTURE			11	–		–	12			FUTURE
SUB TOTAL WATTS	–	–			N			500	1100	SUB TOTAL WATTS
240/120V 1-PH 3-WIRE					TOTAL WATTS, L1	500				PANEL 'B' NORMAL SOURCE PD PANEL
100A THERMAL-MAGNETIC MAIN BREAKER					TOTAL WATTS, L2	1100				
CIRCUIT INTERRUPTING CAPACITY: 10,000 SYM-AMPS					TOTAL WATTS	1600				



WIRING DIAGRAM



RISER DIAGRAM

ALABAMA MANUFACTURED HOUSING COMMISSION

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY 3/16/12

Daniel G. White 7/9/2023

HCS JOB NUMBER: 14100801	HCS Engineering Company, Inc. DECATUR, ALABAMA (256) 353-1972

REV.	DESCRIPTION	ECR #	DATE	BY	CK
0	ORIGINAL ISSUE (DRS/JFC)		05/04/15	HCS	
1	REVISE NOTES, GROUNDING DETAILS AND CIRCUIT ASSIGNMENTS		1/22/16	HCS	
2	GENERAL REVISIONS		3/28/17	HCS	

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

PROJECT			
MATERIAL	SCALE: NONE	DRAWN BY: D.STOVER	
SURFACE COAT		APPROVED BY:	

TITLE: SINGLE 10x56 SHELTER UNIT
ELECTRICAL RISER AND WIRING DIAGRAMS

DATE	SIZE	DRAWING NUMBER	REV
06/04/15	D	D-11056-E3	2

CONDUIT SCHEDULE						
CONDUIT NO.	CONDUIT SIZE	CONDUCTORS	FUNCTION	FROM	TO	CIRCUITS
CN1	1-1/2" SCH 40 PVC	3-#2 w/#6 GND	100 AMP BUILDING FEEDER (BY CUSTOMER)	PNL (BY CUSTOMER)	PANEL 'B'	P1
CN2	1-1/2" SCH 40 PVC	3-#6 w/#8 GND, 8-#18 VENDOR CONTROL CABLE	AUTOMATIC TRANSFER SWITCH (ATS) EMERGENCY SOURCE	GENERATOR	ATS/PANEL 'A'	P2, C1
CN3	1" SCH. 40 PVC	3-#6 w/GND.	AUTOMATIC TRANSFER SWITCH (ATS) NORMAL SOURCE	PANEL 'B'	ATS/PANEL 'A'	P3

CIRCUIT SCHEDULE					
CIRCUIT	WIRE SIZE DATA	DESCRIPTION	FROM	TO	REMARKS/ROUTING
P1	3-#2 w/ #6 GND	100 AMP BUILDING SUPPLY	PNL (BY CUSTOMER)	PANEL 'B'	CN-1, 1 1/2" PVC TO NEW STORM SHELTER
P2	3-#6 w/ #6 GND	AUTOMATIC TRANSFER SWITCH (ATS) EMERGENCY SOURCE	GENERATOR	ATS/PANEL 'A'	CN-2, 1 1/2" PVC, GENERATOR TO ATS
P3	3-#6 w/ #6 GND	AUTOMATIC TRANSFER SWITCH (ATS) NORMAL SOURCE	PANEL 'B'	ATS/PANEL 'A'	CN-3, 1" PVC
C1	8-#18 VENDOR CONTROL CABLE	GENERATOR/ATS CONTROL CABLE AND UTIL SENSE	GENERATOR	ATS/PANEL 'A'	CN-2, 1 1/2" PVC, GENERATOR TO ATS

EQUIPMENT SCHEDULE	
1	STANDBY GENERATOR, 8KW 128/240V, 1-PHASE, NATURAL GAS OR LP OPERATION, WEATHER PROTECTIVE HOUSING, LCD DISPLAY CONTROL PANEL, 35 AMP MAIN CIRCUIT BREAKER, INCLUDES 50 AMP PRE-WIRED AUTOMATIC TRANSFER SWITCH/BREAKER PANEL. GENERAC MODEL #006237-0 (8 KW).
2	AUTOMATIC TRANSFER SWITCH (INCLUDED WITH ITEM 1), 50 AMP, 120/240V, WEEKLY EXERCISER TIMER, NEMA 1 ENCLOSURE, BREAKERS TO BE RATED AT 10,000 AIC. SEE PANEL SCHEDULE FOR BRANCH CIRCUIT BREAKER REQUIREMENTS.
3	LOAD CENTER, 100 AMP, 120/240V, 12-POSITION, 1- PHASE, 3-WIRE, NEMA TYPE 1 PANEL BOARD, FACTORY INSTALLED GROUND BUS, APPROVED FOR SERVICE ENTRANCE WHEN WIRED PER NEC, BREAKERS TO BE RATED AT 10,000 AIC, INCLUDES 100 AMP 2-POLE MAIN BREAKER, 1-40 AMP 2-POLE BRANCH CIRCUIT BREAKER, SPARE SPACES TO REMAIN COVERED. GE MODEL # TM1212CCUQUIK WITH THQL BREAKERS OR EQUAL. PANEL DOOR TO BE PERMANENTLY LABELED "SERVICE DISCONNECT". SEE PANEL SCHEDULE FOR BRANCH CIRCUIT BREAKER REQUIREMENTS.
4	LIGHT FIXTURE. FLOURESCENT LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) MODEL # S232 OR EQUAL.
5	OUTSIDE LIGHT, 120V, 13 WATT CFL LAMP, DUSK TO DAWN AUTOMATIC LIGHT CONTROL, RATED FOR OUTDOOR USE, UTILITECH MODEL CU5813-02-I OR EQUAL.
6	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING MODEL # APC7R OR EQUAL
7	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
8	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL.
9	VENTILATION FAN, 24", 115 VOLT, 1-PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, CFM @ 8.8"SP (HI/LOW): 5830/3470, CFM @ 6.6"SP (HI): 5568, RPM(HI/LOW): 1200/980, INCLUDES CHROME INLET GUARD AND OUTLET SHUTTERS, 9' SWITCHED CORD AND PLUG. USE J & O MANUFACTURING PART NO. WPE24C OR EQUAL.

GENERAL NOTES:

WIRE AND CABLE:

1. WIRE AND CABLE TYPES:

   INSULATED WIRE: 600 VOLT, SINGLE CONDUCTOR, 75°C MIN. INSULATION RATING, POWER CABLE, NEC TYPE THHN/THWN. CONDUCTOR: CLASS B COPPER, INSULATION: POLYVINYL CHLORIDE "PVC", CONDUCTOR JACKET: NYLON.

   BARE WIRE: CLASS B COMPRESSED CONCENTRIC-LAY-STRANDED, SOFT DRAWN, COPPER CONDUCTORS.

2. CONNECTORS: ALL CONNECTORS SHALL BE DESIGNED AND SIZED FOR SPECIFIC CABLE BEING CONNECTED AND SHALL BE SOLDERLESS, PRESSURE-TYPE CONNECTORS CONSTRUCTED OF NON-CORRODIBLE TIN-PLATED COPPER. THE RATED CURRENT-CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING CONNECTED.

   POWER CONNECTORS (18 AWG ARD SMALLER): "SCOTCHLOK" PRE-INSULATED SPRING WIRE CONNECTORS. BUCHANAN OPEN-END COPPER SPLICING CAPS, APPLIED WITH COMPATIBLE TOOL, WITH NYLON SNAP-ON INSULATORS.

   POWER CONNECTORS (SIZES 8-4 AWG): NON-INSULATED RING-TONGUE TYPE. RING TONGUE SIZED TO MATCH TERMINAL STUD SIZE. BRAZED BARREL SEAM. APPLICATION TOOLING DESIGNED TO CRIMP THE WIRE BARREL (CONDUCTOR GRIP) WITH A ONE-STEP CRIMP.

   POWER CONNECTORS (SIZES 2 AWG - 750 MCM): NON-INSULATED ONE-HOLE RECTANGULAR TONGUE FOR SIZES 2 AWG THROUGH 3/8 AWG AND TWO-HOLE RECTANGULAR TONGUE FOR 4/0 AWG THROUGH 750 MCM.

   CONTROL, INSTRUMENT, AND SPECIALTY CABLE CONNECTORS: TIN-PLATED COPPER. VINYL OR NYLON PRE-INSULATED RING-TONGUE TYPE PREFERRED. FLAT SPADE LUGS WILL NOT BE PERMITTED. VINYL PRE-INSULATED SPRING-TYPE SPADE TERMINALS: HOLLINGSWORTH "MINI SPRING SPADES"; THOMAS AND BETTS "LOCKING-FORK"; PANDUIT "LOCKING-FORK" SIZED TO MATCH TERMINAL STUD SIZE ARE ACCEPTABLE.

   GROUNDING CONNECTIONS: ALL GROUNDING SURFACES SHALL BE CLEANED TO OBTAIN "BRIGHT" METAL AT ALL POINTS OF CONTACT.

3. CABLE TIES: CABLE TIES SHALL BE NYLON SELF-LOCKING TYPE, HAVE A NORMAL SERVICE TEMPERATURE RANGE OF -48C TO 85C, BE WEATHER-RESISTANT TYPE FOR OUTDOOR. USE AMP SPECIAL INDUSTRIES "AMP-TY," DENNISON MANUFACTURING COMPANY "BAR-LOK," PANDUIT CORPORATION "PAM-IT," THOMAS & BETTS "TY-RAP," OR MINNESOTA MINING AND 3M BRAND CABLE TIES.

4. TERMINAL BLOCKS:

   MOUNTING IN TERMINAL BOXES: BLOCKS TO BE DESIGNED AND SIZED FOR THE CABLES BEING TERMINATED AND RATED 600V. PROVIDE BINDING SCREW-TYPE TERMINALS FOR POWER CABLES AND STRAP SCREW OR TUBULAR CLAMP TERMINALS FOR CONTROL AND INSTRUMENT CABLES. THE RATED CURRENT CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING TERMINATED.

   MOUNTING IN CABINETS, PANELS, CONTROL BOARDS, ETC.: BLOCKS TO BE DESIGNED AND SIZED FOR THE CABLES BEING TERMINATED AND RATED 600V. PROVIDE BINDING SCREW TYPE TERMINALS FOR POWER CABLES. THE RATED CURRENT CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING TERMINATED. PROVIDE MARKING STRIP ON BLOCKS FOR POWER CABLES AND CONTROL CABLES.

5. WIRE AND CABLE INSTALLATION: DO NOT SUBJECT CABLE TO PULLING TENSIONS OR SIDEWALL PRESSURES IN EXCESS OF MANUFACTURER'S RECOMMENDATIONS. ATTACH PULLING GRIPS OVER THE CABLE SHEATH TO PREVENT SLIPPING OF THE INSULATION. DO NOT SUBJECT CABLE TO BENDING RADIUS LESS THAN THOSE RECOMMENDED BY THE CABLE MANUFACTURER OR (WHICHEVER IS GREATER) EIGHT TIMES THE CABLE OUTSIDE DIAMETER DURING OR AFTER INSTALLATION. INSTALL INTERMEDIATE SPLICES ONLY AS INDICATED OR AS APPROVED BY OWNER OR OWNER REPRESENTATIVE. SUPPORT CABLES AT CONNECTIONS OR TERMINATION POINTS SUCH THAT ANY STRAIN ON CABLE WILL NOT BE TRANSMITTED TO THE CONNECTION OR TERMINATION. INSTALL CABLE SUPPORTS IN VERTICAL RUNS OF CONDUIT AT BOXES AND AT TERMINATIONS IN EQUIPMENT, AND AS REQUIRED TO MEET INTERMEDIATE SUPPORT REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC). ALL PULLING COMPOUNDS SHALL BE APPROVED BY WIRE AND CABLE MANUFACTURER AS BEING COMPATIBLE WITH CABLE MATERIALS. ATTACH A CABLE IDENTIFICATION TAG TO EACH CABLE AT ALL TERMINATION OR END POINTS.

6. POWER, CONTROL INSTRUMENT AND SPECIALTY CABLE: INSTALL METALLIC BARRIER IN ALL BOXES TO SEPARATE POWER AND CONTROL FROM LOW-LEVEL SIGNAL (24V OR LESS) INSTRUMENTATION CIRCUITS WHERE RUN IN THE SAME BOX.

   TERMINATE AND GROUND, CONTROL, INSTRUMENT, AND SPECIALTY CABLE SHIELDS AS INDICATED AND RECOMMENDED BY THE MANUFACTURER OF THE EQUIPMENT BEING CONNECTED. IN GENERAL, GROUND THE SHIELDS AT THE CONTROL BOARDS FOR CONTROL CABLES AND AT THE RECEIVING END EQUIPMENT FOR INSTRUMENTATION AND SPECIALTY CABLES.

CONDUIT

GENERAL NOTES:

1. RIGID STEEL CONDUIT: THE CONDUIT SHALL CONFORM TO ANSI C80.1 AND SHALL BE MILD DUCTILE STEEL, CIRCULAR IN CROSS SECTION WITH UNIFORM WALL THICKNESS SUFFICIENTLY ACCURATE TO CUT CLEAN THREADS. EACH LENGTH SHALL BE THREADED ON BOTH ENDS WITH THREADS PROTECTED. ALL SCALE, GREASE, DIRT, BURRS AND OTHER FOREIGN MATTER SHALL BE REMOVED FROM INSIDE AND OUTSIDE PRIOR TO APPLICATION OF COATING MATERIALS. THE CONDUIT SHALL BE GALVANIZED BY THE HOT-DIP PROCESS AS FOLLOWS: INTERIOR AND EXTERIOR SURFACES COATED WITH A SOLID-UNBROKEN LAYER OF 99% VIRGIN ZINC BY DIPPING. COATING SHALL NOT SHOW FIXED DEPOSITS OF COPPER AFTER FOUR 1-MINUTE IMMERSIONS IN A STANDARD COPPER SULFATE SOLUTION. ONE COAT OF ZINC CHROMATE FINISH ON INSIDE AND OUTSIDE SURFACES TO PREVENT OXIDATION AND WHITE RUST. THE COUPLINGS AND ELBOWS SHALL BE FABRICATED, COATED AND FINISHED BY THE SAME PROCESS AS CONDUIT.

2. RIGID POLYVINYL CHLORIDE (PVC) CONDUIT: THE CONDUIT SHALL BE FABRICATED FROM SELF-EXTINGUISHING HIGH IMPACT POLYVINYL CHLORIDE DESIGNED FOR ABOVEGROUND AND UNDERGROUND INSTALLATIONS. USE TYPE EPC SCHEDULE 40 HEAVY-WALL RIGID CONDUIT. FITTINGS AND ACCESSORIES SHALL BE FABRICATED FROM SAME MATERIAL AS CONDUIT. PROVIDE SOLVENT-CEMENT-TYPE JOINTS AS RECOMMENDED BY MANUFACTURER.

3. RIGID STEEL CONDUIT FITTINGS: HEAVY-DUTY CAST MALLEABLE IRON FITTINGS: MOGUL TYPE FOR CONDUIT SIZES 1-1/2 INCHES AND LARGER. LBD OR ROLLER ACTION TYPE LB FOR RIGHT ANGLE FITTINGS FOR CONDUIT SIZES 2 INCHES AND LARGER. FULL-THREADED HUBS AND RUBBER-GASKETED COVERS. PROVIDE ZINC, CADMIUM-PLATED OR BRONZE HARDWARE BOLTS AND SCREWS FOR ASSEMBLY. FINISH WITH CADMIUM-PLATED OR GALVANIZING.

4. INDOOR AND OUTDOOR BOXES: PROVIDE FS OR RS TYPE JUNCTION BOXES WITH CADMIUM ZINC ELECTROPLATE AND HOT-DIP GALVANIZED FINISH. COVER SHALL BE FASTENED WITH CADMIUM-PLATED BOLTS. PROVIDE THREADED CONDUIT ENTRANCE HUBS ON ALL BOXES. PROVIDE RUBBER OR NEOPRENE GASKET FOR COVER AND HUBS (NEMA TYPE 4 ENCLOSURE), CONFORM TO NEMA TYPE 4 ENCLOSURE. PROVIDE FOR THE ISOLATION OF POWER CIRCUITS FROM OTHER TYPE CIRCUITS.

5. ELECTRICAL BOXES (LESS THAN 100 CU. IN.): METALLIC OUTLET BOXES SHALL CONFORM TO ANSI/UL514A.

6. ELECTRICAL SPLICE BOXES (GREATER THAN 100 CU. IN.): METALLIC SPLICE BOXES SHALL CONFORM TO UL50, TYPE 1.

7. SUPPORT SYSTEM: FABRICATED FROM MANUFACTURED FRAMING MEMBERS EQUAL TO "UNISTRUT" P-3000 SERIES AS MANUFACTURED BY UNISTRUT CORPORATION. CONSTRUCT AS REQUIRED TO RIGIDLY SUPPORT ALL CONDUIT RUNS AND BOXES. PROVIDE CONDUIT CLAMPS, SIZED FOR THE SPECIFIC CONDUIT SIZE, TO SUPPORT ALL EXPOSED METALLIC CONDUIT. PROVIDE NONMAGNETIC CLAMPS TO SUPPORT NONMETALLIC CONDUITS. PROVIDE STEEL RODS, ANCHORS, INSERTS, BOLTS, WASHER, NUTS AND ALL OTHER SUPPORT HARDWARE.

8. INSTALLATION: PROVIDE SUITABLE PROTECTION FOR CONDUIT RISERS AGAINST DAMAGE DURING CONSTRUCTION. CAP ENDS OF ALL CONDUITS BEFORE CONCRETE IS POURED. CAP ALL CONDUITS AFTER CLEANING WHERE CONDUITS ARE TO BE LEFT EMPTY BY THIS CONTRACT. CAREFULLY REAM ENDS OF ALL CONDUIT LENGTHS AFTER CUTTING TO ELIMINATE SHARP BURRS. CLEAN OUT ALL CONDUIT BEFORE PULLING WIRE. CLEAN OUT ALL CONDUITS IMMEDIATELY AFTER CONCRETE WORK IS FINISHED. SHIFT LOCATIONS AS REQUIRED TO AVOID INTERFERENCE WITH OTHER EQUIPMENT AND PIPING BEING INSTALLED.

9. HOLES AND SLEEVES: PROVIDES THROUGH FLOORS, WALLS AND ROOFS AS NECESSARY FOR CONDUIT RUNS, INCLUDING APPROVED FLASHING AND WEATHER PROOFING AT OUTSIDE WALLS AND ON ROOFS. INSTALL SLEEVES OR FORMS FOR ALL OPENINGS IN NEW WORK. PROVIDE THE REQUIRED INSERTS AND HOLES. COMPLETELY SLEEVED, BONDED, CURBED, FLASHED AND FINISHED OFF IN AN APPROVED MANNER, WHETHER IN CONCRETE, STEEL GRATING, METAL PANELS OR ROOFS. MAKE CONNECTIONS TO BOXES, PANELS, AND OTHER EQUIPMENT AS FOLLOWS. MYERS SCREW-TIGHT HUBS OR EQUIVALENT THREADED HUBS FOR ALL OUTDOOR CONDUIT ENTRANCES. ENTER FROM BOTTOM OF ENCLOSURE OR EQUIPMENT UNLESS PHYSICALLY NOT POSSIBLE. RUNNING THREADS WILL NOT BE PERMITTED. COAT ALL FIELD CUT THREADS IN GALVANIZED CONDUIT WITH COLD GALVANIZE PAINT. COMPLY WITH APPLICABLE REQUIREMENTS OF NEC PERTAINING TO INSTALLATION OF CONDUIT SYSTEMS. PLACE DRAINAGE FITTINGS OR WEEP HOLES AT UNAVOIDABLE LOW POINTS WHERE MOISTURE CAN COLLECT. INSTALL AN ENTIRE CONDUIT SYSTEM THAT IS ELECTRICALLY CONTINUOUS WITH BONDING JUMPERS PROVIDED AS NECESSARY TO CONFORM TO NEC. ALL CONDUIT RUNS SHALL HAVE A METAL TAG ATTACHED ON EACH END 12 INCHES OR LESS FROM THE END WITH AN IDENTIFICATION NUMBER. ALL SPARE CONDUITS SHALL HAVE A 200-POUND NYLON PULL ROPE INSTALLED INSIDE AND BE CAPPED FOR FUTURE USE.

10. EXPOSED CONDUIT INSTALLATION: INSTALL HORIZONTAL RUNS AS HIGH ABOVE FLOOR AS POSSIBLE, AND IN NO CASE LOWER THAN 7 FEET ABOVE FLOOR, WALKWAY, OR PLATFORM IN PASSAGE AREA. RUN CONDUIT PARALLEL OR PERPENDICULAR TO WALLS, CEILING, BEAMS AND COLUMNS UNLESS INDICATED OTHERWISE. ROUTE TO CLEAR ALL DOORS, WINDOWS, ACCESS HOLLS, AND OPENINGS. GROUP PARALLEL RUNS IN NEATLY ALIGNED BANKS WHERE POSSIBLE WITH MINIMUM OF 1-INCH CLEARANCE BETWEEN CONDUITS. MAINTAIN 6-INCH CLEARANCE BETWEEN CONDUIT AND COVERINGS ON LINES: STEAM, HOT WATER, ETC. DO NOT EXCEED A DISTANCE OF 8 FEET BETWEEN SUPPORTS ON HORIZONTAL OR VERTICAL RUNS.

11. CONCEALED CONDUIT INSTALLATION: CONCEAL CONDUIT FOR LIGHTING, CONVENIENCE OUTLETS, AND OTHER CIRCUITS IN WALLS, CEILING AND FLOORS WHERE POSSIBLE. CONCEALED CONDUIT SHALL BE RIGID STEEL IF NOT EMBEDDED IN CONCRETE AND PVC SCHEDULE 40 IF EMBEDDED IN CONCRETE. DO NOT INSTALL CONDUIT IN CONCRETE WHERE CONDUIT OUTSIDE DIAMETER EXCEEDS ONE-THIRD OF CONCRETE THICKNESS. USE EXPANSION AND DEFLECTION FITTING WITH BONDING JUMPERS AT ALL CONCRETE EXPANSION JOINTS. TIE SECURELY IN PLACE TO PREVENT MOVEMENT WHEN CONCRETE IS POURED. INSTALL IN FLOOR SLABS IN AS STRAIGHT A RUN AS POSSIBLE. CONDUIT CROSSOVERS ARE NOT PERMITTED UNLESS CONDUIT TOTAL OUTSIDE DIAMETER IS ONE-THIRD OF THE CONCRETE THICKNESS OR LESS. USE LONG RADIUS ELBOWS EXCEPT ON RISERS WHERE CURVED PORTION OF ELBOW WOULD EXTEND ABOVE THE FINISHED FLOOR OR FOUNDATION. PVC CONDUIT EMBEDDED IN CONCRETE SHALL TRANSITION TO RIGID GALVANIZED STEEL FOR ALL 90-DEGREE ELBOWS AND BEFORE TURNING EXPOSED. MAKE ALL JOINTS WATERTIGHT AFTER INSTALLATION BY COATING ALL FINISHED JOINTS WITH COAL TAR SOLUTION APPLIED AT 15 MILS MINIMUM DRY FILM.

12. BURIED CONDUIT INSTALLATION: USE SCH 40 PVC CONDUIT. INSTALL IN AS STRAIGHT A RUN AS POSSIBLE BETWEEN TERMINATION POINTS. BURY CONDUITS AS MINIMUM OF 30 INCHES BELOW FINISH GRADE UNLESS INDICATED OTHERWISE. SLOPE CONDUIT AWAY FROM CONDUIT RISERS WHERE POSSIBLE. MAINTAIN 6-INCH SEPARATION FROM UNDERGROUND PIPING. USE LONG RADIUS BENDS AT ALL RISERS UNLESS INDICATED OTHERWISE. AFTER TRENCH BOTTOM HAS BEEN FINISHED TO GRADE, LAY CONDUIT. CAP ENDS OF ALL CONDUIT RISERS BEFORE BACKFILLING. PROVIDE WATERTIGHT SEAL AROUND WIRES WHERE CONDUIT TERMINATES IN PULL BOX.

13. CONDUIT FITTINGS INSTALLATION. INSTALL SPECIAL BOXES AS INDICATED FOR SIZE REQUIRED FOR CONDUITS AND CABLES ENTERING AND LEAVING BOX. INSTALL WHERE REQUIRED FOR PULL OR JUNCTION BOXES AND FOR MOUNTING OR CONNECTING TO SWITCHES, OUTLETS, INTERMEDIATE TERMINAL BLOCKS OR CONTROL DEVICES. PROVIDE 1/4-INCH WEEP HOLES IN INTERIOR BOXES WHERE CONDUITS ENTER FROM EXTERIOR OR BURIED INSTALLATION. CONSTRUCT SUPPORTS WITH SUFFICIENT RIGIDITY TO HOLD ALL MOUNTED EQUIPMENT AND MATERIAL IN PERMANENT AND NEAT ALIGNMENT. DESIGN SUPPORTS TO PROVIDE 1/4-INCH SPACE BETWEEN EQUIPMENT HOUSINGS AND WALLS OR COLUMNS UPON WHICH THEY ARE MOUNTED. DO NOT EXCEED LOAD REQUIREMENTS IN NEC AND NEMA STANDARDS.

LABELING

1. SERVICE EQUIPMENT SHALL BE LABELED WITH A CONSPICUOUS AND PERMANENT LABEL INDICATING AVAILABLE FAULT CURRENT AND DATE CALCULATED. LABEL AND FAULT CURRENT VALUE TO BE PROVIDED BY CUSTOMER.
2. THE CUSTOMER SHALL PROVIDE AND INSTALL A LABEL ON THE PANELBOARD DOOR WITH THE LOCATION, DEVICE OR EQUIPMENT THAT SUPPLIES POWER TO THE PANELBOARD.
3. PANELBOARD AND TRANSFER SWITCH DOORS TO BE LABELED WITH ARC-FLASH WARNING LABEL, BRADY CAT. NO. 94913 OR EQUAL.

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY

ALABAMA MANUFACTURED HOUSING COMMISSION — Daniel G. White — 7/12/2007

SAFE-T-SHELTER ® SAFE ROOMS & STORM SHELTERS

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353 - 1972

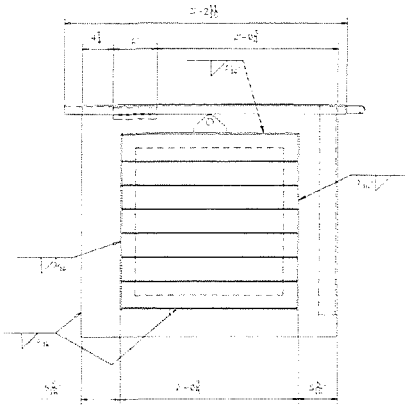
HCS JOB NUMBER: 14100901

NO.	DESCRIPTION	CCR #	DATE	BY	CK
0	ORIGINAL ISSUE (DRS/JFC)		12/18/14	HCS	
1	GENERAL REVISIONS (DRS/JFC)		5/21/15	HCS	
2	GENERAL REVISIONS (JFC)		2/22/17	HCS	

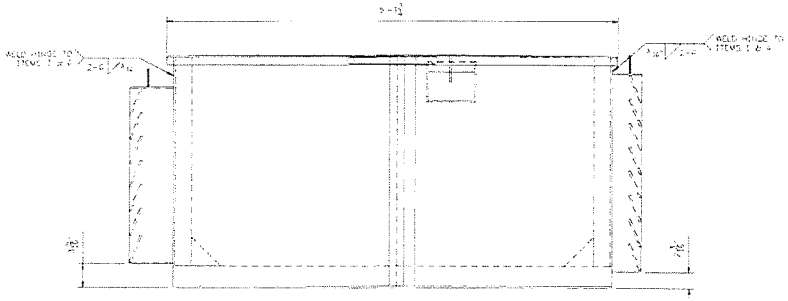
MATERIAL: NONE | SCALE: NONE | DRAWN BY: D. STOVER | APPROVED BY:

TITLE: ELECTRICAL NOTES AND SCHEDULES

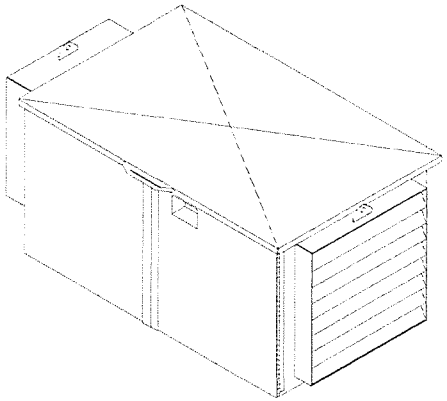
DATE: 12/10/14 | SIZE: D | DRAWING NUMBER: D-NON-ESPEC | REV: 2

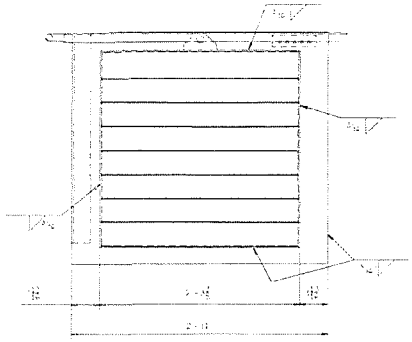


LEFT SIDE VIEW

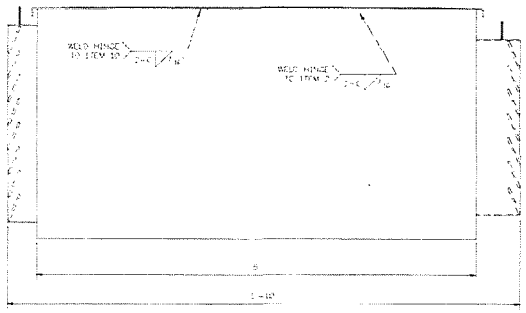


FRONT VIEW





RIGHT SIDE VIEW



REAR VIEW

GENERATOR B.O. ASSEMBLY

SCALE: 1" = 1'-0"

ALABAMA MANUFACTURED HOUSING COMMISSION

Daniel G. White

7/9/2023

ALABAMA REGISTERED PROFESSIONAL ENGINEER

4/11/23

SAFE-T-SHELTER®

SAFE ROOMS & STORM SHELTERS

SCALE: 1 1/2"=1'-0"

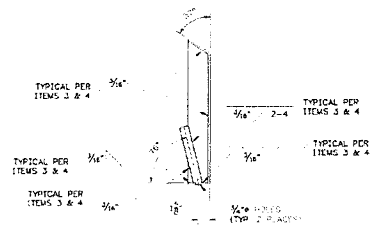
OPTION 1 - GENERATOR
SHOP DRAWING

UNLESS OTHERWISE SPECIFIED

04/01/23

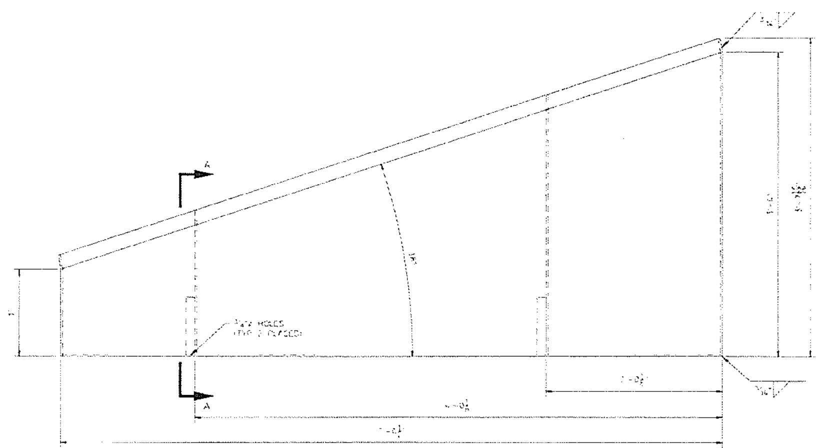
STS1056 Page 11

1



SECTION A-A

SCALE 1½" = 1'-0"



OPTION 2 - WING ASSEMBLY

SCALE 1½" = 1'-0"

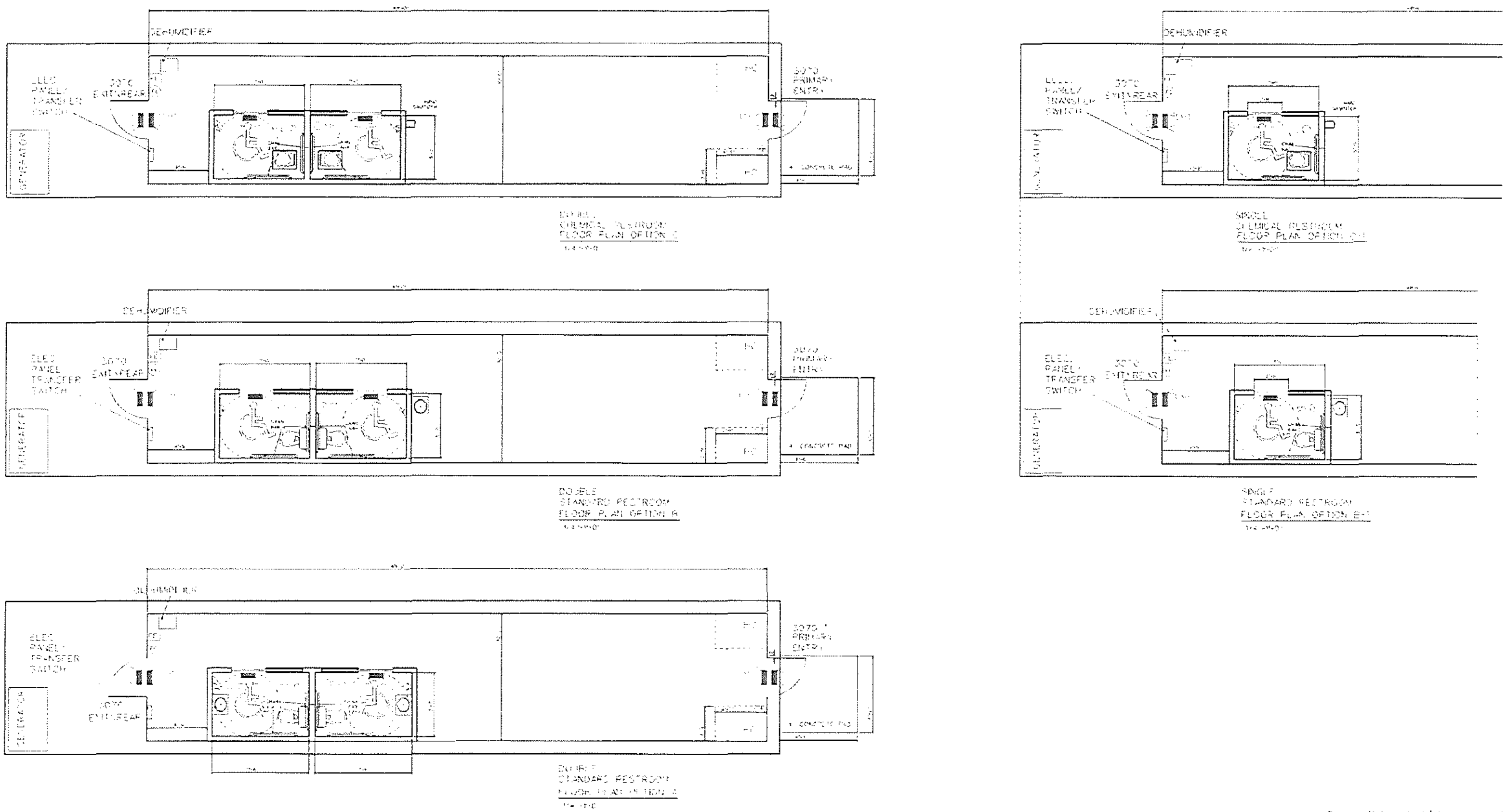
SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

ALABAMA MANUFACTURED HOUSING COMMISSION
Daniel G. White
7/9/2023

4/1/23

UNLESS OTHERWISE SPECIFIED:

SCALE	1 1/2"=1'-0"
TITLE	OPTION 2 - WING WALL ASSEMBLY SHOP DRAWING
DATE	04/01/23
DRAWING NUMBER	STS1056 Page 12
REV	1



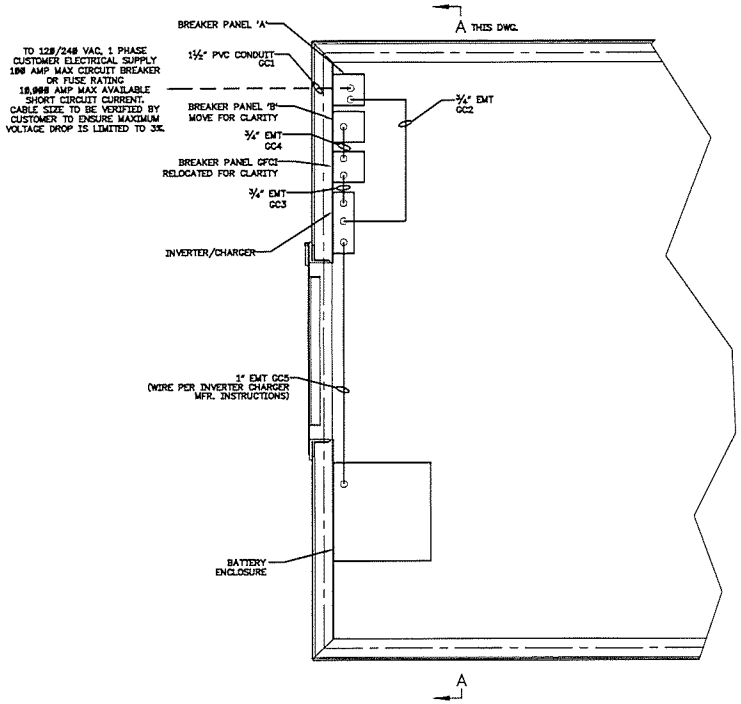
Restroom(s) to be constructed at customer's site, after shelter has been delivered and anchored. Restroom(s) to be constructed by STS or others.

March 2015 and ICC 500-2014.

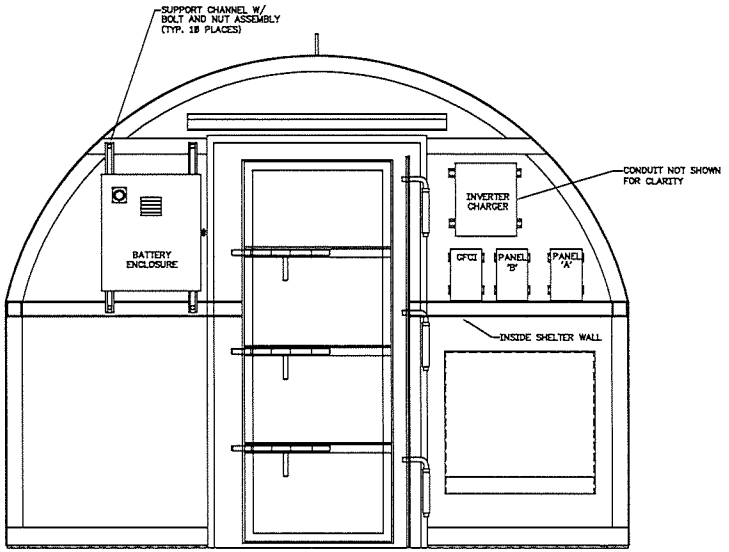
A-1

1

BILL OF MATERIAL	
ITEM	DESCRIPTION
1	LOAD CENTER, 100 AMP, 12-SPACE, 1- PHASE, 3-WIRE, NEMA TYPE 1 ENCLOSURE, FACTORY INSTALLED GROUND BUS, 100 AMP 2-POLE MAIN BREAKER, (1) 30 AMP 1-POLE AND (3) 20 AMP 1-POLE BRANCH CIRCUIT
	BREAKERS, SPACES TO REMAIN COVERED. GE M/N TM1210CCUG1K WITH THQL BREAKERS. PANEL DOOR TO BE PERMANENTLY LABELED "SERVICE DISCONNECT"
2	INVERTER/CHARGER, W/BUILT-IN TRANSFER SWITCH, OUTPUT RATING: 1000W(2000W SURGE), 120VAC, 8.4A, CHARGER RATING: 50A, TRANSFER SWITCH RATING: 30A, XANTREX M/N FREEDOM XC1000
3	BATTERY ENCLOSURE (ACCOMMODATES 2 BATTERIES), MATERIAL: ALUMINUM, DIMS: 22.625H X 19.25W X 19.625D, UL 508A, NEMA 3R, AMERESCO SOLAFR M/N BBA-2 OR EQUAL
4	BATTERY, 12.8V 100AH DEEP CYCLE, 1280 WATT-HOURS (WH), WEIGHT 29 LBS, 11.9" X 6.8" 8.5", EXPION360 M/N EX-G27-100C OR EQUAL
5	BATTERY SWITCH, CONTINUOUS CURRENT RATING: 275 A, VOLTAGE RATING: 48 V, SURFACE OR REAR PANEL MOUNT, VICTRON ENERGY M/N VBS127010010
6	FUSE BLOCK, 100A, CLASS T, 300V, BOX LUG CONNECTOR, 2/0–6 AWG WIRE RANGE, LITTELFUSE M/N LFT301001 W/LFT30100FBC COVER
7	FUSE, 100A, CLASS T, 125VDC, LITTELFUSE M/N JLLN100
8	NOT USED
9	LIGHT FIXTURE, INDOOR, LED LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) M/N S232
10	LIGHT FIXUTURE, OUTDOOR, 120V, 13 WATT CFL LAMP, DUSK TO DAWN AUTOMATIC LIGHT CONTROL, UTILITECH M/N GU8813-BZ-I
11	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING M/N APC7R OR EQUAL
12	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
13	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL
14	VENTILATION FAN, 24", 115 VOLT, 1- PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, 5850 CFM @ 0.0"SP, 5560 CFM @ 0.05"SP, 9' SWITCHED CORD AND PLUG,
	INCLUDES WEATHER HOOD, J & D MANUFACTURING M/N VPES24 AND VFT140858 (HOOD)



SHELTER POWER PLAN
(GRID OPTION)



VIEW A–A
(GRID OPTION)

ALABAMA LICENSED J. Conway No. 22480 PROFESSIONAL 9/15/2023 ENGINEER JOHN F. CONWAY

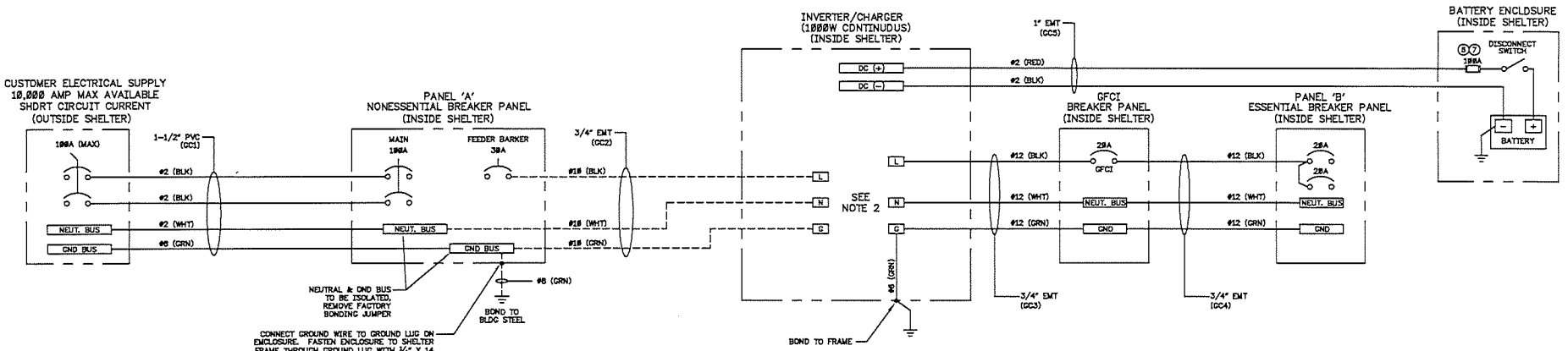
SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353-1672

HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
DRAWN BY: PAUL STRANGE
APPROVED BY: JOHN CONWAY
TITLE: OPTIONAL GRID / BATTERY UPS SYSTEM ELECTRICAL PLAN & VIEW
DATE: 07/19/23
SIZE: D
DRAWING NUMBER: E-UPS-GRID-1
REV: 0



WIRING DIAGRAM GRID OPTION
(GRID OPTION)

BATTERY NOTES:

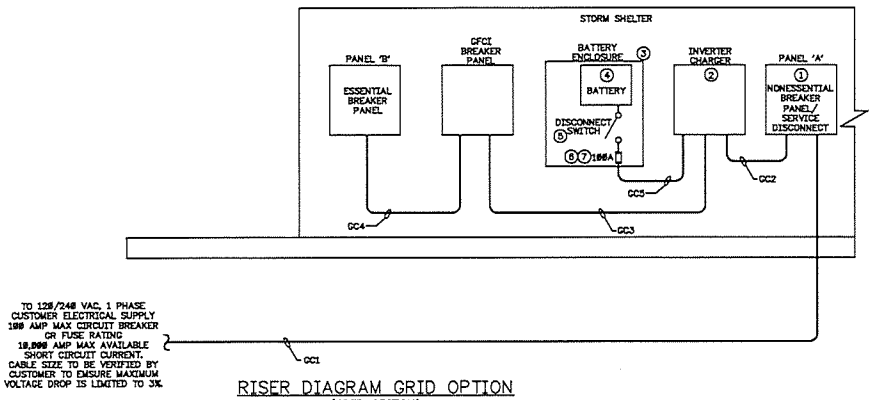
1. AVOID LONG PERIODS OF EXTREME COLD OR HOT TEMPERATURES. LONG PERIODS OF EXPOSURE TO THESE TEMPERATURES CAN RESULT IN BATTERY DAMAGE.
2. INVERTER/CHARGER XANTREX FREEDOM HAS BUILT IN TRANSFER SWITCH AND WILL SWITCH TO BATTERY POWER IF MAIN POWER IS LOST. DO NOT INSTALL INVERTER/CHARGER IN ANY COMPARTMENT CONTAINING OF FLAMMABLE VAPORS OR GASSES.

CONDUIT SCHEDULE					
"CONDUIT NO."	"CONDUIT SIZE"	CONDUCTORS	FUNCTION	FROM	TO
GC1	1-1/2" SCH 40 PVC	3- #2 W/#8 GND	BUILDING FEEDER	OWNER SUPPLY PANEL	PANEL 'A'
GC2	3/4" EMT	2- #10 W/GND	INVERTER/CHARGER AC INPUT	PANEL 'A'	INVERTER/CHARGER
GC3	3/4" EMT	2- #12 W/GND	INVERTER/CHARGER AC OUTPUT	INVERTER/CHARGER	GFCI PANEL
GC4	3/4" EMT	2- #12 W/GND	PANEL 'B' FEEDER	GFCI PANEL	PANEL 'B'
GC5	1" EMT	2- #2	INVERTER/CHARGER DC INPUT	BATTERY ENCLOSURE	INVERTER/CHARGER

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	NO.	AMPS		AMPS	NO.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
MAIN BREAKER - BACK FED			1	100		30	2	.		INVERTER/CHARGER
			3	100		20	4		.	RECEPTACLE--DEHUMIDIFIER
SPACE			5	20		20	6			SPACE
SPACE			7	-		-	8			SPACE
SPACE			9	-		-	10			SPACE
SPACE			11	-		-	12			SPACE
SUB TOTAL WATTS	-	-		N				.	.	SUB TOTAL WATTS
240/120V 1-PH 3-WIRE	TOTAL WATTS, L1					.				PANEL 'A' DIRECTORY NONESSENTIAL LOADS
100 AMP MAIN BREAKER	TOTAL WATTS, L2					.				
(ISOLATED GROUND BUS)	TOTAL WATTS					.				

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
PANEL 'B' (GFCI)	.	1	20	
SPACE	.	2	.	
SUB TOTAL WATTS	-	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS) GFCI BREAKER	TOTAL WATTS			.
GFCI BREAKER PANEL ESSENTIAL LOADS				

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
LIGHTS	.	1	20	
RECEPTACLES	.	2	20	
SUB TOTAL WATTS	-	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS)	TOTAL WATTS			.
PANEL 'B' ESSENTIAL LOADS				



RISER DIAGRAM GRID OPTION
(GRID OPTION)

HCS Engineering Company,
DECATUR, ALABAMA (256) 353-1972

HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/25/23	HCS	CMB

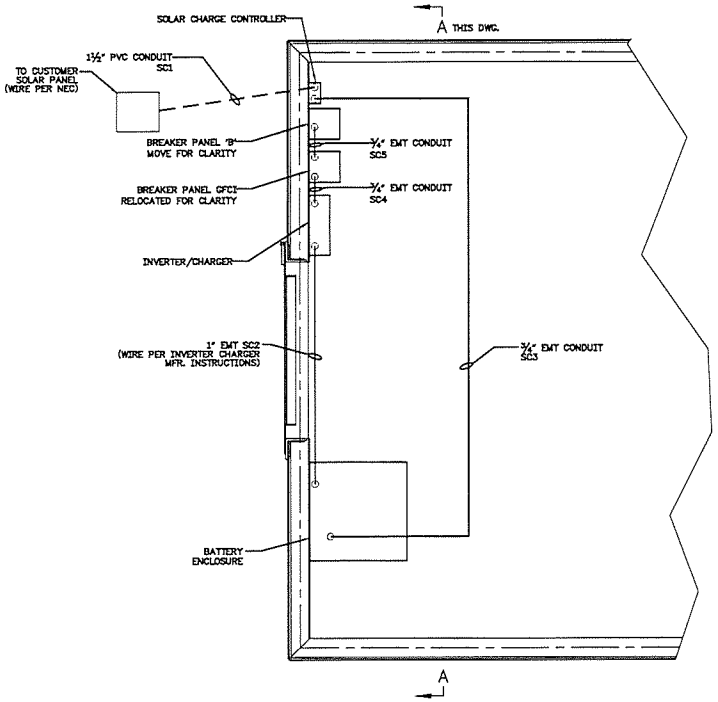
SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-364B

MATERIAL	SOLD	DRAWN BY	PAUL STRANDE
SURFACE DIAT	NONE	APPROVED BY	JOHN CONWAY

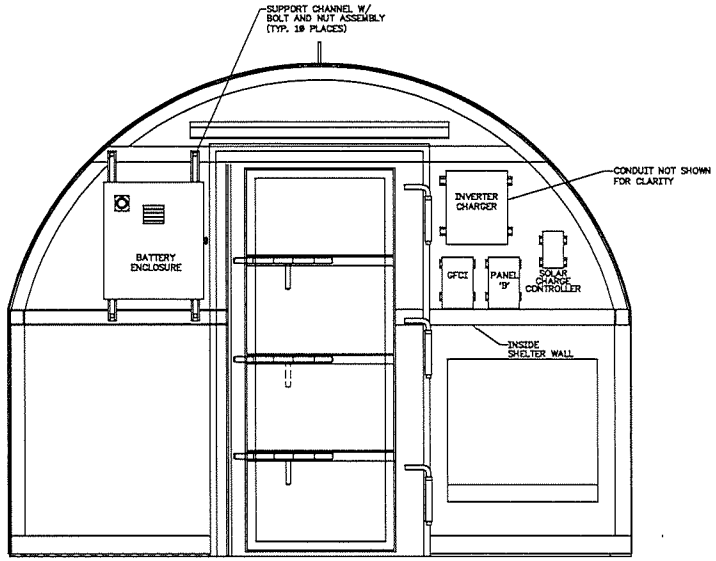
TITLE: OPTIONAL GRID / BATTERY UPS SYSTEM DIAGRAMS & SCHEDULES

DATE	SIZE	DRAWING NUMBER	REV
07/19/23	D	E-UPS-GRID-2	0

BILL OF MATERIAL	
ITEM	DESCRIPTION
1	NOT USED
2	NOT USED
3	BATTERY ENCLOSURE (ACCOMMODATES 2 BATTERIES), MATERIAL: ALUMINUM, OIMS: 22.625H X 19.25W X 19.625D, UL 508A, NEMA 3R, AMERESCO SOLAFR M/N BBA-2 OR EQUAL
4	BATTERY, 12.8V 100AH DEEP CYCLE, 1280 WATT-HOURS (WH), WEIGHT 29 LBS, 11.9" X 6.8" 8.6", EXPION360 M/N EX-G27-100C OR EQUAL
5	BATTERY SWITCH, CONTINUOUS CURRENT RATING: 275 A, VOLTAGE RATING: 48 V, SURFACE OR REAR PANEL MOUNT, VICTRON ENERGY M/N VBS127010010
6	FUSE BLOCK, 100A, CLASS T, 300V, BOX LUG CONNECTOR, 2/0–6 AWG WIRE RANGE, LITTELFUSE M/N LFT301001 W/LFT30100FBC COVER
7	FUSE, 100A, CLASS T, 125VDC, LITTELFUSE M/N JLLN100
8	FUSE, 30A, CLASS T, 125VDC, LITTELFUSE M/N JLLN030
9	LIGHT FIXTURE, INDOOR, LEO LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) M/N S232
10	LIGHT FIXUTURE, OUTDOOR, 120V, 13 WATT CFL LAMP, DUSK TO DAWN AUTOMATIC LIGHT CONTROL, UTILITECH M/N GU8813-BZ-I
11	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING M/N APC7R OR EQUAL
12	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
13	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL
14	VENTILATION FAN, 24", 115 VOLT, 1- PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, 5850 CFM @ 0.0"SP, 5560 CFM @ 0.05"SP, 9' SWITCHED CORD AND PLUG,
	INCLUDES WEATHER HOOD, J & O MANUFACTURING M/N VPES24 AND VFT140858 (HOOD)
15	SOLAR CHARGE CONTROLLER, 12/24VDC, WIRE TERMINALS UP TO 6 AWG, CIRCUIT VOLTAGE100 VDC, BATTERY OUTPUT 9A2 VOC, (L X W X O) 7.1" X 4.0" X 2.4", XANTREX M/N 710-3024-01 OR EQUAL
16	SOLAR PANEL, FLEXIBLE, 220W, 24.6V, 44 MONO-CRYSTALLINE PERC CELLS, DIMENSIONS (L X W X O) 71.6" X 28.8" X 0.08", XANTREX M/N 784-0220 OR EQUAL



SHELTER POWER PLAN
(SOLAR OPTION)



VIEW A–A
(SOLAR OPTION)

LICENSED PROFESSIONAL ENGINEER No. 22480 2/15/2023 JOHN T. CONWAY

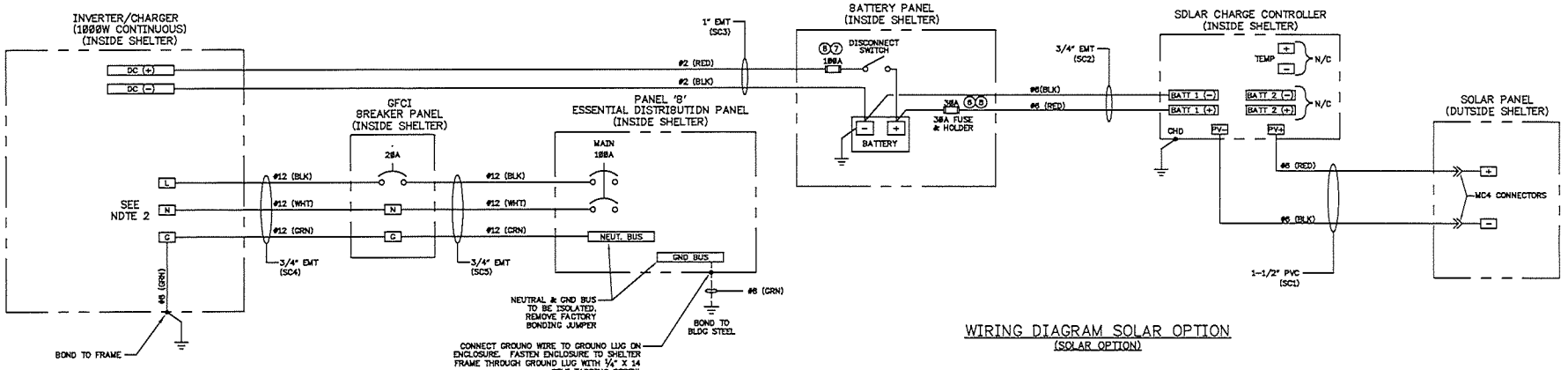
SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353-1972

HCS JOB NUMBER: 23180001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
0	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
DRAWN BY: PAUL STRANGE
APPROVED BY: JOHN CONWAY
TITLE: OPTIONAL SOLAR / BATTERY UPS SYSTEM ELECTRICAL PLAN & VIEW
DATE: 07/19/23
SIZE: D
DRAWING NUMBER: E-UPS-SOLAR-1
REV: 0



WIRING DIAGRAM SOLAR OPTION
(SOLAR OPTION)

CONDUIT SCHEDULE					
"CONDUIT NO."	"CONDUIT SIZE"	CONDUCTORS	FUNCTION	FROM	TO
SC1	1-1/2" SCH 40 PVC	2-#6	SOLAR PANEL OUTPUT	SOLAR PANEL	SOLAR CHARGE CONTROLLER
SC2	3/4" EMT	2-#6	SOLAR CHARGE CONTROLLER OUTPUT	SOLAR CHARGE CONTROLLER	BATTERY ENCLOSURE
SC3	1" EMT	2-#2	INVERTER/CHARGER DC INPUT	BATTERY ENCLOSURE	INVERTER/CHARGER
SC4	3/4" EMT	2-#12 W/GND	INVERTER/CHARGER AC OUTPUT	INVERTER/CHARGER	GFCI PANEL
SC5	3/4" EMT	2-#12 W/GND	PANEL 'B' FEEDER	GFCI PANEL	PANEL 'B'

BATTERY NOTES:

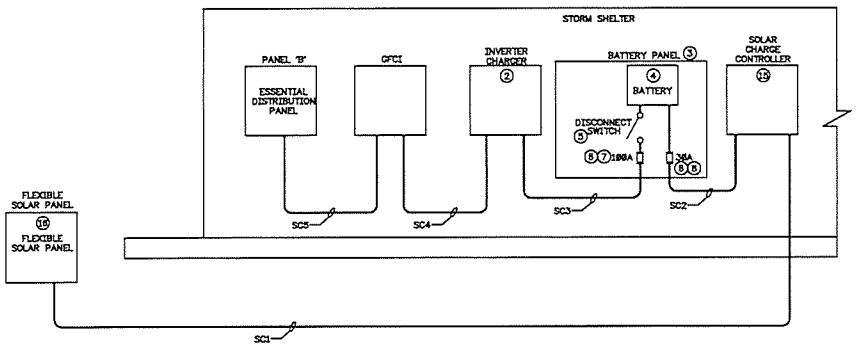
1. AVOID LONG PERIODS OF EXTREME COLD OR HOT TEMPERATURES. LONG PERIODS OF EXPOSURE TO THESE TEMPERATURES CAN RESULT IN BATTERY DAMAGE.
2. INVERTER/CHARGER XANTREX FREEDOM HAS BUILT IN TRANSFER SWITCH AND WILL SWITCH TO BATTERY POWER IF MAIN POWER IS LOST. DO NOT INSTALL INVERTER/CHARGER IN ANY COMPARTMENT CONTAINING OF FLAMMABLE VAPORS OR GASSES.

PANEL DIRECTORY	LOAD WATTS L1	No.	AMPS	
PANEL 'B' (GFCI)	.	1	20	
SPACE	.	2	.	
SUB TOTAL WATTS	—	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS) GFCI BREAKER	TOTAL WATTS			.

GFCI BREAKER PANEL
ESSENTIAL LOADS

PANEL DIRECTORY	LOAD WATTS L1	No.	AMPS	
LIGHTS	.	1	20	
RECEPTACLES	.	2	20	
SUB TOTAL WATTS	—	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS)	TOTAL WATTS			.

PANEL 'B'
ESSENTIAL LOADS



RISER DIAGRAM SOLAR OPTION
(SOLAR OPTION)

ALABAMA LICENSED No. 22480 PROFESSIONAL 5/15/2023 ENGINEER JOHN T. CONWAY

SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353 - 1972

HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
SURFACE DAT:
DRAWN BY: PAUL STRANGE
APPROVED BY: JOHN CONWAY
TITLE: OPTIONAL SOLAR / BATTERY UPS SYSTEM DIAGRAMS & SCHEDULES
DATE: 07/19/23
SIZE: D
DRAWING NUMBER: E-UPS-SOLAR-2
REV: 0

REV	DESCRIPTION	ECO #	DATE	BY	CK

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

TRIPLE 10'X48' COMMUNITY STORM SHELTER MODEL #: STS3-1048

CONSTRUCTION DOCUMENTS: DESIGN INFORMATION
THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THEAPPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DEISGNED TO WITHSTAND 250 MPH WINDS.

1. DESIGNATION: TORNADO SHELTER
2. WIND DESIGN CONFIRMS TO FEMA 361-2021ICC 500-2020 ICC/NSSA STANDARD FOR THE DESIGN AND CONSTRUCTION OF STORM SHELTERS
3. SHELTER DESIGN WIND SPEED: 250 MPH
4. SHELTER FLOOR DESIGN LIVE LOAD: 150 PSF
5. SHELTER ROOF DESIGN LIVE LOAD· 100 PSF
6. SHELTER DESIGN DEAD LOAD: 20 PSF
7. MISILE IMPACT COMPLIANCE:
   PROTECTED OCCUPANT AREAS:
   WALLS: ¼" STEEL PLATE
   ROOF STRUCTURE: ¼' STEEL PLATE
   PROTECTED OCCUPANT AREA DOORS: FEMA 361COMPLIANT
   PROTECTED OCCUPANT AREA LOUVERS: FEMA 361 COMPLIANT
   VENTILATION LOUVER: FEMA 361 COMPLIANT
8. SHELTER NOT TO BE CONSTRUCTED WITHIN AN AREA SUSCEPTIBLE TO FLOODING

STEEL MATERIALS LIST AND NOTES
1. ALL CHANNEL, ANGLES, AND PLATES TO BE A36 U.N.O
2. ALL STEEL TUBE SECTIONS TO BE A500 GRADE B
3. ALL STEEL PIPE SECTIONS TO BE SCH 40 GRADE A501 OR A53
4. TYPICAL SHELTER WALLS ARE ¼" THICK SOLID PLATE STEEL
5. ALL CHANNEL, 3x3 & 2 ½ x2 ½ ANGLES, AND PLATE TO BE ¼" THICK STEEL. TUBE 3/16" THICK STEEL
6. ALL 4x4 ANGLES TO BE 3/8" THICK STEEL
7. SEAT MATERIAL AND GENERATOR PROTECTIVE HOUSING MATERIAL TO BE 3/16" THICK STEEL
8. ALL DIMENSIONS ARE NOMINAL AND ARE SUBJECT TO CONVENTIONAL INDUSTRY TOLERANCES.

DRAWING INDEX

CONCRETE
1. CONCRETING OPERATIONS SHALL COMPLY WITH ACI STANDARDS.
2. MINIMUM CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS (PSI).
3. STRENGTH: 3500 PSI
4. TYPE: NORMAL WT.
5. W/C: 0.513
6. AIR: 3% - 5%
7. SLUMP: 3" TO 5"
8. REINFORCING BARS: ASTM A615 GRADE 60
9. REINFORCING STEEL SHOWN IN SECTIONS AND DETAILS ARE A SCHEMATIC INDICATION THAT REINFORCING EXISTS. SEE SECTION NOTES AND GENERAL NOTES FOR ACTUAL REINFORCING REQUIRED.
10. REINFORCING BAR PLACING ACCESSORIES IN ACCORDANCE WITH ACI MANUAL OF STANDARD PRACTICE.
11. DETAIL REINFORCEMENT IN ACCORDANCE WITH ACI 315.
12. ALL SPLICES SHALL BE CLASS "B" TENSION LAP SPLICE OR PROPERLY SELECTED MECHANICAL SPLICES, PROPERLY INSTALLED PER MANUFACTURING SPECIFICATIONS.
13. MINIMUM CONCRETE COVERAGE OF REINFORCEMENT: SLAB
    FOUNDATION ----------2" TOP & 3" BOTTOM & SIDES

FOUNDATION QUALITY CONTROL DURING CONSTRUCTION
1. FOOTINGS SHALL BE NEATLY EXCAVATED WHERE POSSIBLE WITH SIDES AND TOP EDGES FREE OF LOOSE OR WET MATERIALS. WHERE NEAT EXCAVATION IS NOT POSSIBLE, FOOTING EXCAVATION SHALL BE OPEN CUT WITH EDGES FORMED AND BRACED. THE BOTTOM EXCAVATION SHALL BE CLEAN AND DRY WITH ALL LOOSE MATERIAL REMOVED FOR AN ESSENTIALLY FLAT BEARING SURFACE. WHERE SOFT OR UNSUITABLE BEARING SURFACES ARE ENCOUNTERED, THE AREA SHALL BE UNDERCUT AS REQUIRED AND REPLACED WITH LEAN CONCRETE OR COMPACTED DENSE GRADED CRUSHED STONE AS DIRECTED BY THE ARCHITECT OR ENGINEER.

BUILDING CODE DATA
ICC 500-2020, FEMA 361-2021, FEMA 320-2021, NEC-2020, IBC 2021

OCCUPANCY TYPE:	ASSEMBLY A-3
CONSTRUCTION TYPE:	I B
BUILDING AREA:	1,488 SF
PROPOSED HEIGHT:	9'0"
PROPOSED LENGTH:	48'0"
PROPOSED WIDTH:	38'0"

EGRESS REQUIREMENTS SUMMARY

OCCUPANCY LOAD:	293 PERSONS
WITH (1) RESTROOM:	289 PERSONS
WITH (2) RESTROOMS:	286 PERSONS

OCCUPANCY LOAD & EGRESSCALCULATIONS
ICC 500 – COMMUNITY SHELTER USE
USABLE FLOOR AREA = 1,488 SF – 10 SF (ICC 501.1.2.2 – FIXED/MOVABLE) = 1,478 SF
1,478 SF – 20 SF (TWO WHEELCHAIR SPACE) = 1,458 SF
1,458 SF / 5 SF/PERSON = 292 STANDING/SEATING
292 STAND/SEATING + 1 WC = 293 TOTAL

WITH ONE (1) REST ROOM.
USABLE FLOOR AREA = 1,488 SF – 17.5 SF = 1,470.5 SF
1,470.5 SF – 10 SF (ICC 501.1.2.2 – FIXED/MOVABLE) = 1,460.5 SF
1,460.5 SF – 20 SF (TWO WHEELCHAIR SPACE) = 1,440.5 SF
1,440.5 SF / 5 SF/PERSON = 288 STANDING/SEATING
288 STAND/SEATING + 1 WC = 289 TOTAL

WITH TWO (2) REST ROOM:
USABLE FLOOR AREA = 1,488 SF – 35 SF = 1,453 SF
1,453 SF – 10 SF (ICC 501.1.2.2 –FIXED/MOVABLE) = 1,443 SF
1,443 SF – 20 SF (TWO WHEELCHAIR SPACE) = 1,423 SF
1,423 SF / 5 SF/PERSON = 285 STANDING/SEATING
285 STAND/SEATING + 1 WC = 286 TOTAL

NASBA NATIONAL ASSOCIATION OF STATE BOARDS OF ACCOUNTANCY NO. 12107 PROFESSIONAL ENGINEER
4/1/23

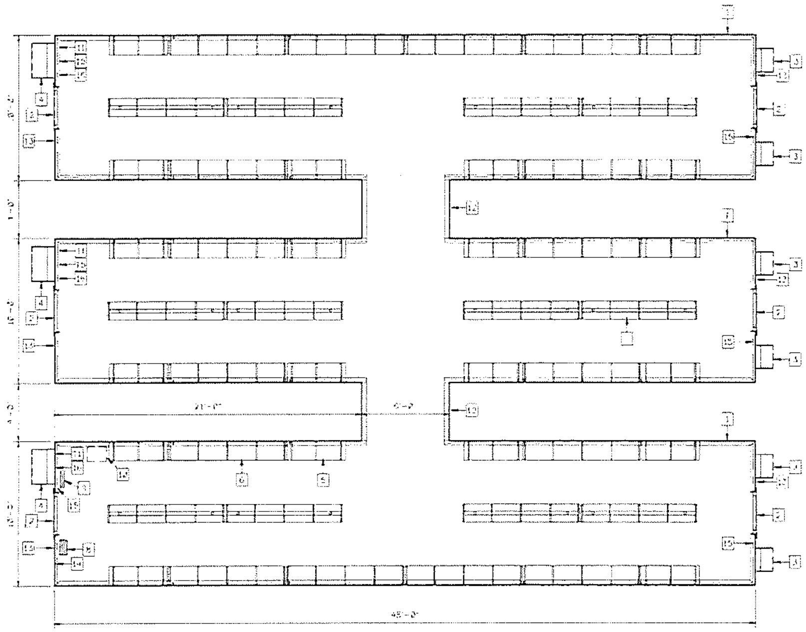
SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

PROJECT:
MATERIAL: SCALE: N.T.S. DRAWN BY:
SURFACE COAT: APPROVED BY:
TITLE: SHELTER CODE SUMMARY, DESIGN PARAMETERS STRUCTURAL LOAD LIMITATIONS & PLAN INDEX

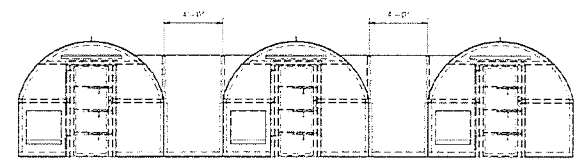
UNLESS OTHERWISE SPECIFIED TOLERANCE EXCEPT AS NOTED

04/01/23 | STS3-1048 Page 1

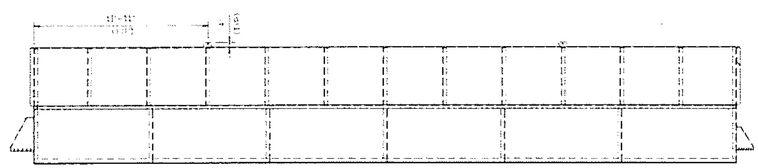
Updated: 02-03-2017



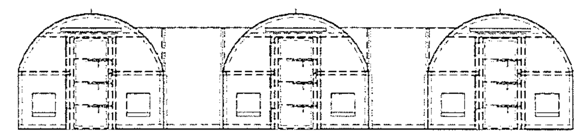
FLOOR PLAN



BACK ELEV.



SIDE ELEV.



FRONT ELEV.

1	PREFABRICATED STEEL STRUCTURE ANCHORED AND SEALED TO SMOOTH CONCRETE FLOOR
2	ICC-500 COMPLIANT STEEL DOOR ASSEMBLY
3	ICC-500 COMPLIANT VENTILATION LOUVERED INTAKE HOOD
4	ICC-500 COMPLIANT VENTILATION LOUVERED EXHAUST HOOD
5	TYPICAL PREFABRICATED WALL BENCH, 4'-0"
6	TYPICAL PREFABRICATED WALL BENCH, 7'-6"
7	TYPICAL PREFABRICATED CENTER BENCH, 8'-0"
8	TRANSFER SWITCH/LOAD CENTER 'A'
9	ELECTRICAL PANEL 'B'
10	DEHUMIDIFIER
11	EXHAUST FAN
12	PREFABRICATED STEEL INTERCONNECT
13	TORNADO SHELTER SIGNAGE
14	TORNADO SHELTER SIGNAGE, MANUFACTURER DESIGN WIND SPEED & MAXIMUM OCCUPANT LOAD
15	FIRE EXTINGUISHER
16	FIRST AID KIT

ALABAMA REGISTERED PROFESSIONAL ENGINEER No. 12307

4/1/23

THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THE APPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DESIGNED TO WITHSTAND 250 MPH WINDS.

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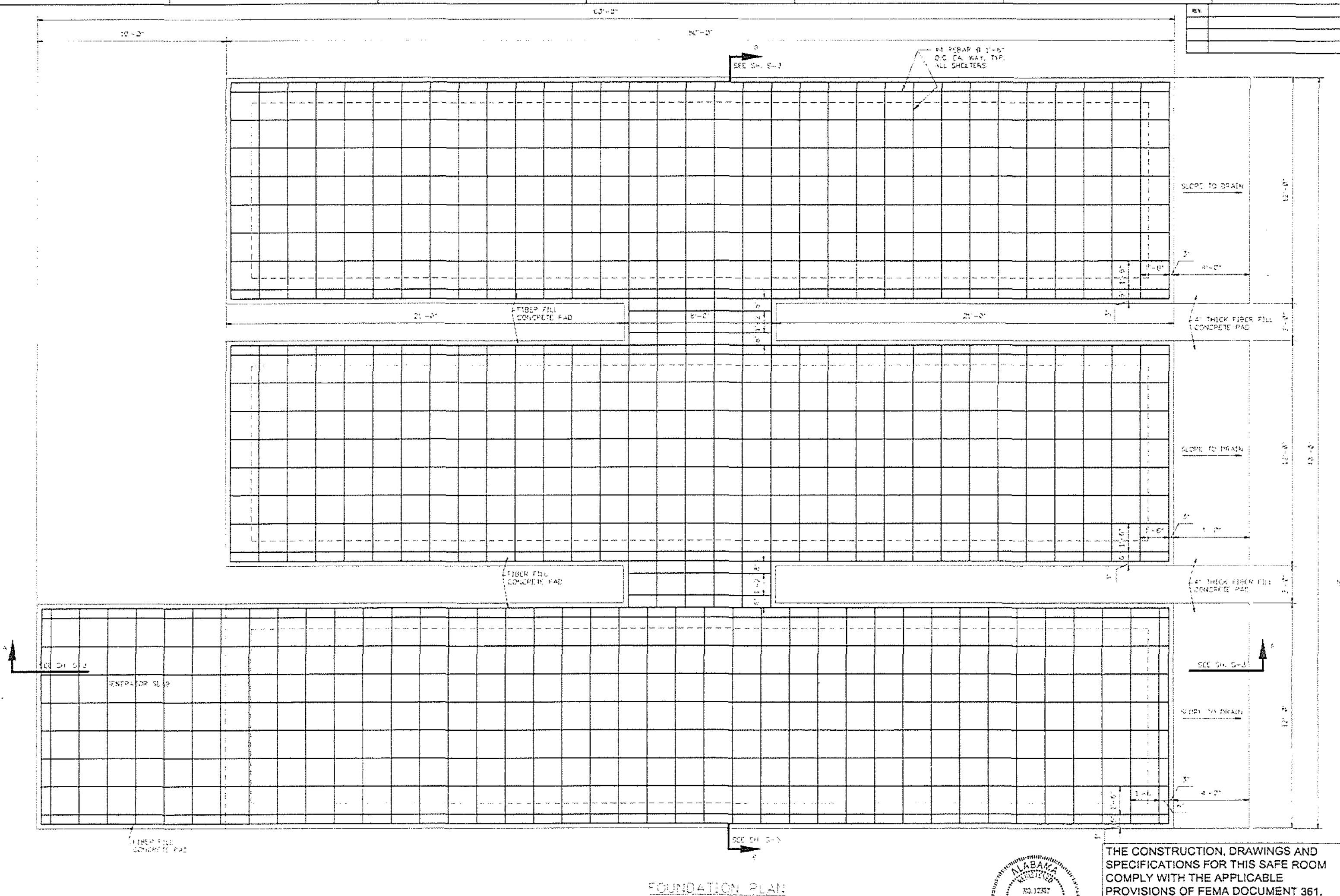
SAFE ROOMS & STORM SHELTERS

SCALE: 1/4"=1'-0"

DRAWN BY: D. STOVER

TITLE: TRIPLE 10x40 SHELTER UNIT FLOOR PLAN & ELEVATIONS

DATE: 04/01/23 | SIZE: D | DRAWING NUMBER: STS3-1048 Page 2 | REV: 1



NOTES:
MINIMUM CONCRETE STRENGTH (f'c) = 2500 PSI @ 28 DAYS
MINIMUM REINFORCING STRENGTH (fy) = 60 KSI
MINIMUM CONCRETE COVER OVER REINFORCING
CONCRETE CAST AGAINST EARTH 3"
CONCRETE EXPOSED TO WEATHER 2"

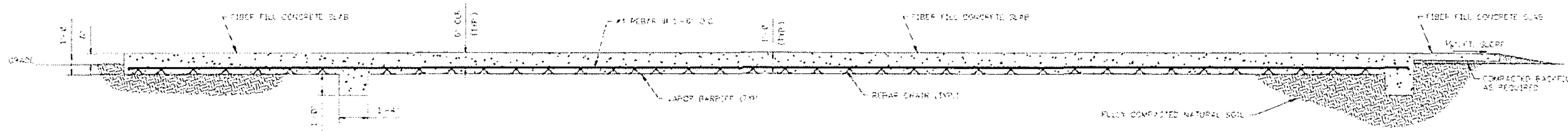
THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THE APPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DESIGNED TO WITHSTAND 250 MPH WINDS.

UNLESS OTHERWISE SPECIFIED

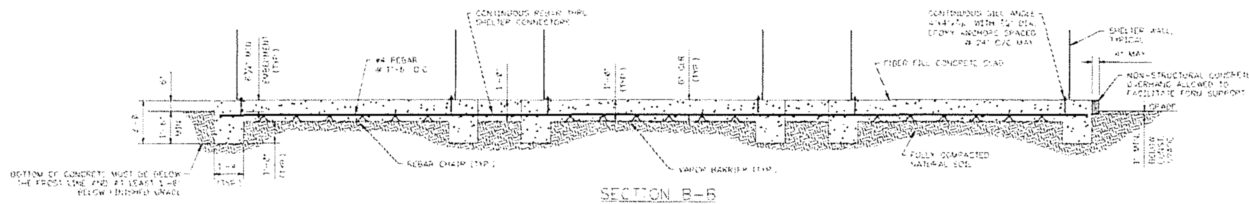
SAFE-T-SHELTER ©
SAFE ROOMS & STORM SHELTERS

SCALE	3/8" = 1'-0"
DRAWN BY	D. STOVER
TITLE	TRIPLE 10x48 SHELTER UNIT FOUNDATION PLAN
DATE	04/01/23
SIZE	D
DRAWING NUMBER	STS3-1048 Page 3
REV	1

4/1/23



SECTION A-A



SECTION B-B

NOTES:
MINIMUM CONCRETE STRENGTH (f'c) = 2500 PSI @ 28 DAYS
MINIMUM REINFORCING STRENGTH (fy) = 60 KSI
MINIMUM CONCRETE COVER OVER REINFORCING:
CONCRETE CAST AGAINST EARTH 3"
CONCRETE EXPOSED TO WEATHER 2"

THE CONSTRUCTION, DRAWINGS AND SPECIFICATIONS FOR THIS SAFE ROOM COMPLY WITH THE APPLICABLE PROVISIONS OF FEMA DOCUMENT 361, "SAFE ROOMS FOR TORNADOES AND HURRICANES: GUIDANCE FOR COMMUNITY AND RESIDENTIAL SAFE ROOMS", APRIL 2021 AND ICC-500-2020. THIS SAFE ROOM IS FOR TORNADO PROTECTION AND IS DESIGNED TO WITHSTAND 250 MPH WINDS

UNLESS OTHERWISE SPECIFIED

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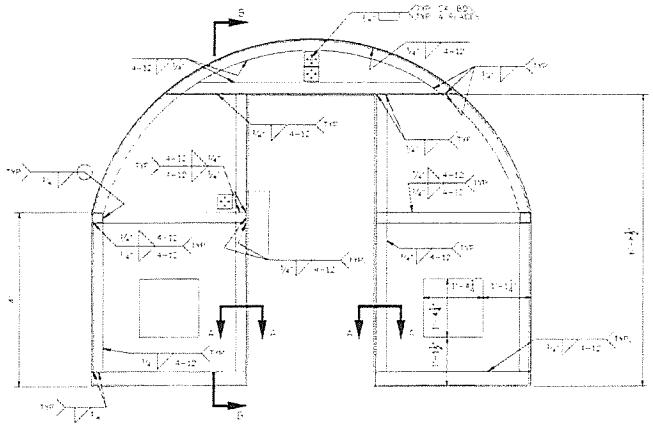
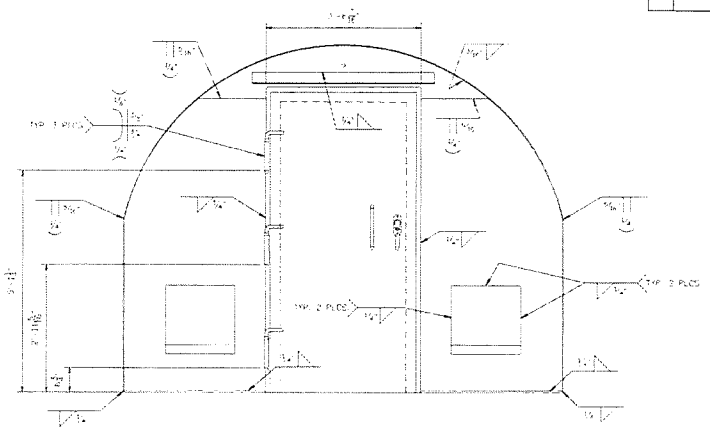
SAFE ROOMS & STORM SHELTERS

SCALE	3/8" = 1'-0"
DRAWN BY	D. STOVER
TITLE	TRIPLE 10x48 SHELTER UNIT FOUNDATION SECTIONS
DATE	04/01/23
SIZE	D
DRAWING NUMBER	STS3-1048 Page 4
REV	1

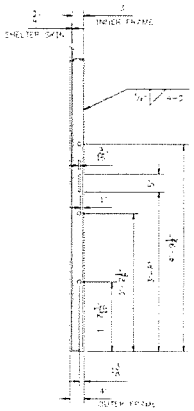
4/1/23



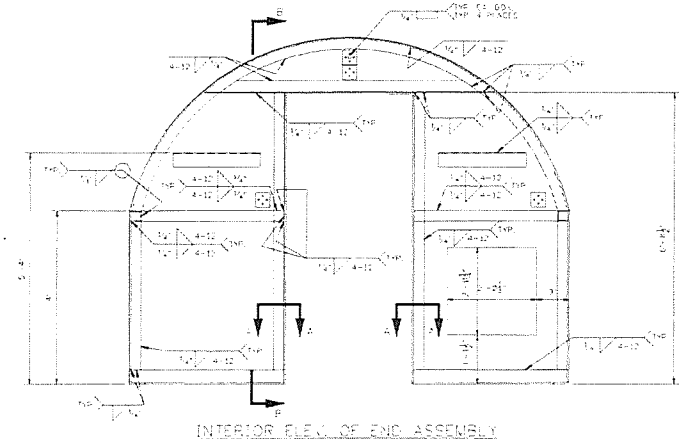
INTERIOR ELEV. OF END ASSEMBLY



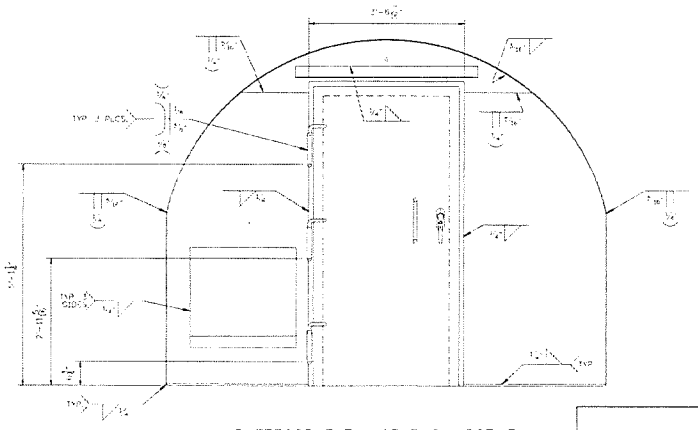
EXTERIOR ELEV. OF END ASSEMBLY



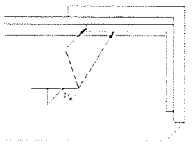
SECTION B-B



INTERIOR ELEV. OF END ASSEMBLY



EXTERIOR ELEV. OF END ASSEMBLY



SECTION A-A

REV	DESCRIPTION	LTR	DATE	BY	CK

ALABAMA REGISTERED 103 12567 PROFESSIONAL ENGINEER

4/1/23

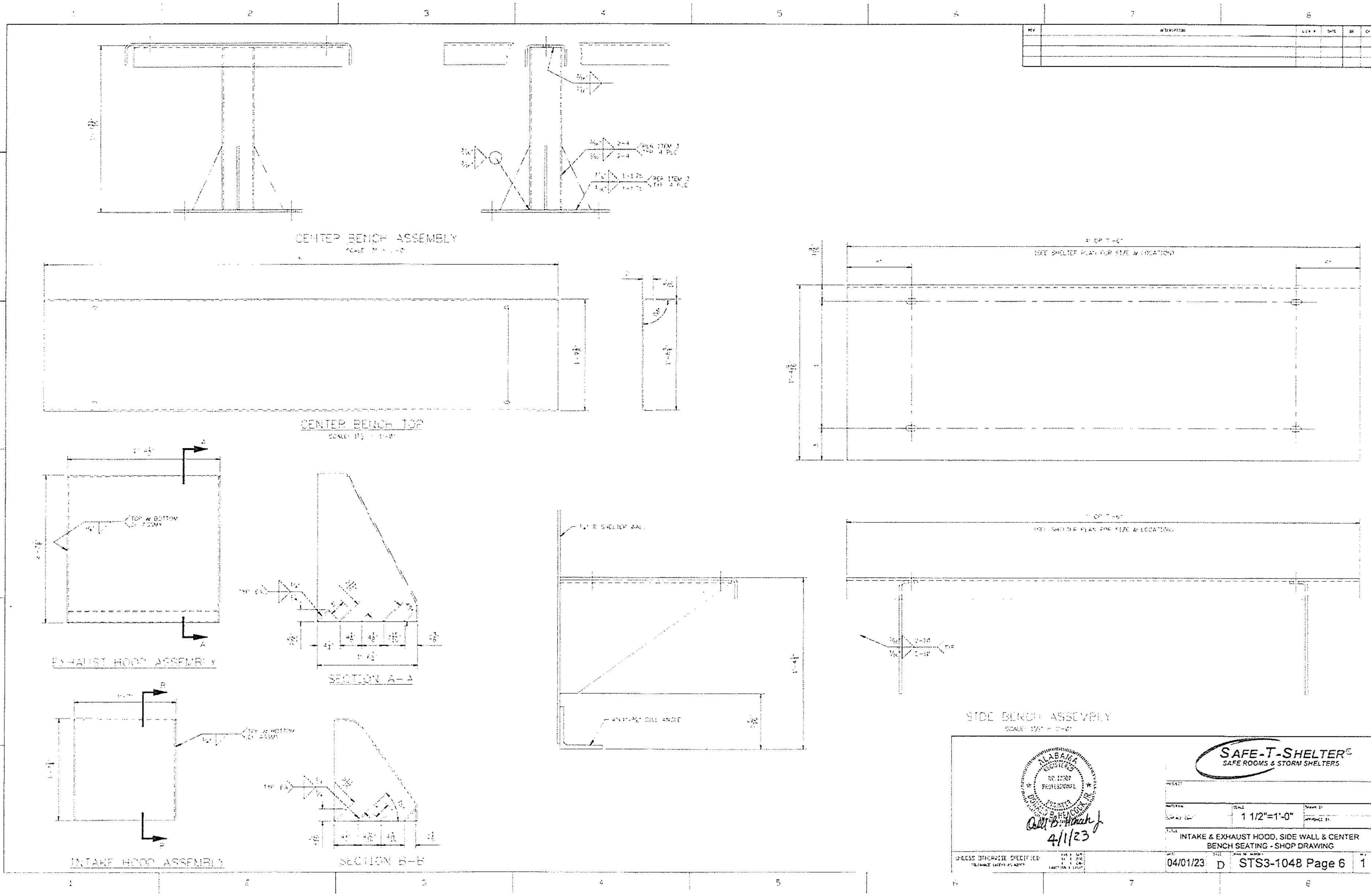
SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

SCALE	AS NOTED	
DRAWN BY		
APPROVED BY		

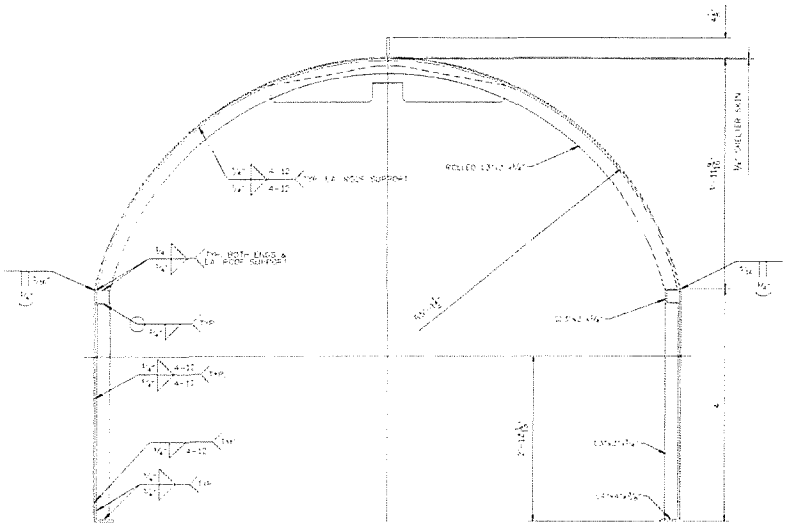
TYPICAL ELEVATIONS & SECTIONS
SHOP DRAWING

UNLESS OTHERWISE SPECIFIED
TOLERANCE EXCEPT AS NOTED

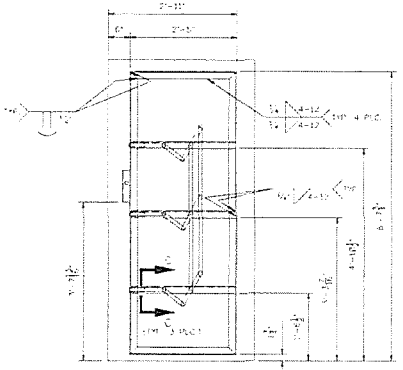
DATE	SIZE	DRAWING NUMBER	SHT
04/01/23		STS3-1048 Page 5	1


CENTER BENCH ASSEMBLY
CENTER BENCH TOP
EXHAUST HOOD ASSEMBLY
SECTION A-A
INTAKE HOOD ASSEMBLY
SECTION B-B
SIDE BENCH ASSEMBLY
SAFE-T-SHELTER©
SAFE ROOMS & STORM SHELTERS
1 1/2"=1'-0"
INTAKE & EXHAUST HOOD, SIDE WALL & CENTER BENCH SEATING - SHOP DRAWING
04/01/23
D
STS3-1048 Page 6
1
4/1/23

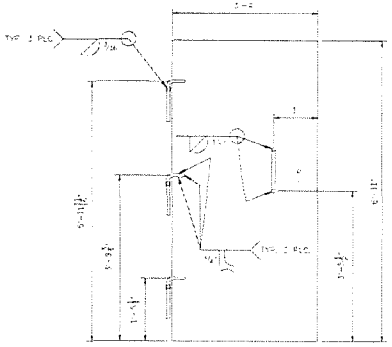
MK.	DESCRIPTION	DES'R	DATE	BY	CK



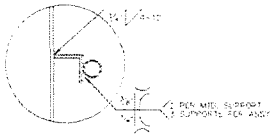
TYPICAL INTERMEDIATE SUPPORT ELEVATION



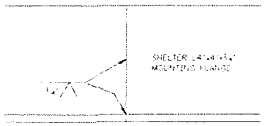
TYP. DOOR ASSY - INTERIOR VIEW



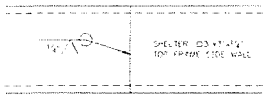
TYP. DOOR ASSY - EXTERIOR VIEW



SECTION C-C'



SHELTER MOUNTING FLANGE WELD DETAIL



SHELTER TOP FRAME WELD DETAIL

NASHUA REGISTERED PROFESSIONAL ENGINEER NO. 13307 PROFESSIONAL

4/1/23

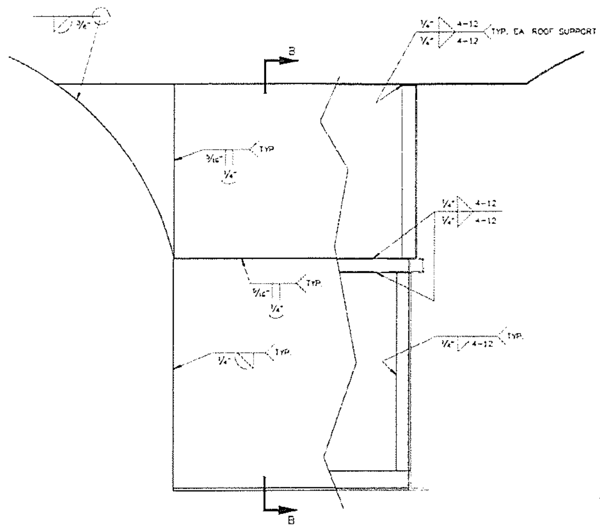
UNLESS OTHERWISE SPECIFIED

SAFE-T-SHELTER©
SAFE ROOMS & STORM SHELTERS

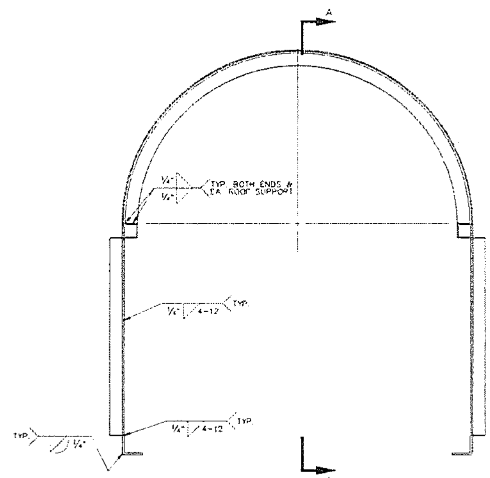
MATERIAL	SCALE: AS NOTED	DRAWN BY:
SURFACE COAT		APPROVED BY:

TITLE: TYPICAL INTERMEDIATE SECTION, DOOR ELEVATIONS AND WELD DETAILS - SHOP DRAWING

DATE	SIZE	DRAWING NUMBER	REV
04/01/23		STS3-1048 Page 7	1



CROSS-OVER ELEVATION/SECTION A-A
SCALE: 1" = 1'-0"



CROSS-OVER ELEVATION/SECTION B-B
SCALE: 1" = 1'-0"

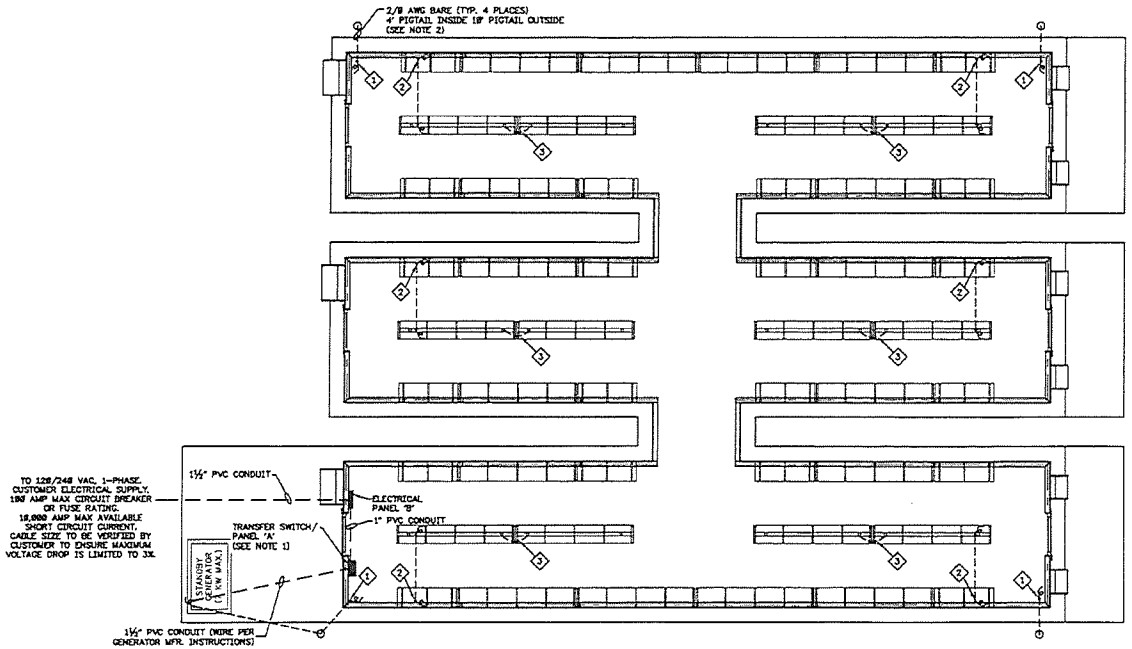
NOTE
CROSSOVER IS MANUFACTURED BY SAFE-T-SHELTER AT MANUFACTURING FACILITY. CROSSOVER TO BE SET, INSTALLED AND WELDED BY SAFE-T-SHELTER.

ALABAMA REGISTERED NO. 17307 PROFESSIONAL ENGINEER DONALD B. HEACOCK, JR.
4/1/23

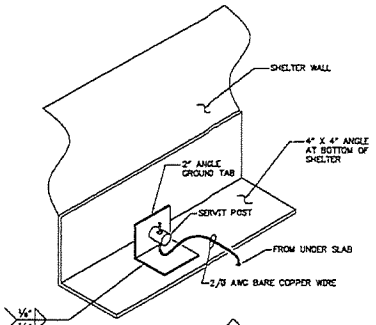
SAFE-T-SHELTER©
SAFE ROOMS & STORM SHELTERS

SCALE	1"=1'-0"
TITLE	CROSS-OVER ASSEMBLY SHOP DRAWING
DATE	04/01/23
DRAWING NUMBER	STS3-1048 Page 8
REV	1

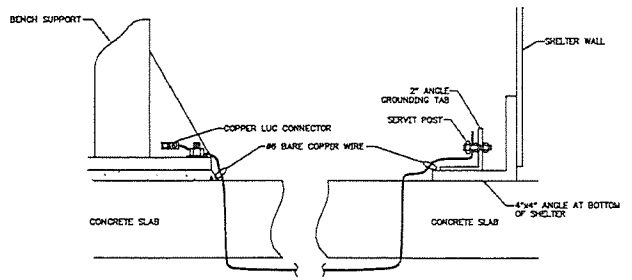
UNLESS OTHERWISE SPECIFIED



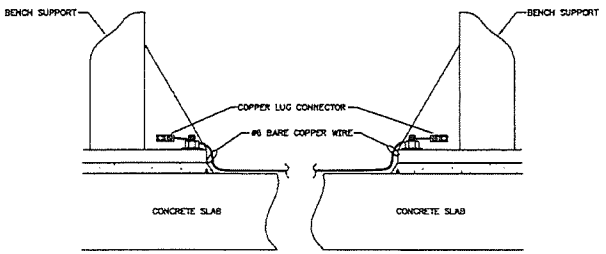
SHELTER POWER AND GROUNDING PLAN



DETAIL 1
GROUND BAR INSTALLATION
(THIS DWG.)



DETAIL 2
BENCH GROUND DETAIL
(THIS DWG.)



DETAIL 3
BENCH GROUND DETAIL
(THIS DWG.)

NOTES:

1. TRANSFER SWITCH/PANEL 'A' TO BE INSTALLED AFTER SHELTER IS SET IN PLACE.
2. GROUNDING SYSTEM TO BE COMPLETED AFTER SHELTER IS SET IN PLACE.

LEGEND

- BELOW GRADE
- ◇ DETAIL NUMBER (SEE THIS DWG.)
- ⊙ GROUND ROD, ⅝" x 8' COPPER CLAD

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY 3/10/17

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353 - 1072

HCS JOB NUMBER: 14100001

REV.	DESCRIPTION	C.C.S. #	DATE	BY	CK
0	ORIGINAL ISSUE (DRS/JFC)		05/18/15	HCS	
1	UPDATE NOTES AND GROUNDING ARRANGEMENT		1/23/16	HCS	
2	GENERAL REVISIONS		3/10/17	HCS	

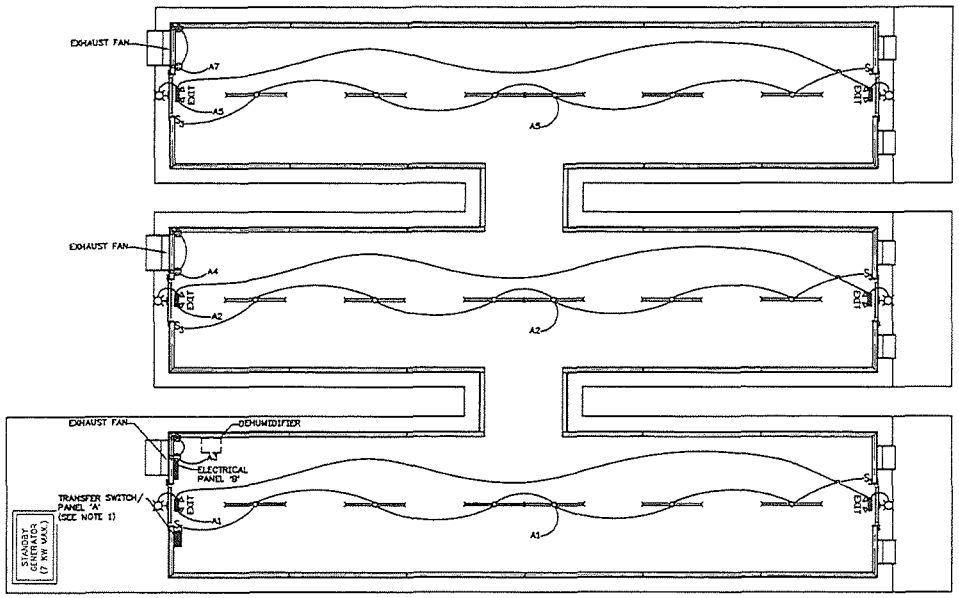
SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

PROJECT

MATERIAL | SCALE: 1/4"=1'-0" | DRAWN BY: D. STOVER | APPROVED BY | SURFACE CUST

TITLE: TRIPLE 10x48 SHELTER UNIT
ELECTRICAL POWER & GROUNDING PLAN & DETAILS

DATE	SIZE	DRAWING NUMBER	REV
06/10/15	D	D-31048-E1	2



SHELTER LIGHTING AND RECEPTACLE PLAN

LEGEND

- 4' FLUORESCENT STRIP LIGHT W/ WIRE GUARD
- EXIT SIGN W/ LIGHTS
- OUTDOOR, WALL MTD. LIGHT
- S_3 THREE-WAY SWITCH
- XX HOME RUN CONDUIT (CIRCUIT NUMBER)
- DUPLEX RECEPTACLE

NOTES:

1. TRANSFER SWITCH/PANEL 'A' TO BE INSTALLED AFTER SHELTER IS SET IN PLACE.

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY 3/16/17

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353-1072

HCS JOB NUMBER: 14100001

NO.	DESCRIPTION	ECO #	DATE	BY	CK
0	ORIGINAL ISSUE (DRS/JFC)		06/10/15	HCS	
1	CHANGE CIRCUIT ASSIGNMENTS		1/22/16	HCS	
2	GENERAL REVISIONS		3/16/17	HCS	

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

PROJECT

MATERIAL | SCALE: 1/4"=1'-0" | DRAWN BY: D. STOVER

CHECKED BY

TITLE: TRIPLE 10x48 SHELTER UNIT
ELECTRICAL LIGHTING & RECEPTACLE PLAN

DATE: 06/10/15 | SIZE: D | DRAWING NUMBER: D-31048-E2 | REV: 2

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	NO.	AMPS
LIGHTS (EXIT, INSIDE & OUTSIDE) (UNIT #1)	400		1	15
RECEPTACLE (FAN & HUMIDIFIER) (UNIT #1)		1100	3	20
LIGHTS (EXIT, INSIDE & OUTSIDE) (UNIT #3)	400		5	15
RECEPTACLE (FAN & HUMIDIFIER) (UNIT #3)		1100	7	30
SPARE			9	30
SUB TOTAL WATTS:	800	2200		N

	AMPS	NO.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
	20	2	1100		RECEPTACLE (FAN & DEHUMIDIFIER) (UNIT #2)
	15	4		400	LIGHTS (EXIT, INSIDE, OUTSIDE) (UNIT #2)
	15	6			SPARE
	20	8			SPARE
	20	10			SPARE
			1100	400	SUB TOTAL WATTS

240/120V 1-PH 3-WIRE	TOTAL WATTS, L1 1000
MAIN LUG ONLY	TOTAL WATTS, L2 2600
CIRCUIT INTERRUPTING CAPACITY: 10,000 SYM-AMPS	TOTAL WATTS 4600

PANEL 'A'
ATS PANEL

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	NO.	AMPS
MAIN BREAKER - BACK FED			1	100
			3	100
FUTURE			5	-
FUTURE			7	-
FUTURE			9	-
FUTURE			11	-
SUB TOTAL WATTS:	-	-		N

	AMPS	NO.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
	40	2	1025		ATS NORMAL POWER
	40	4		2500	
	-	6			FUTURE
	-	8			FUTURE
	-	10			FUTURE
	-	12			FUTURE
			1000	2500	SUB TOTAL WATTS

240/120V 1-PH 3-WIRE	TOTAL WATTS, L1 1000
100A THERMAL-MAGNETIC MAIN BREAKER	TOTAL WATTS, L2 2500
CIRCUIT INTERRUPTING CAPACITY: 10,000 SYM-AMPS	TOTAL WATTS 4500

PANEL 'B'
NORMAL SOURCE PD PANEL

8KW GENERATOR
RATED 7KW NAT. GAS
1.0 P.F. (7KVA), 240/120V

35A
#6 (BLK)
#6 (BLK)
#8 (WHT)
#6 (GRN)
NEUT. BUS
GND BUS
BOND TO FRAME
#2/0 BARE TO GND WELL
UTIL SENSE - N1 - #18 (YEL)
UTIL SENSE - N2 - #18 (YEL)
LOAD SENSE - T1 - #18 (WHT)
COMMON ALARM - 209
COMMON ALARM - 216
DC COMMON - 9
+12VDC - 194
CONTROL TRANSFER - 23
6-#18 (CONTROLS)
#18 (BLK)
#18 (RED)
#18 (WHT)
1-1/2" PVC (CN-2)

PANEL 'A'
50A AUTOMATIC TRANSFER SWITCH
(INSIDE SHELTER)

UTIL SENSE - F1 - N1 - #18 (YEL)
UTIL SENSE - F2 - N2 - #18 (YEL)
LOAD SENSE - F3 - T1 - #18 (WHT)
FUSES
6-#18 (BLK)
+12VDC - TR1-8 - 194 - #18 (RED)
CONTROL XFER - TR1-7 - 23 - #18 (WHT)
TIMER RELAY
E1 #6 (BLK)
N1 TO ATS CB'S
E2 #6 (BLK)
N2 TO ATS CB'S
NEUT. BUS #6 (WHT)
GND BUS #6 (GRN)
#6 (GRN)
BOND TO FRAME
#2/0 BARE TO GND WELL

CUSTOMER ELECTRICAL SUPPLY
10,000 AMP MAX AVAILABLE
SHORT CIRCUIT CURRENT

100A
1-1/2" PVC (CN-1)
#2 (BLK)
#2 (BLK)
#2 (WHT)
#6 (GRN)
NEUT. BUS
GND BUS

PANEL 'B'
(INSIDE SHELTER)

MAIN 100A
FEEDER BRKR 40A
1" PVC (CN-3)
#6 (BLK)
#6 (BLK)
#6 (WHT)
#6 (GRN)
#6 (GRN)
NEUTRAL & GND BUS TO BE ISOLATED, REMOVE FACTORY BONDING JUMPER
CONNECT GROUND WIRE TO GROUND LUG ON ENCLOSURE. FASTEN ENCLOSURE TO SHELTER FRAME THROUGH GROUND LUG WITH ¼" X 14 SELF TAPPING SCREW.

WIRING DIAGRAM

TORNADO SHELTER
(UNIT #1)
PANEL 'A'
TRANSFER SWITCH / DISTRIBUTION PANEL
PANEL 'B'
BREAKER PANEL/ SERVICE DISCONNECT
STANDBY GENERATOR
TO 120/240 VAC, 1-PHASE CUSTOMER ELECTRICAL SUPPLY. 100 AMP MAX CIRCUIT BREAKER OR FUSE RATING. 10,000 AMP MAX AVAILABLE SHORT CIRCUIT CURRENT. CABLE SIZE TO BE VERIFIED BY CUSTOMER TO ENSURE MAXIMUM VOLTAGE DROP IS LIMITED TO 3%
P2, C1 (CN2)
P3 (CN3)
P1 (CN1)

RISER DIAGRAM

ALABAMA LICENSED
No. 22480
PROFESSIONAL ENGINEER
JOHN F. CONWAY
3/16/17

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353-1972
HCS JOB NUMBER: 14100001

NO.	DESCRIPTION	ECN #	DATE	BY	CK.
0	ORIGINAL ISSUE (DRS/JFC)		05/18/15	HCS	
1	REVISE NOTES, GROUNDING DETAILS AND CIRCUIT ASSIGNMENTS		1/22/16	HCS	
2	GENERAL REVISIONS		3/16/17	HCS	

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

MATERIAL	SCALE	DRAWN BY
	NONE	D. STOVER

TRIPLE 10x48 SHELTER UNIT
ELECTRICAL RISER AND WIRING DIAGRAMS

DATE	SIZE	DRAWING NUMBER	REV
06/10/15	D	D-31048-E3	2

CONDUIT SCHEDULE						
CONDUIT NO.	CONDUIT SIZE	CONDUCTORS	FUNCTION	FROM	TO	CIRCUITS
CN1	1-1/2" SCH 40 PVC	3-#2 w/#6 GND	100 AMP BUILDING FEEDER (BY CUSTOMER)	PNL (BY CUSTOMER)	PANEL 'B'	P1
CN2	1-1/2" SCH 40 PVC	3-#6 w/#6 GND, 6-#18 VENDOR CONTROL CABLE	AUTOMATIC TRANSFER SWITCH (ATS) EMERGENCY SOURCE	GENERATOR	ATS/PANEL 'A'	P2, C1
CN3	1" SCH. 40 PVC	3-#6 w/GND.	AUTOMATIC TRANSFER SWITCH (ATS) NORMAL SOURCE	PANEL 'B'	ATS/PANEL 'A'	P3

CIRCUIT SCHEDULE					
CIRCUIT	WIRE SIZE DATA	DESCRIPTION	FROM	TO	REMARKS/ROUTING
P1	3-#2 w/ #6 GND	100 AMP BUILDING SUPPLY	PNL (BY CUSTOMER)	PANEL 'B'	CN-1, 1 1/2" PVC TO NEW STORM SHELTER
P2	3-#6 w/ #6 GND	AUTOMATIC TRANSFER SWITCH (ATS) EMERGENCY SOURCE	GENERATOR	ATS/PANEL 'A'	CN-2, 1 1/2" PVC, GENERATOR TO ATS
P3	3-#6 w/ #6 GND	AUTOMATIC TRANSFER SWITCH (ATS) NORMAL SOURCE	PANEL 'B'	ATS/PANEL 'A'	CN-3, 1" PVC
C1	6-#18 VENDOR CONTROL CABLE	GENERATOR/ATS CONTROL CABLE AND UTIL SENSE	GENERATOR	ATS/PANEL 'A'	CN-2, 1 1/2" PVC, GENERATOR TO ATS

EQUIPMENT SCHEDULE	
1	STANDBY GENERATOR, 8KW 120/240V, 1-PHASE, NATURAL GAS OR LP OPERATION, WEATHER PROTECTIVE HOUSING, LCD DISPLAY CONTROL PANEL, 35 AMP MAIN CIRCUIT BREAKER, INCLUDES 50 AMP PRE-WIRED AUTOMATIC TRANSFER SWITCH/BREAKER PANEL. GENERAC MODEL #006237-0 (8 KW).
2	AUTOMATIC TRANSFER SWITCH (INCLUDED WITH ITEM 1). 50 AMP, 120/240V, WEEKLY EXERCISER TIMER, NEMA 1 ENCLOSURE, BREAKERS TO BE RATED AT 10,000 AIC. SEE PANEL SCHEDULE FOR BRANCH CIRCUIT BREAKER REQUIREMENTS.
3	LOAD CENTER, 100 AMP, 120/240V, 12-POSITION, 1- PHASE, 3-WIRE, NEMA TYPE 1 PANEL BOARD, FACTORY INSTALLED GROUND BUS, APPROVED FOR SERVICE ENTRANCE WHEN WIRED PER NEC. BREAKERS TO BE RATED AT 10,000 AIC, INCLUDES 100 AMP 2-POLE MAIN BREAKER, 1-40 AMP 2-POLE BRANCH CIRCUIT BREAKER, SPARE SPACES TO REMAIN COVERED. GE MODEL # TM1210CCUGUK WITH THQL BREAKERS OR EQUAL. PANEL DOOR TO BE PERMANENTLY LABELED "SERVICE DISCONNECT". SEE PANEL SCHEDULE FOR BRANCH CIRCUIT BREAKER REQUIREMENTS.
4	LIGHT FIXTURE. FLOURESCENT LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) MODEL # 5232 OR EQUAL.
5	OUTSIDE LIGHT, 120V, 13 WATT CFL LAMP. DUSK TO DAWN AUTOMATIC LIGHT CONTROL. RATED FOR OUTDOOR USE. UTILITECH MODEL CU8813-DZ-1 OR EQUAL.
6	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING MODEL # APC7R OR EQUAL
7	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
8	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL.
9	VENTILATION FAN, 24", 115 VOLT, 1-PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, CFM @ 0.05"SP (HI/LOW): 5606/3475, CFM @ 0.05"SP (HI): 5568, RPM(HI/LOW): 1200/900, INCLUDES CHROME INLET GUARD AND OUTLET SHUTTERS, 9' SWITCHED CORD AND PLUG. USE J & D MANUFACTURING PART NO. VPE24C OR EQUAL.

GENERAL NOTES.

WIRE AND CABLE:

1. WIRE AND CABLE TYPES:

   INSULATED WIRE: 600 VOLT, SINGLE CONDUCTOR, 75°C MIN. INSULATION RATING, POWER CABLE. NEC TYPE THHN/THWN. CONDUCTOR: CLASS B COPPER. INSULATION: POLYVINYL CHLORIDE "PVC". CONDUCTOR JACKET: NYLON.

   BARE WIRE: CLASS B COMPRESSED CONCENTRIC-LAY-STRANDED, SOFT DRAWN, COPPER CONDUCTORS.

2. CONNECTORS: ALL CONNECTORS SHALL BE DESIGNED AND SIZED FOR SPECIFIC CABLE BEING CONNECTED AND SHALL BE SOLDERLESS, PRESSURE-TYPE CONNECTORS CONSTRUCTED OF NON-CORRODIBLE TIN-PLATED COPPER. THE RATED CURRENT-CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING CONNECTED.

   POWER CONNECTORS (18 AWG AND SMALLER): "SCOTCHLOK" PRE-INSULATED SPRING WIRE CONNECTORS. BUCHANAN OPEN-END COPPER SPLICING CAPS, APPLIED WITH COMPATIBLE TOOL, WITH NYLON SNAP-ON INSULATORS.

   POWER CONNECTORS (SIZES 8-4 AWG): NON-INSULATED RING-TONGUE TYPE. RING TONGUE SIZED TO MATCH TERMINAL STUD SIZE. BRAZED BARREL SEAM. APPLICATION TOOLING DESIGNED TO CRIMP THE WIRE BARREL (CONDUCTOR GRIP) WITH A ONE-STEP CRIMP.

   POWER CONNECTORS (SIZES 2 AWG - 750 MCM): NON-INSULATED ONE-HOLE RECTANGULAR TONGUE FOR SIZES 2 AWG THROUGH 3/0 AWG AND TWO-HOLE RECTANGULAR TONGUE FOR 4/0 AWG THROUGH 750 MCM.

   CONTROL, INSTRUMENT, AND SPECIALTY CABLE CONNECTORS: TIN-PLATED COPPER. VINYL OR NYLON PRE-INSULATED RING-TONGUE TYPE PREFERRED. FLAT SPADE LUGS WILL NOT BE PERMITTED. VINYL PRE-INSULATED SPRING-TYPE SPADE TERMINALS: HOLLINGSWORTH "MINI SPRING SPADES"; THOMAS AND BETTS "LOCKING-FORK"; PANDUIT "LOCKING-FORK" SIZED TO MATCH TERMINAL STUD SIZE ARE ACCEPTABLE.

   GROUNDING CONNECTIONS: ALL GROUNDING SURFACES SHALL BE CLEANED TO OBTAIN "BRIGHT" METAL AT ALL POINTS OF CONTACT.

3. CABLE TIES: CABLE TIES SHALL BE NYLON SELF-LOCKING TYPE, HAVE A NORMAL SERVICE TEMPERATURE RANGE OF -40°C TO 85C, BE WEATHER-RESISTANT TYPE FOR OUTDOOR. USE AMP SPECIAL INDUSTRIES "AMP-TY," DENNISON MANUFACTURING COMPANY "BAR-LOK," PANDUIT CORPORATION "PAN-TY," THOMAS & BETTS "TY-RAP," OR MINNESOTA MINING AND 3M BRAND CABLE TIES.

4. TERMINAL BLOCKS:

   MOUNTING IN TERMINAL BOXES: BLOCKS TO BE DESIGNED AND SIZED FOR THE CABLES BEING TERMINATED AND RATED 600V. PROVIDE BINDING SCREW-TYPE TERMINALS FOR POWER CABLES AND STRAP SCREW OR TUBULAR CLAMP TERMINALS FOR CONTROL AND INSTRUMENT CABLES. THE RATED CURRENT CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING TERMINATED.

   MOUNTING IN CABINETS, PANELS, CONTROL BOARDS, ETC.: BLOCKS TO BE DESIGNED AND SIZED FOR THE CABLES BEING TERMINATED AND RATED 600V. PROVIDE BINDING SCREW TYPE TERMINALS FOR POWER CABLES. THE RATED CURRENT CARRYING CAPACITY SHALL BE EQUAL TO OR GREATER THAN THE CABLE BEING TERMINATED. PROVIDE MARKING STRIP OR BLOCKS FOR POWER CABLES AND CONTROL CABLES.

5. WIRE AND CABLE INSTALLATION: DO NOT SUBJECT CABLE TO PULLING TENSIONS OR SIDEWALL PRESSURES IN EXCESS OF MANUFACTURER'S RECOMMENDATIONS. ATTACH PULLING GRIPS OVER THE CABLE SHEATH TO PREVENT SLIPPING OF THE INSULATION. DO NOT SUBJECT CABLE TO BENDING RADIUS LESS THAN THOSE RECOMMENDED BY THE CABLE MANUFACTURER OR (WHICHEVER IS GREATER) EIGHT TIMES THE CABLE OUTSIDE DIAMETER DURING OR AFTER INSTALLATION. INSTALL INTERMEDIATE SPLICES ONLY AS INDICATED OR AS APPROVED BY OWNER OR OWNER REPRESENTATIVE. SUPPORT CABLES AT CONNECTIONS OR TERMINATION POINTS SUCH THAT ANY STRAIN ON CABLE WILL NOT BE TRANSMITTED TO THE CONNECTION OR TERMINATION. INSTALL CABLE SUPPORTS IN VERTICAL RUNS OF CONDUIT AT BOXES AND AT TERMINATIONS IN EQUIPMENT, AND AS REQUIRED TO MEET INTERMEDIATE SUPPORT REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC). ALL PULLING COMPOUNDS SHALL BE APPROVED BY WIRE AND CABLE MANUFACTURER AS BEING COMPATIBLE WITH CABLE MATERIALS. ATTACH A CABLE IDENTIFICATION TAG TO EACH CABLE AT ALL TERMINATION OR END POINTS.

6. POWER, CONTROL, INSTRUMENT AND SPECIALTY CABLE: INSTALL METALLIC BARRIER IN ALL BOXES TO SEPARATE POWER AND CONTROL FROM LOW-LEVEL SIGNAL (50V OR LESS) INSTRUMENTATION CIRCUITS WHERE RUN IN THE SAME BOX.

   TERMINATE AND GROUND, CONTROL, INSTRUMENT, AND SPECIALTY CABLE SHIELDS AS INDICATED AND RECOMMENDED BY THE MANUFACTURER OF THE EQUIPMENT BEING CONNECTED. IN GENERAL, GROUND THE SHIELDS AT THE CONTROL BOARDS FOR CONTROL CABLES AND AT THE RECEIVING END EQUIPMENT FOR INSTRUMENTATION AND SPECIALTY CABLES.

CONDUIT

GENERAL NOTES:

1. RIGID STEEL CONDUIT: THE CONDUIT SHALL CONFORM TO ANSI C80.1 AND SHALL BE MILD DUCTILE STEEL, CIRCULAR IN CROSS SECTION WITH UNIFORM WALL THICKNESS SUFFICIENTLY ACCURATE TO CUT CLEAN THREADS. EACH LENGTH SHALL BE THREADED ON BOTH ENDS WITH THREADS PROTECTED. ALL SCALE, GREASE, DIRT, BURRS AND OTHER FOREIGN MATTER SHALL BE REMOVED FROM INSIDE AND OUTSIDE PRIOR TO APPLICATION OF COATING MATERIALS. THE CONDUIT SHALL BE GALVANIZED BY THE HOT-DIP PROCESS AS FOLLOWS: INTERIOR AND EXTERIOR SURFACES COATED WITH A SOLID-UNBROKEN LAYER OF 99% VIRGIN ZINC BY DIPPING. COATING SHALL NOT SHOW FIXED DEPOSITS OF COPPER AFTER FOUR 1-MINUTE IMMERSIONS IN A STANDARD COPPER SULFATE SOLUTION. ONE COAT OF ZINC CHROMATE FINISH ON INSIDE AND OUTSIDE SURFACES TO PREVENT OXIDATION AND WHITE RUST. THE COUPLINGS AND ELBOWS SHALL BE FABRICATED, COATED AND FINISHED BY THE SAME PROCESS AS CONDUIT.

2. RIGID POLYVINYL CHLORIDE (PVC) CONDUIT. THE CONDUIT SHALL BE FABRICATED FROM SELF-EXTINGUISHING HIGH IMPACT POLYVINYL CHLORIDE DESIGNED FOR ABOVEGROUND AND UNDERGROUND INSTALLATIONS. USE TYPE CPC SCHEDULE 40 HEAVY-WALL RIGID CONDUIT. FITTINGS AND ACCESSORIES SHALL BE FABRICATED FROM SAME MATERIAL AS CONDUIT. PROVIDE SOLVENT-CEMENT-TYPE JOINTS AS RECOMMENDED BY MANUFACTURER.

3. RIGID STEEL CONDUIT FITTINGS: HEAVY-DUTY CAST MALLEABLE IRON FITTINGS: MOGUL TYPE FOR CONDUIT SIZES 1-1/2 INCHES AND LARGER. LBD OR ROLLER ACTION TYPE LB FOR RIGHT ANGLE FITTINGS FOR CONDUIT SIZES 2 INCHES AND LARGER. FULL-THREADED HUBS AND RUBBER-GASKETED COVERS. PROVIDE ZINC, CADMIUM-PLATED OR BRONZE HARDWARE BOLTS AND SCREWS FOR ASSEMBLY. FINISH WITH CADMIUM-PLATED OR GALVANIZING.

4. INDOOR AND OUTDOOR BOXES: PROVIDE FS OR FS TYPE JUNCTION BOXES WITH CADMIUM ZINC ELECTROPLATE AND HOT-DIP GALVANIZED FINISH. COVER SHALL BE FASTENED WITH CADMIUM-PLATED BOLTS. PROVIDE THREADED CONDUIT ENTRANCE HUBS ON ALL BOXES. PROVIDE RUBBER OR NEOPRENE GASKET FOR COVER AND HUBS (NEMA TYPE 4 ENCLOSURE). CONFORM TO NEMA TYPE 4 ENCLOSURE. PROVIDE FOR THE ISOLATION OF POWER CIRCUITS FROM OTHER TYPE CIRCUITS.

5. ELECTRICAL BOXES (LESS THAN 100 CU. IN.): METALLIC OUTLET BOXES SHALL CONFORM TO ANSI/UL514A.

6. ELECTRICAL SPLICE BOXES (GREATER THAN 100 CU. IN.): METALLIC SPLICE BOXES SHALL CONFORM TO UL50, TYPE 1.

7. SUPPORT SYSTEM: FABRICATED FROM MANUFACTURED FRAMING MEMBERS EQUAL TO "UNISTRUT" P-3000 SERIES AS MANUFACTURED BY UNISTRUT CORPORATION. CONSTRUCT AS REQUIRED TO RIGIDLY SUPPORT ALL CONDUIT RUNS AND BOXES. PROVIDE CONDUIT CLAMPS, SIZED FOR THE SPECIFIC CONDUIT SIZE, TO SUPPORT ALL EXPOSED METALLIC CONDUIT. PROVIDE NON-MAGNETIC CLAMPS TO SUPPORT NON-METALLIC CONDUITS. PROVIDE STEEL RODS, ANCHORS, INSERTS, BOLTS, WASHER, NUTS AND ALL OTHER SUPPORT HARDWARE.

8. INSTALLATION: PROVIDE SUITABLE PROTECTION FOR CONDUIT RISERS AGAINST DAMAGE DURING CONSTRUCTION. CAP ENDS OF ALL CONDUITS BEFORE CONCRETE IS POURED. CAP ALL CONDUITS AFTER CLEANING WHERE CONDUITS ARE TO BE LEFT EMPTY BY THIS CONTRACT. CAREFULLY REAM ENDS OF ALL CONDUIT LENGTHS AFTER CUTTING TO ELIMINATE SHARP BURRS. CLEAN OUT ALL CONDUIT BEFORE PULLING WIRE. CLEAN OUT ALL CONDUITS IMMEDIATELY AFTER CONCRETE WORK IS FINISHED. SHIFT LOCATIONS AS REQUIRED TO AVOID INTERFERENCE WITH OTHER EQUIPMENT AND PIPING BEING INSTALLED.

9. HOLES AND SLEEVES: PROVIDES THROUGH FLOORS, WALLS AND ROOFS AS NECESSARY FOR CONDUIT RUNS, INCLUDING APPROVED FLASHING AND WEATHER PROOFING AT OUTSIDE WALLS AND ON ROOFS. INSTALL SLEEVES OR FORMS FOR ALL OPENINGS IN NEW WORK. PROVIDE THE REQUIRED INSERTS AND HOLES, COMPLETELY SLEEVED, BONDED, CURBED, FLASHED AND FINISHED OFF IN AN APPROVED MANNER, WHETHER IN CONCRETE, STEEL GRATING, METAL PANELS OR ROOFS. MAKE CONNECTIONS TO BOXES, PANELS, AND OTHER EQUIPMENT AS FOLLOWS: MYERS SCREW-TIGHT HUBS OR EQUIVALENT THREADED HUBS FOR ALL OUTDOOR CONDUIT ENTRANCES. ENTER FROM BOTTOM OF ENCLOSURE OR EQUIPMENT UNLESS PHYSICALLY NOT POSSIBLE. RUNNING THREADS WILL NOT BE PERMITTED. COAT ALL FIELD CUT THREADS IN GALVANIZED CONDUIT WITH COLD GALVANIZE PAINT. COMPLY WITH APPLICABLE REQUIREMENTS OF NEC PERTAINING TO INSTALLATION OF CONDUIT SYSTEMS. PLACE DRAINAGE FITTINGS OR WEEP HOLES AT UNAVOIDABLE LOW POINTS WHERE MOISTURE CAN COLLECT. INSTALL AN ENTIRE CONDUIT SYSTEM THAT IS ELECTRICALLY CONTINUOUS WITH BONDING JUMPERS PROVIDED AS NECESSARY TO CONFORM TO NEC. ALL CONDUIT RUNS SHALL HAVE A METAL TAG ATTACHED ON EACH END 12 INCHES OR LESS FROM THE END WITH AN IDENTIFICATION NUMBER. ALL SPARE CONDUITS SHALL HAVE A 200-POUND NYLON PULL ROPE INSTALLED INSIDE AND BE CAPPED FOR FUTURE USE.

10. EXPOSED CONDUIT INSTALLATION: INSTALL HORIZONTAL RUNS AS HIGH ABOVE FLOOR AS POSSIBLE, AND IN NO CASE LOWER THAN 7 FEET ABOVE FLOOR, WALKWAY, OR PLATFORM IN PASSAGE AREA. RUN CONDUIT PARALLEL OR PERPENDICULAR TO WALLS, CEILING, BEAMS AND COLUMNS UNLESS INDICATED OTHERWISE. ROUTE TO CLEAR ALL DOORS, WINDOWS, ACCESS WELLS, AND OPENINGS. GROUP PARALLEL RUNS IN NEATLY ALIGNED BANKS WHERE POSSIBLE WITH MINIMUM OF 1-INCH CLEARANCE BETWEEN CONDUITS. MAINTAIN 6-INCH CLEARANCE BETWEEN CONDUIT AND COVERINGS ON LINES: STEAM, HOT WATER, ETC. DO NOT EXCEED A DISTANCE OF 8 FEET BETWEEN SUPPORTS ON HORIZONTAL OR VERTICAL RUNS.

11. CONCEALED CONDUIT INSTALLATION: CONCEAL CONDUIT FOR LIGHTING, CONVENIENCE OUTLETS, AND OTHER CIRCUITS IN WALLS, CEILING AND FLOORS WHERE POSSIBLE. CONCEALED CONDUIT SHALL BE RIGID STEEL IF NOT EMBEDDED IN CONCRETE AND PVC SCHEDULE 40 IF EMBEDDED IN CONCRETE. DO NOT INSTALL CONDUIT IN CONCRETE WHERE CONDUIT OUTSIDE DIAMETER EXCEEDS ONE-THIRD OF CONCRETE THICKNESS. USE EXPANSION AND DEFLECTION FITTING WITH BONDING JUMPERS AT ALL CONCRETE EXPANSION JOINTS. TIE SECURELY IN PLACE TO PREVENT MOVEMENT WHEN CONCRETE IS POURED. INSTALL IN FLOOR SLABS IN AS STRAIGHT A RUN AS POSSIBLE. CONDUIT CROSSOVERS ARE NOT PERMITTED UNLESS CONDUIT TOTAL OUTSIDE DIAMETER IS ONE-THIRD OF THE CONCRETE THICKNESS OR LESS. USE LONG RADIUS ELBOWS EXCEPT ON RISERS WHERE CURVED PORTION OF ELBOW WOULD EXTEND ABOVE THE FINISHED FLOOR OR FOUNDATION. PVC CONDUIT EMBEDDED IN CONCRETE SHALL TRANSITION TO RIGID GALVANIZED STEEL FOR ALL 90-DEGREE ELBOWS AND BEFORE TURNING EXPOSED. MAKE ALL JOINTS WATERTIGHT AFTER INSTALLATION BY COATING ALL FINISHED JOINTS WITH COAL TAR SOLUTION APPLIED AT 15 MILS MINIMUM DRY FILM.

10. BURIED CONDUIT INSTALLATION: USE SCH 40 PVC CONDUIT. INSTALL IN AS STRAIGHT A RUN AS POSSIBLE BETWEEN TERMINATION POINTS. BURY CONDUITS AS MINIMUM OF 30 INCHES BELOW FINISH GRADE UNLESS INDICATED OTHERWISE. SLOPE CONDUIT AWAY FROM CONDUIT RISERS WHERE POSSIBLE. MAINTAIN 6-INCH SEPARATION FROM UNDERGROUND PIPING. USE LONG RADIUS BENDS AT ALL RISERS UNLESS INDICATED OTHERWISE. AFTER TRENCH BOTTOM HAS BEEN FINISHED TO GRADE, LAY CONDUIT. CAP ENDS OF ALL CONDUIT RISERS BEFORE BACKFILLING. PROVIDE WATERTIGHT SEAL AROUND WIRES WHERE CONDUIT TERMINATES IN PULL BOX.

11. CONDUIT FITTINGS INSTALLATION: INSTALL SPECIAL BOXES AS INDICATED FOR SIZE REQUIRED FOR CONDUITS AND CABLES ENTERING AND LEAVING BOX. INSTALL WHERE REQUIRED FOR PULL OR JUNCTION BOXES AND FOR MOUNTING OR CONNECTING TO SWITCHES, OUTLETS, INTERMEDIATE TERMINAL BLOCKS OR CONTROL DEVICES. PROVIDE 1/4-INCH WEEP HOLES IN INTERIOR BOXES WHERE CONDUITS ENTER FROM EXTERIOR OR BURIED INSTALLATION. CONSTRUCT SUPPORTS WITH SUFFICIENT RIGIDITY TO HOLD ALL MOUNTED EQUIPMENT AND MATERIAL IN PERMANENT AND NEAT ALIGNMENT. DESIGN SUPPORTS TO PROVIDE 1/4-INCH SPACE BETWEEN EQUIPMENT HOUSINGS AND WALLS OR COLUMNS UPON WHICH THEY ARE MOUNTED. DO NOT EXCEED LOAD REQUIREMENTS IN NEC AND NEMA STANDARDS.

LABELING

1. SERVICE EQUIPMENT SHALL BE LABELED WITH A CONSPICUOUS AND PERMANENT LABEL INDICATING AVAILABLE FAULT CURRENT AND DATE CALCULATED. LABEL AND FAULT CURRENT VALUE TO BE PROVIDED BY CUSTOMER.
2. THE CUSTOMER SHALL PROVIDE AND INSTALL A LABEL ON THE PANELBOARD DOOR WITH THE LOCATION, DEVICE OR EQUIPMENT THAT SUPPLIES POWER TO THE PANELBOARD.
3. PANELBOARD AND TRANSFER SWITCH DOORS TO BE LABELED WITH ARC-FLASH WARNING LABEL, BRADY CAT. NO. 94913 OR EQUAL.

ALABAMA LICENSED NO. 22480 PROFESSIONAL ENGINEER JOHN F. CONWAY 2/17/2017

SAFE-T-SHELTER ®
SAFE ROOMS & STORM SHELTERS

HCS Engineering Company, Inc.
DECATUR, ALABAMA (256) 353-1972

HCS JOB NUMBER: 14100001

REV.	DESCRIPTION	C.O.#	DATE	BY	CK
0	ORIGINAL ISSUE (DRS/JFC)		12/18/14	HCS	
1	GENERAL REVISIONS (DRS/JFC)		5/21/15	HCS	
2	GENERAL REVISIONS (JFC)		2/22/17	HCS	

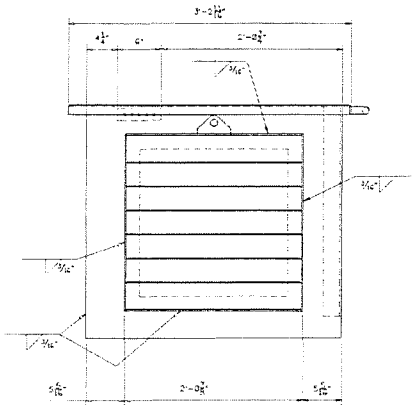
PROJECT

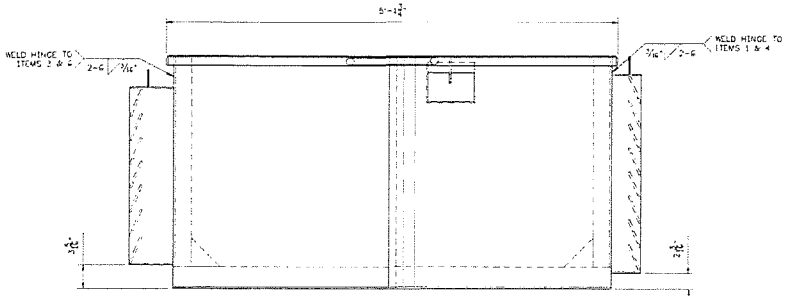
MATERIAL: NONE | SCALE: NONE | DRAWN BY: D. STOVER | APPROVED BY:

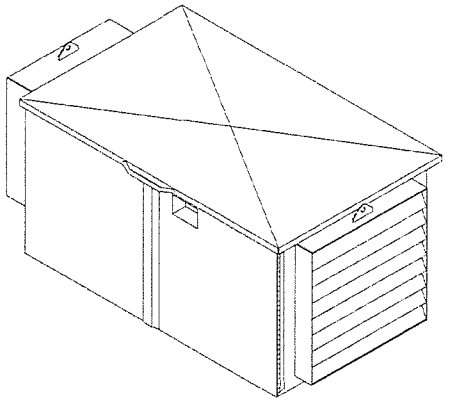
TITLE: ELECTRICAL NOTES AND SCHEDULES

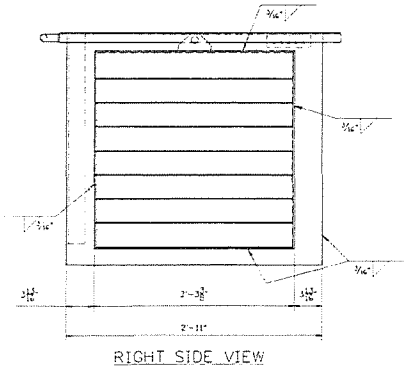
DATE: 12/10/14 | SIZE: D | DRAWING NUMBER: D-NON-ESPEC | REV: 2

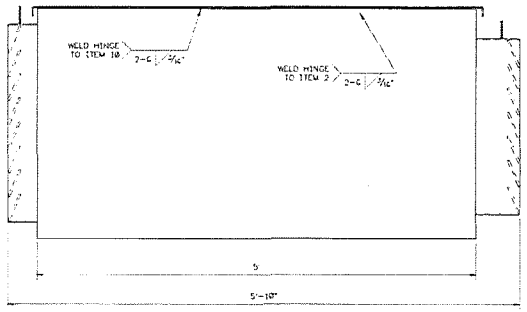
REV	DESCRIPTION	EXP. #	DATE	BY	CK











GENERATOR BOX ASSEMBLY

SCALE: 1½" = 1'-0"

ALABAMA REGISTERED NO 12307 PROFESSIONAL ENGINEER
4/1/23

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

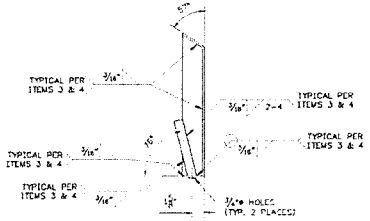
SCALE	1 1/2"=1'-0"
DRAWN BY	
APPROVED BY	

OPTION 1 - GENERATOR
SHOP DRAWING

UNLESS OTHERWISE SPECIFIED

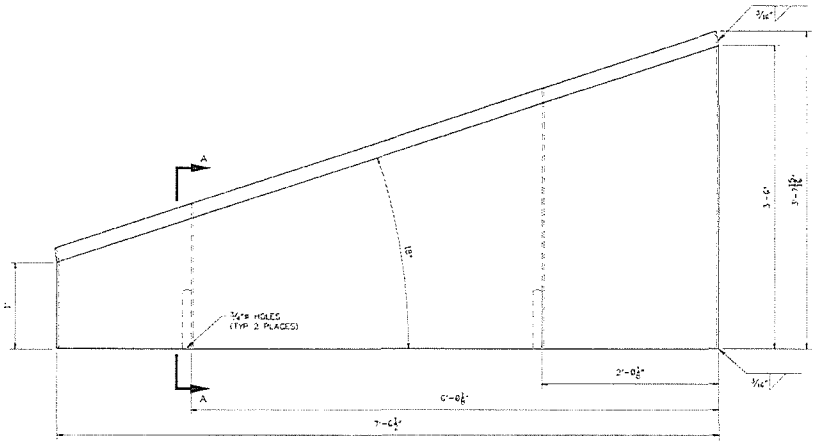
DATE	04/01/23
DRAWING NUMBER	STS3-1048 Page 13
SHT	1

KEY	DESCRIPTION	DRN #	DATE	BY	CK



SECTION A-A

SCALE: 1½" = 1'-0"



OPTION 2 – WING ASSEMBLY

SCALE: 1½" = 1'-0"

ALABAMA REGISTERED PROFESSIONAL ENGINEER

4/1/23

UNLESS OTHERWISE SPECIFIED

SAFE-T-SHELTER®
SAFE ROOMS & STORM SHELTERS

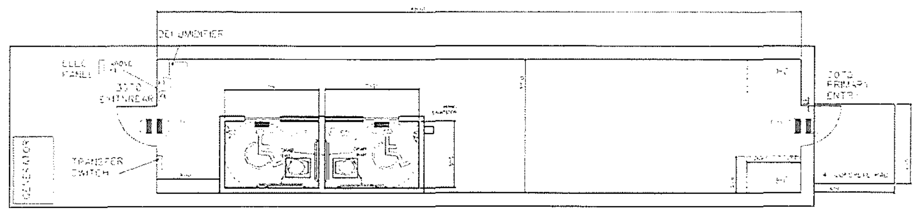
SCALE: 1 1/2"=1'-0"

OPTION 2 - WING WALL ASSEMBLY
SHOP DRAWING

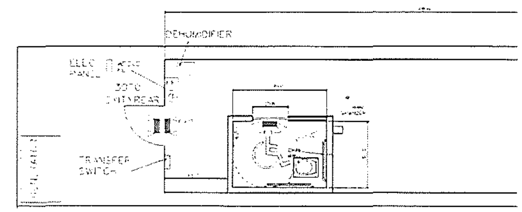
04/01/23

STS3-1048 Page 14

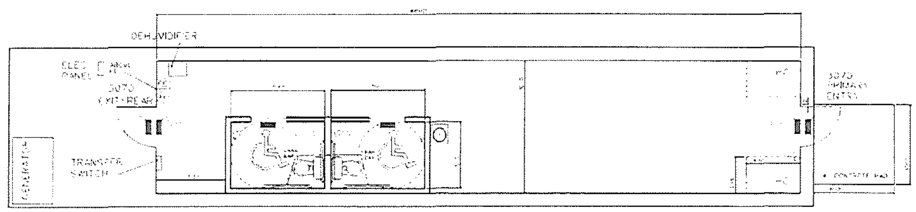
1



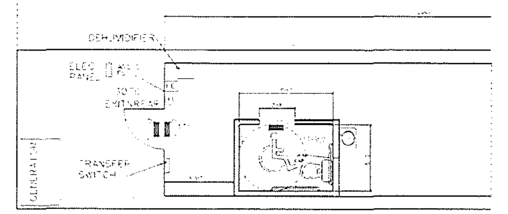
DOUBLE
CHEMICAL RESTROOM
FLOOR PLAN OPTION C



SINGLE
CHEMICAL RESTROOM
FLOOR PLAN OPTION C-1



DOUBLE
STANDARD RESTROOM
FLOOR PLAN OPTION B



SINGLE
STANDARD RESTROOM
FLOOR PLAN OPTION B-1

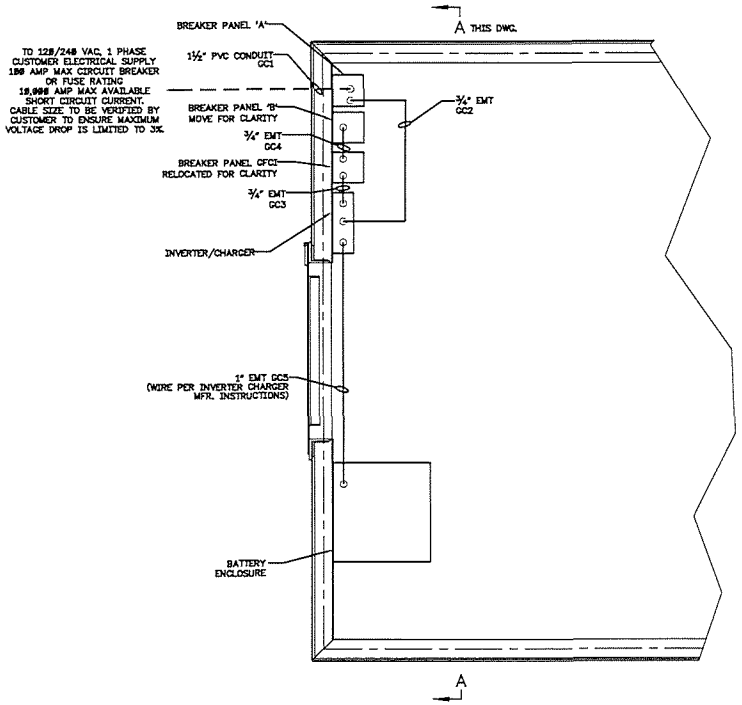
The construction for this safe room shall comply with the applicable provisions of FEMA Document 361 "Design and Construction Guidance for Community Shelters", March 2015 and ICC 500-2014.

SAFETY SHELTER

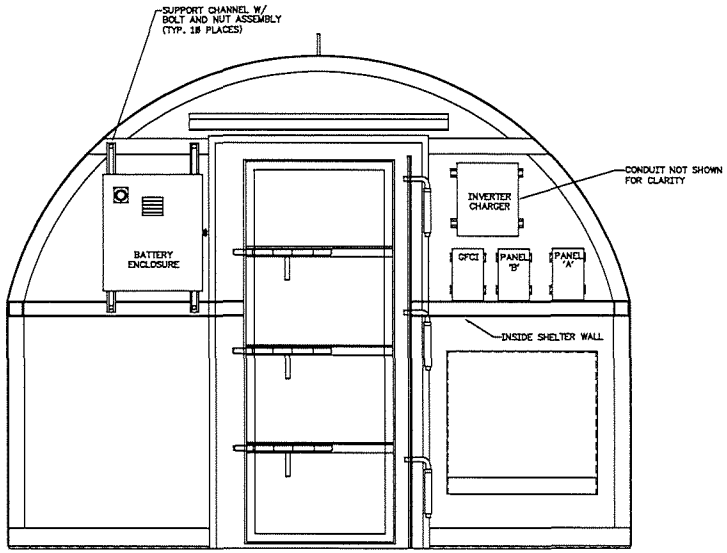
OPTIONAL RESTROOM CONFIGURATIONS

A-1

BILL OF MATERIAL	
ITEM	DESCRIPTION
1	LOAD CENTER, 100 AMP, 12-SPACE, 1- PHASE, 3-WIRE, NEMA TYPE 1 ENCLOSURE, FACTORY INSTALLED GROUND BUS, 100 AMP 2-POLE MAIN BREAKER, (1) 30 AMP 1-POLE AND (3) 20 AMP 1-POLE BRANCH CIRCUIT
	BREAKERS, SPACES TO REMAIN COVERED. GE M/N TM1210CCUG1K WITH THQL BREAKERS. PANEL DOOR TO BE PERMANENTLY LABELED "SERVICE DISCONNECT"
2	INVERTER/CHARGER, W/BUILT-IN TRANSFER SWITCH, OUTPUT RATING: 1000W(2000W SURGE), 120VAC, 8.4A, CHARGER RATING: 50A, TRANSFER SWITCH RATING: 30A, XANTREX M/N FREEDOM XC1000
3	BATTERY ENCLOSURE (ACCOMMODATES 2 BATTERIES), MATERIAL: ALUMINUM, DIMS: 22.625H X 19.25W X 19.625D, UL 508A, NEMA 3R, AMERESCO SOLAFR M/N BBA-2 OR EQUAL
4	BATTERY, 12.8V 100AH DEEP CYCLE, 1280 WATT-HOURS (WH), WEIGHT 29 LBS, 11.9" X 6.8" 8.6", EXPION360 M/N EX-G27-100C OR EQUAL
5	BATTERY SWITCH, CONTINUOUS CURRENT RATING: 275 A, VOLTAGE RATING: 48 V, SURFACE OR REAR PANEL MOUNT, VICTRON ENERGY M/N VBS127010010
6	FUSE BLOCK, 100A, CLASS T, 300V, BOX LUG CONNECTOR, 2/0–6 AWG WIRE RANGE, LITTELFUSE M/N LFT301001 W/LFT30100FBC COVER
7	FUSE, 100A, CLASS T, 125VDC, LITTELFUSE M/N JLLN100
8	NOT USED
9	LIGHT FIXTURE, INDOOR, LED LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) M/N S232
10	LIGHT FIXUTURE, OUTDOOR, 120V, 13 WATT CFL LAMP, DUSK TO DAWN AUTOMATIC LIGHT CONTROL, UTILITECH M/N GU8813-BZ-I
11	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING M/N APC7R OR EQUAL
12	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
13	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL
14	VENTILATION FAN, 24", 115 VOLT, 1- PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, 5850 CFM @ 0.0"SP, 5560 CFM @ 0.05"SP, 9' SWITCHED CORD AND PLUG,
	INCLUDES WEATHER HOOD, J & D MANUFACTURING M/N VPES24 AND VFT140858 (HOOD)



SHELTER POWER PLAN
(GRID OPTION)



VIEW A–A
(GRID OPTION)

ALABAMA LICENSED No. 22480 PROFESSIONAL 7/5/2023 ENGINEER JOHN F. CONWAY

SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353 - 1972

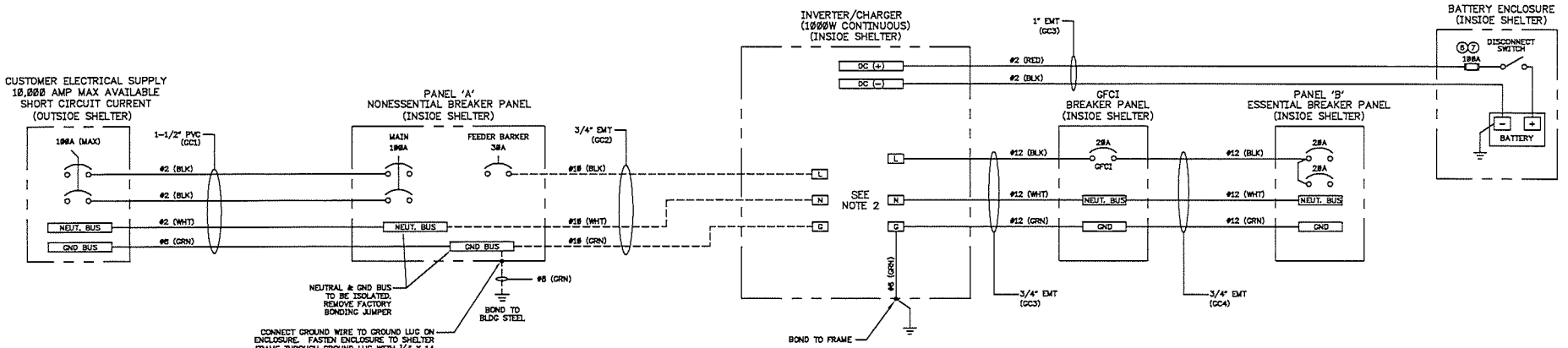
HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
0	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
DRAWN BY: PAUL STRANOF
APPROVED BY: JOHN CONWAY

TITLE: OPTIONAL GRID / BATTERY UPS SYSTEM ELECTRICAL PLAN & VIEW

DATE: 07/19/23 | SIZE: D | DRAWING NUMBER: E-UPS-GRID-1 | REV: 0



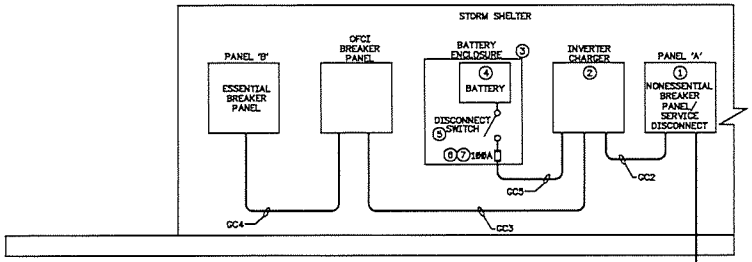
WIRING DIAGRAM GRID OPTION
(GRID OPTION)

BATTERY NOTES:

1. AVOID LONG PERIODS OF EXTREME COLD OR HOT TEMPERATURES. LONG PERIODS OF EXPOSURE TO THESE TEMPERATURES CAN RESULT IN BATTERY DAMAGE.
2. INVERTER/CHARGER XANTREX FREEDOM HAS BUILT IN TRANSFER SWITCH AND WILL SWITCH TO BATTERY POWER IF MAIN POWER IS LOST. DO NOT INSTALL INVERTER/CHARGER IN ANY COMPARTMENT CONTAINING OF FLAMMABLE VAPORS OR GASSES.

CONDUIT SCHEDULE					
"CONDUIT NO."	"CONDUIT SIZE"	CONDUCTORS	FUNCTION	FROM	TO
GC1	1-1/2" SCH 40 PVC	3- #2 W/#8 GND	BUILDING FEEDER	OWNER SUPPLY PANEL	PANEL 'A'
GC2	3/4" EMT	2- #10 W/GND	INVERTER/CHARGER AC INPUT	PANEL 'A'	INVERTER/CHARGER
GC3	3/4" EMT	2- #12 W/GND	INVERTER/CHARGER AC OUTPUT	INVERTER/CHARGER	GFCI PANEL
GC4	3/4" EMT	2- #12 W/GND	PANEL 'B' FEEDER	GFCI PANEL	PANEL 'B'
GC5	1" EMT	2- #2	INVERTER/CHARGER DC INPUT	BATTERY ENCLOSURE	INVERTER/CHARGER

DIRECTORY	LOAD-WATTS L1	LOAD-WATTS L2	NO.	AMPS		AMPS	NO.	LOAD-WATTS L1	LOAD-WATTS L2	DIRECTORY
MAIN BREAKER – BACK FED			1	100		30	2	.		INVERTER/CHARGER
			3	100		20	4		.	RECEPTACLE-DEHUMIDIFIER
SPACE			5	20		20	6			SPACE
SPACE			7	–		–	8			SPACE
SPACE			9	–		–	10			SPACE
SPACE			11	–		–	12			SPACE
SUB TOTAL WATTS	–	–			N			.	.	SUB TOTAL WATTS
240/120V 1-PH 3-WIRE	TOTAL WATTS, L1					.				PANEL 'A' DIRECTORY NONESSENTIAL LOADS
100 AMP MAIN BREAKER	TOTAL WATTS, L2					.				
(ISOLATED GROUND BUS)	TOTAL WATTS					.				



TO 120/240 VAC, 1 PHASE CUSTOMER ELECTRICAL SUPPLY 100 AMP MAX CIRCUIT BREAKER OR FUSE RATING 10,000 AMP MAX AVAILABLE SHORT CIRCUIT CURRENT. CABLE SIZE TO BE VERIFIED BY CUSTOMER TO ENSURE MAXIMUM VOLTAGE DROP IS LIMITED TO 3%.

RISER DIAGRAM GRID OPTION
(GRID OPTION)

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
PANEL 'B' (GFCI)	.	1	20	
SPACE	.	2	.	
SUB TOTAL WATTS	–	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED ORCUND BUS) GFCI BREAKER	TOTAL WATTS			.

GFCI BREAKER PANEL
ESSENTIAL LOADS

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
LIGHTS	.	1	20	
RECEPTACLES	.	2	20	
SUB TOTAL WATTS	–	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS)	TOTAL WATTS			.

PANEL 'B'
ESSENTIAL LOADS

ALABAMA LICENSED No. 22480 PROFESSIONAL 5/15/2023 ENGINEER JOHN T. CONWAY

SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353-1972

HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

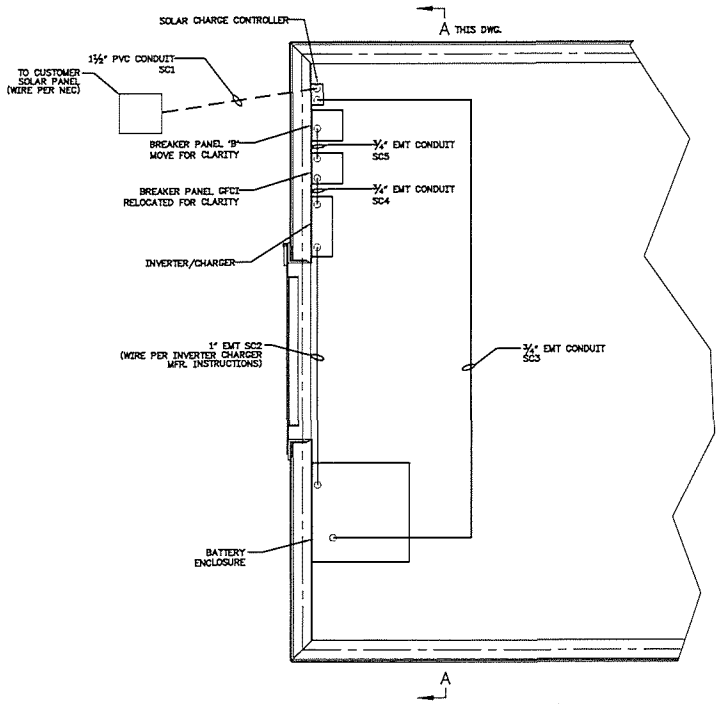
MATERIAL	NONE
BUILD	
DRAWN BY	PAUL STRANCE
SURFACE DIST	
APPROVED BY	JOHN CONWAY

TITLE: OPTIONAL GRID / BATTERY UPS SYSTEM DIAGRAMS & SCHEDULES

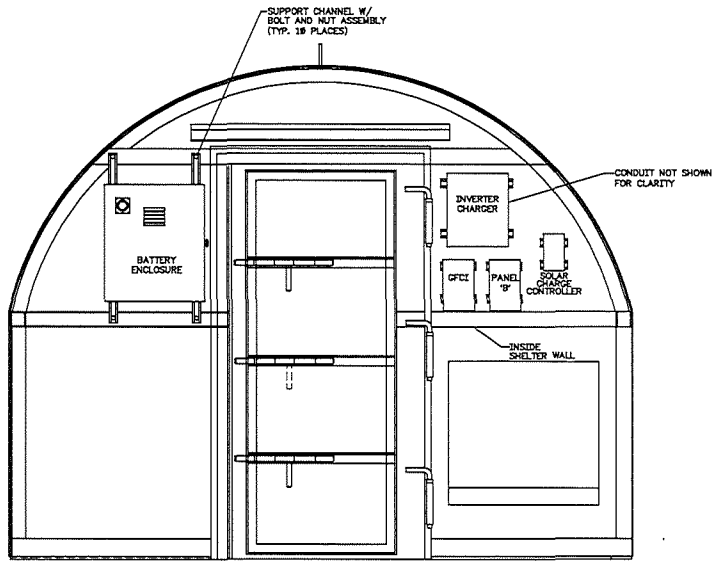
DATE	SIZE	DRAWING NUMBER	REV
07/19/23	D	E-UPS-GRID-2	0

BILL OF MATERIAL

ITEM	DESCRIPTION
1	NOT USED
2	NOT USED
3	BATTERY ENCLOSURE (ACCOMMODATES 2 BATTERIES), MATERIAL: ALUMINUM, DIMS: 22.625H X 19.25W X 19.625D, UL 508A, NEMA 3R, AMERESCO SOLAFR M/N 8BA-2 OR EQUAL
4	BATTERY, 12.8V 100AH DEEP CYCLE, 1280 WATT-HOURS (WH), WEIGHT 29 LBS, 11.9" X 6.8" 8.5", EXPION360 M/N EX-G27-100C OR EQUAL
5	BATTERY SWITCH, CONTINUOUS CURRENT RATING: 275 A, VOLTAGE RATING: 48 V, SURFACE OR REAR PANEL MOUNT, VICTRON ENERGY M/N VBS127010010
6	FUSE BLOCK, 100A, CLASS T, 300V, BOX LUG CONNECTOR, 2/0–6 AWG WIRE RANGE, LITTELFUSE M/N LFT301001 W/LFT30100FBC COVER
7	FUSE, 100A, CLASS T, 125VDC, LITTELFUSE M/N JLLN100
8	FUSE, 30A, CLASS T, 125VDC, LITTELFUSE M/N JLLN030
9	LIGHT FIXTURE, INDOOR, LED LUMINAIRE, SURFACE MOUNT, 120V BALLAST, 2-32 WATT T8 LAMPS, DSS (DIVERSE SUPPLY SOLUTIONS) M/N S232
10	LIGHT FIXUTURE, OUTDOOR, 120V, 13 WATT CFL LAMP, DUSK TO DAWN AUTOMATIC LIGHT CONTROL, UTILITECH M/N GUB813-BZ-I
11	EXIT SIGN, COMBINATION SIGN/LIGHT, 120V, DUAL LAMPS, NICAD BACKUP BATTERY, COOPER LIGHTING M/N APC7R OR EQUAL
12	DUPLEX RECEPTACLE, SPECIFICATION GRADE DUPLEX AND DUPLEX/GFI RECEPTACLES LEVITON 5362/5362GF SERIES OR EQUAL
13	WALL SWITCH, SPECIFICATION GRADE 2 AND 3-WAY SWITCH, LEVITON 1221/1223 SERIES OR EQUAL
14	VENTILATION FAN, 24", 115 VOLT, 1- PHASE, 60 HZ, 1.8 AMP, 2-SPEED, 1/8 HP MOTOR, 5850 CFM @ 0.0"SP, 5560 CFM @ 0.05"SP, 9' SWITCHED CORD AND PLUG,
	INCLUDES WEATHER HOOD, J & D MANUFACTURING M/N VPES24 AND VFT140858 (HOOD)
15	SOLAR CHARGE CONTROLLER, 12/24VDC, WIRE TERMINALS UP TO 6 AWG, CIRCUIT VOLTAGE100 VDC, BATTERY OUTPUT 9A2 VDC, (L X W X D) 7.1" X 4.0" X 2.4", XANTREX M/N 710-3024-01 OR EQUAL
16	SOLAR PANEL, FLEXIBLE, 220W, 24.6V, 44 MONO-CRYSTALLINE PERC CELLS, DIMENSIONS (L X W X D) 71.5" X 28.8" X 0.08", XANTREX M/N 784-0220 OR EQUAL



SHELTER POWER PLAN
(SOLAR OPTION)



VIEW A–A
(SOLAR OPTION)

ALABAMA LICENSED No. 22480 PROFESSIONAL 3/15/2023 ENGINEER JOHN F. CONWAY

SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353-1972

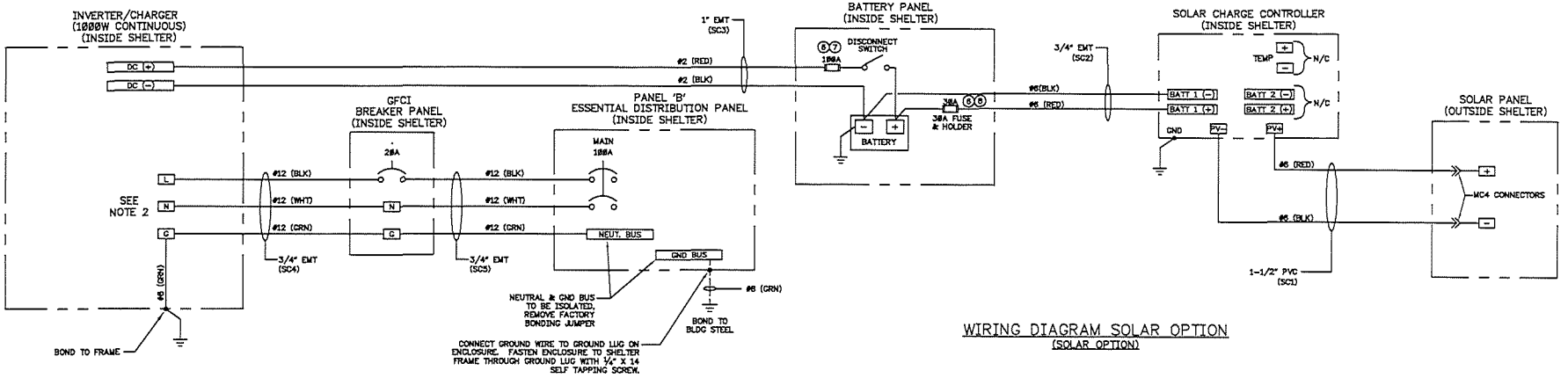
HCS JOB NUMBER: 23188001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
SURFACE TREAT:
DRAWN BY: PAUL STRANCE
APPROVED BY: JOHN CONWAY

TITLE: OPTIONAL SOLAR / BATTERY UPS SYSTEM ELECTRICAL PLAN & VIEW

DATE: 07/19/23 | SIZE: D | DRAWING NUMBER: E-UPS-SOLAR-1 | REV: 0



WIRING DIAGRAM SOLAR OPTION
(SOLAR OPTION)

CONDUIT SCHEDULE					
"CONDUIT NO."	"CONDUIT SIZE"	CONDUCTORS	FUNCTION	FROM	TO
SC1	1-1/2" SCH 40 PVC	2- #6	SOLAR PANEL OUTPUT	SOLAR PANEL	SOLAR CHARGE CONTROLLER
SC2	3/4" EMT	2- #6	SOLAR CHARGE CONTROLLER OUTPUT	SOLAR CHARGE CONTROLLER	BATTERY ENCLOSURE
SC3	1" EMT	2- #2	INVERTER/CHARGER DC INPUT	BATTERY ENCLOSURE	INVERTER/CHARGER
SC4	3/4" EMT	2- #12 W/GND	INVERTER/CHARGER AC OUTPUT	INVERTER/CHARGER	GFCI PANEL
SC5	3/4" EMT	2- #12 W/GND	PANEL 'B' FEEDER	GFCI PANEL	PANEL 'B'

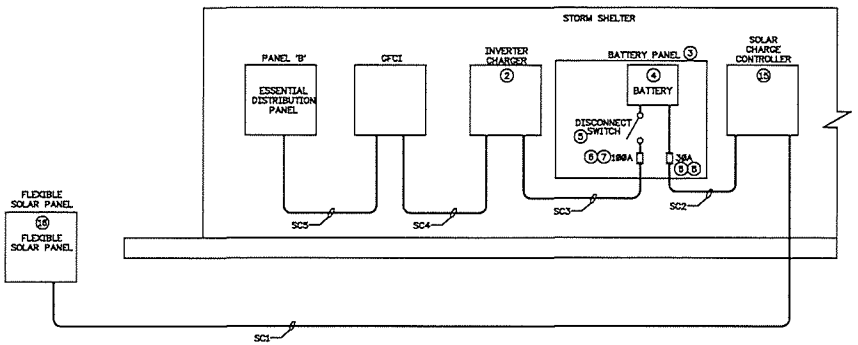
BATTERY NOTES:
1. AVOID LONG PERIODS OF EXTREME COLD OR HOT TEMPERATURES. LONG PERIODS OF EXPOSURE TO THESE TEMPERATURES CAN RESULT IN BATTERY DAMAGE.
2. INVERTER/CHARGER XANTREX FREEDOM HAS BUILT IN TRANSFER SWITCH AND WILL SWITCH TO BATTERY POWER IF MAIN POWER IS LOST. DO NOT INSTALL INVERTER/CHARGER IN ANY COMPARTMENT CONTAINING OF FLAMMABLE VAPORS OR GASSES.

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
PANEL 'B' (GFCI)	.	1	20	
SPACE	.	2	.	
SUB TOTAL WATTS	—	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS) GFCI BREAKER	TOTAL WATTS			.

GFCI BREAKER PANEL
ESSENTIAL LOADS

PANEL DIRECTORY	LOAD WATTS L1	NO.	AMPS	
LIGHTS	.	1	20	
RECEPTACLES	.	2	20	
SUB TOTAL WATTS	—	.	.	N
120V 1-PH 2-WIRE	TOTAL WATTS, L1			.
(ISOLATED GROUND BUS)	TOTAL WATTS			.

PANEL 'B'
ESSENTIAL LOADS



RISER DIAGRAM SOLAR OPTION
(SOLAR OPTION)

ALABAMA LICENSED
No. 22480
PROFESSIONAL
9/15/2023
ENGINEER
JOHN T. CONWAY

SAFE-T-SHELTER®
Safe Rooms/Shelters 1-800-462-3648

HCS Engineering Company,
DECATUR, ALABAMA (256) 353 - 1972

HCS JOB NUMBER: 23100001

REV.	DESCRIPTION	E.C.N. #	DATE	DR.	CK.
B	ISSUED FOR CONSTRUCTION (PSS/CMB)		9/15/23	HCS	CMB

MATERIAL: NONE
SURFACE DAT:
DRAWN BY: PAUL STRANGE
APPROVED BY: JOHN CONWAY

TITLE: OPTIONAL SOLAR / BATTERY UPS SYSTEM DIAGRAMS & SCHEDULES

DATE: 07/19/23 | SIZE: D | DRAWING NUMBER: E-UPS-SOLAR-2 | NO: 0

1.0 - GENERAL

1.1 Scope

A. HVAC means Heating, Ventilation and Air Conditioning.

B. Provisions of this Section apply to all HVAC and Building Management and Control System (BMCS) work.

C. Include the provisions of General, Supplementary and Special Conditions and provisions of the Specifications shall apply to and form a part of this Section.

D. Provide all labor, materials, equipment, and services necessary for the completion of all HVAC work shown or specified, except work specifically specified to be done or furnished under other sections of the Specifications. Include performing all operations in connection with the complete HVAC installation in strict accordance with the specification and applicable drawings subject to the terms and conditions of the Contract.

E. Give required notices, file drawings, obtain and pay for permits, deposits and fees necessary for the installation of the HVAC work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.

F. "Provide" means to furnish and install, complete and ready for operation.

G. All equipment shall be U.L. or E.T.L. Listed as an assembly.

1.2 Drawings:

A. HVAC Drawings are diagrammatic and subject to requirements of Architectural Drawings. HVAC Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work. Coordinate with Architectural, Structural, Electrical, Plumbing and other Building Drawings.

B. Follow the Drawings closely, check dimensions with Architectural Drawings and field conditions. DO NOT scale HVAC Drawings for location of system components.

C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or mislocated work.

D. Do not scale Drawings to locate ceiling diffusers. Coordinate with lighting, ceiling grids and/or reflected ceiling plans.

1.3 Applicable Codes And Standards:

A. Comply with the current editions of the following Codes and Standards:

1. ANSI/ASHRAE 15 - Code for Building Services Piping.

2. ANSI B9.1 - Safety Code for Mechanical Refrigeration.

3. NFPA 70 - National Electrical Code.

4. NFPA 90A - Air Conditioning and Ventilating Systems.

5. NFPA 101 - Life Safety Code.

6. Other Standard as referenced in other Sections of Divisions 15.

7. Local Building Code (International Building Code if no local Building Code in effect).

8. Local Plumbing Code (International Plumbing Code if no local Plumbing Code in effect).

9. Local Gas Code (International Gas Code if no local Gas Code in effect).

10. Local Mechanical Code (International Mechanical Code if no local Code in effect).

1.4 Qualifications Of Subcontractor:

A. The HVAC Contractor shall meet the following qualifications:

1. The HVAC Contractor must be approved by the Architect.

2. The HVAC Contractor shall have been in business as a HVAC Contractor for at least three (3) years prior to Bid Date.

3. The HVAC Contractor shall have a satisfactory experience record with HVAC installations of character and scope comparable with this project and have completed five projects of the same cost (or more) as the cost of this project, and for at least three (3) years prior to the Bid Date shall have had an established service department capable of providing service inspection or full maintenance contracts.

4. Contractor must have bonding capacity for project of this size and must bond the project.

1.5 Conflicts And Interferences:

A. If systems interfere or conflict, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.6 Workmanship:

A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.7 Cooperation:

A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.8 Visiting Site:

A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

1.9 Scheduled Work Hours And Facility Occupancy:

A. Schedule all connections to existing systems and shutdowns with the Architect/Owner.

2.0 - PRODUCTS

2.1 Materials, Substitutions And Submittals:

A. Unless otherwise noted, provide new, standard, first-grade materials throughout. Equipment and materials furnished shall be fabricated by manufacturer regularly engaged in their production and shall be the standard and current model for which replacement parts are available. HVAC equipment shall be substantially the same equipment of a given manufacturer which has been in successful commercial use and operation for at least three (3) years.

B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the Bid, without substitution, and shall be furnished under the Contract unless requests for substitutions are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.

C. Substitutions will be considered only if written request for approval has been received by the Architect ten (10) days prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which substitution is proposed, specification section/paragraph number and a complete description of the proposed substitute including drawings, cuts, performance and test data, samples and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

D. If the Architect approves any proposed substitution prior to receipt of Proposals, approval will be set forth in an Addendum. Do not rely upon approvals made in any other manner. Prior approval to be secured for "equal" or "approved equal" manufacturer.

E. No substitutions will be considered after the Contract has been executed, except as described in the General Conditions.

F. Submittal data and shop drawings, except controls, shall be submitted at one time, partial submittals will not be considered. Provide submittal in three (3) ring binders with tab sheets for each major item of equipment. Before ordering materials and equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Number of Shop Drawings and procedure shall be as directed by the Architect.

G. Architect and / or Engineer's approval of submittal data does not relieve the contractor of his responsibility to comply with the contract documents.

H. It is the responsibility of the Mechanical contractor to coordinate all Electrical requirements of the submitted equipment with the Electrical contractor. Any increase in cost due to a variance between the contract documents and the submitted equipment shall be the responsibility of the Mechanical Contractor.

i. Similar items of equipment shall be the product of the same Manufacturer.

J. See section, "ALTERNATES" in other section of the Specifications and Bid accordingly.

2.2 Shop Drawings:

A. Before starting work, submit and obtain approval of detailed drawings of the following, fully dimensioned (including elevations of ductwork and piping) and drawn not less than 1/4"= 1'-0" scale. Submit one (1) set of paper or bond.

1. Ductwork (do not scale diffuser locations, coordinate with ceiling grids and lighting layout). See Section 15860 "DUCT ACCESSORIES".

2. Complete mechanical equipment and fan room plans showing location of equipment, conduit stubs for motors, floor drains, and equipment pads and foundations.

3. Equipment piping.

B. Submit complete control and power wiring diagrams for approval before installing controls. See Section 15900 "CONTROLS".

2.3 Record Drawings:

A. When work starts, obtain white prints of the HVAC Drawings. All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection.

B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one (1) complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this Contract.

C. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.

D. When work is completed Contractor shall purchase from the Architect (At Architects' printing cost) one (1) set of prints of HVAC Drawings for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the mylar record drawings, removing all superseded data in order to show the actual completed conditions.

1. Accurately shown location, size and elevation of new exterior piping work and its relationship to any existing piping and utilities, obstructions, etc., contiguous to the area of work.

2. Block out areas modified by change-order and identify them by change-order number.

E. Ductwork and Control Drawings may be a set of mylar reproducible shop drawings, up-dated to show actual conditions at completion of work.

F. HVAC piping drawings may be prepared as noted in paragraph "D" above, or HVAC piping may be added to the ductwork shop drawings as noted in paragraph "E" above.

2.4 Motors, Starters And Electrical Equipment:

A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.

B. Should the Contractor with the Architect's and Engineer's approval make changes in electrical equipment from those shown on the Electrical Drawings, he shall be responsible for the coordination and cost of required changes.

C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.

D. Motors:

1. 1750 RPM open drip-proof construction unless otherwise shown or specified. Integral horsepower three phase motors shall be of premium energy-efficient design with apparent efficiency (power factor X efficiency) not less than ASHRAE 90.1.

2. All motors served by variable frequency drives (VFD's) shall be inverter duty rated.

3. Unless shown otherwise motors less than 1/2 HP shall be single phase, motors 1/2 HP and larger shall be three phase.

4. Allis-Chalmer, General Electric, Goulds, Louis Allis, and Westinghouse.

E. Do not run motors until correct overload elements are installed in starters. Trading overload elements for elements of correct size for motors actually furnished shall be included in this Section.

F. Starters shall be in motor control centers, furnished mounted on packaged equipment or furnished in this section and installed under "ELECTRICAL SECTION" as indicated and/or shown on the Electrical Drawings. All starters furnished with fused control circuit transformers.

G. Starters shall be equipped with melting alloy terminal overload protection, in a 3 phase. Starters, unless indicated otherwise, shall be across-the-line type with overload and low voltage protection. Starting equipment shall comply with local utility company requirements.

H. Starters to be Square "D", Allen-Bradley, Cutler-Hammer or approved equal.

I. For single phase motors provide manual starters equal to Square "D" Class 2510. When installed in equipment rooms provide surface mounted enclosure, and when installed in finished walls outside equipment rooms provide flush mounted

enclosure, key operated.

J. For three phase motors provide magnetic line voltage starters with NEMA I enclosures and melting alloy overload elements.

K. Provide H-O-A switches, fused control circuit transformers, auxiliary contacts, etc., as shown on control diagrams or required by control sequences and/or arrange for these items to be furnished with the starters or motor control centers specified in Electrical Work.

L. All starters shall be by the same manufacturer.

M. Provide thermal overload with equipment for motors 1/2 HP and less at 120/1/60.

2.5 Sleeves:

A. For pipe through floors inside rated chases or through non-fire-rated walls: 20 gauge galvanized steel, 1/2" larger than pipe or covering.

B. For uninsulated pipe through fire rated walls or partitions or floors outside chases: Pipe Shields, Inc., Model WFB or approved equal at walls, Model DFB at floors.

C. For insulated pipe passing through fire rated partitions or walls or floors outside chases: Pipe Shields, Inc., Model WFB-CS for hot lines, VFB-CS-CW for cold lines. Insulation: Calcium silicate for hot lines and foamglass for cold lines, thickness specified for adjacent pipe covering.

D. For pipe through concrete beams: Schedule 40 black steel pipe, 1/2" larger than pipe or covering. Pipe covering passing through sleeve: calcium silicate in a 24 gauge galvanized steel shield similar to Pipe Shields, Inc. thermal hanger shield. Caulk space between bare pipe insulation jacket and beam with fire retardant rope at both ends of the sleeve and seal with 3M Brand fire barrier caulk CD 25 or Putty 303, thickness and application in strict accord with manufacturer's recommendations, minimum thickness 1".

E. At Contractor's option, instead of the factory fabricated sleeves specified above for pipe passing through floors and fire rated walls and partitions substitute 20 gauge galvanized steel sleeve 1/2" larger in diameter than pipe or pipe covering and seal one end of sleeve (both ends if both ends are exposed) with 3M Branch Fire Barrier Caulk CP25 or Putty 303, thickness and application in strict accord with manufacturer's recommendations, minimum thickness 1". Where pipe is insulated, insulation shall be continuous thru sleeve, calcium silicate for hot lines and foamglass for cold lines. In exposed areas, after product has dried it shall be sanded smooth for painting under painting section.

F. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.

G. Sleeves for ducts: See Fire Dampers (See Section 15860 "DUCT ACCESSORIES").

H. Extend sleeves 1-1/2" above finish floor and waterproof.

I. Where exposed ducts pass through walls and partitions, provide 4" wide 20 gauge galvanized steel closure plates except at grilles and registers. Fit closure plates snugly to duct and secure to wall. Grout around ducts and sound absorbers at equipment room walls.

J. Where exposed pipes pass through walls and partitions in finished spaces, provide chrome plated F & C plates or escutcheons.

2.6 Access Doors:

A. Doors in non-fire rated walls and ceilings: 17-gauge steel with hinges and screwdriver latches, Bilco, Milcor, Miami-Carey, or equal. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Provide door styles compatible with adjoining surfaces as selected by Architect. Size doors to permit removal of equipment and/or maintenance, minimum size 18" X 18".

B. Mark lay-in ceilings with paper brads at maintenance access points. Bend ends of brads over above ceiling tile.

3.0 - EXECUTION

3.1 Protection Of Rotating Parts:

A. Equip exposed belt drives with belt guards with holes for measuring speeds of driven shafts.

B. Provide exposed couplings with coupling guards.

C. Equip propeller fans with guards.

D. Equip inlets and outlets of open centrifugal fans with 1-1/2" #10 Diamond mesh galvanized steel screens.

E. All motors or other equipment exposed to weather shall be provided with weatherproof covers.

3.2 Protection Of Equipment:

A. During construction, protect mechanical equipment from damage or deterioration.

B. When installation is complete, clean equipment and make ready for painting.

C. During construction all ductwork, piping, and equipment shall be stored in a clean/dry location. Any ductwork or piping stored outside that is not protected shall be removed from the job site. Installed ductwork and piping shall have open ends covered at the end of each work day to prevent dust, dirt, and water from entering the ductwork and piping.

3.3 Installation Of Equipment:

A. Install equipment to provide normal service access to all components.

B. Provide sufficient space for removing components, install equipment to provide such clearance.

C. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with contract documents, obtain Architect's decision before proceeding.

D. All equipment shall be firmly fastened in place:

1. Roof curbs shall be secured to deck and structure and curb mounted items shall be secured to curbs.

2. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.

3. Vibration isolators shall be secured to floors, pads or structure and equipment shall be bolted to the isolators.

3.4 Equipment Supports:

A. Provide supports for ductwork, piping and equipment. Hot dip galvanize after fabrication all grillage, supports, etc., located outdoors.

B. Set all floor-mounted equipment, other than condensate pumps, on concrete pads or rails (as indicated of height shown, but not less than 4" high). Coordinate pad height with condensate drain trap requirements. Chamfer rails and pads 1". Where shown, provide reinforced floating pads mounted on vibration isolators. Form, reinforce and pour any pads and rails required but not shown on Structural and Architectural Drawings.

3.5 Cutting And Patching:

A. Set sleeves and inserts and lay-out and form openings in walls, beams, girders and structural floors in this Section.

B. Cut, patch and repair as required to accomplish HVAC Work and finish to match adjacent work. Architect's approval required before cutting any part where strength or appearance of finished work is involved.

3.6 Incidental Work:

A. Provide all motors incidental to the Mechanical Systems. Wiring of motors, switches and starters is included in "ELECTRICAL SECTIONS".

B. Do all control wiring required for Mechanical work.

C. Provide motor starters as specified above.

D. Submit refrigerant piping diagrams as prepared by the HVAC Contractor and/or refrigeration equipment manufacturer for approval.

E. Final water connections to services are included in this Section.

F. Permanent drain connections for AC units, etc., and auto air vents to nearest floor drain are included in this Section.

G. Door louvers are not included in this Section.

H. Items obviously omitted from drawings and/or specifications shall be called to attention of the Architect prior to submitting Bid, after award of Contract any changes or rearrangements necessary to complete Contract shall be at no additional cost to Owner.

I. All return air and exhaust air grilles shall be covered with filter media if they are started and operated during construction.

3.7 Flashing:

A. General: Furnish all fans curbs, pitch cups, metal base flashing and counter flashing required for HVAC Work. Installation of above items is specified in "ROOFING SECTION" with coordination by HVAC Contractor.

B. Fan curbs for power roof ventilators are specified with the fans.

C. Pitch Cups: 20 gauge galvanized steel, at least 8" deep, bases mitered and soldered and extending at least 4" horizontally.

D. Metal Base Flashing: Galvanized steel for ferrous items, and stainless steel for stainless steel duct and aluminum for aluminum duct. Minimum thickness 22 gauge (0.034") galvanized steel, 20 gauge (0.038") stainless steel, 0.032" aluminum. Bases mitered and soldered extending out at least 4" horizontally and 8" vertically.

E. Metal Counter Flashing: Of material and gauges specified for base flashing, lapping base flashing at least 3".

3.8 Hvac Installation Of And Connections To Items Furnished By Others Or Specified In Other Sections:

A. Clothes Dryers: Provide Vents.

B. Duct Mounted Smoke Detectors: Install in duct.

C. Domestic Water Heaters: Provide gas flues and combustion air vents.

D. Kitchen Hoods: Provide exhaust fans and grease duct.

3.9 Painting:

A. Refinish equipment damaged during construction to new condition.

B. Paint all non-potable water pipe and insulation yellow in accordance with Plumbing Code using paint of type specified in Painting Section.

C. Paint un-insulated duct surfaces visible through grilles and registers flat black.

D. Other painting is specified in "PAINTING SECTION, Finishes Division".

3.10 Pipe Identifications:

A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. Markers on lines 8" OD and smaller shall be taped in place; on lines over 8" OD secure with spring clips.

B. Submit samples of all labels, tags, stencils, chains, etc., for approval.

C. Protect all factory identification tags, nameplates, model and serial numbers, stenciling, etc., during construction and replace if damaged.

D. Label Spacing and Extent:

1. On straight run of pipes; Above suspended ceilings space labels approximately 10 feet on center; elsewhere, 20 feet on center.

2. Wherever a pipe enters or leaves a room or building.

3. At change of direction.

4. At main valves and control valves (not equipment valves).

5. On risers, just above and below floors.

3.11 Valve Tags:

A. 2" X 3" laminated plastic with 1/2" numbers engraved at top indicating type service and valve number, leaving space for further engraving by others. Secure tags with chains to valve yoke or stem, not handles.

B. Valve tags colors: Brass tags with black numbers.

C. Valve tag locations: At all valves on mains, risers and branches.

D. Valve tag numbers: Starting with Number 1, number tags in sequence from the lowest point to the highest point in the building. In existing building extend existing sequences.

3.12 Valve Charts:

A. In all mechanical rooms, provide charts showing number and locations of all valves, type of service, etc. Frame with aluminum, under glass.

3.13 Equipment Identifications:

A. Provide 2" X 3" or larger laminated plastic nameplates with 1/2" numbers and letters in colors specified below. Screw tags to equipment in obvious locations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tags, leaving lower half of tag for future engraving by Owner.

B. Provide similar nameplates for motor starters furnished under this section.

C. Secure nameplates with acorn head screws.

D. Colors:

1. Equipment connected to utility power only - black letters on white nameplates.

2. Equipment connected to emergency power - red letters on white nameplates.

3.14 Exhaust Fan Identifications:

A. 2" X 3" or larger laminated plastic nameplates with red letters and numbers on white background, identifying type of fans, number according to plans, and rooms served. Engrave on upper half of tag, leaving lower half for engraving by Owner. Fasten with acorn head screws.

3.15 Access Doors:

A. Provide access doors for valves, fire dampers, dampers, controls, air vents, and other items located above non-lift-out ceilings or behind partitions or walls.

3.16 Use Of Hvac System During Construction:

A. Ducted HVAC systems may be used during construction as long as the following conditions are met:

1. All AC units shall have filters installed in the AC units that are equal to the filters that are scheduled for each piece of equipment. The contractor shall be responsible for changing the filters in all AC units during construction at a minimum of every 30 days starting from the day the AC units are started. At the completion of the project, the contractor shall replace all filters.

2. All return air and outside air openings shall be protected with temporary filter media. The temporary filter media shall be changed by the contractor. Temporary filter media is required to protect the installed ductwork. During or after construction, if any ductwork is observed without temporary filter media, the contractor shall be solely responsible for cleaning the entire ductwork system and AC unit. Temporary filter media shall be changed bi-weekly at a minimum.

3. All AC units shall have all correct motor overload elements installed and all safeties shall be wired and operational prior to temporary use of the AC unit.

4. Temporary controls and temporary control sequences may be utilized by the contractor until the permanent controls and control sequences are installed. Temporary control methods shall be the sole responsibility of the contractor.

5. All AC units required to have factory start-up shall have factory start-up completed prior to use.

6. The building envelope for the area served by the AC units shall be substantially complete prior to using the AC units during construction.

B. Ductless split systems shall NOT be used during construction. Protect all indoor sections of ductless split systems during construction to prevent dust, dirt, or water from entering the unit.

3.17 Warranty And Instructions:

A. See General Conditions - One-Year Warranty.

B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one (1) year after date of substantial completion of the Contract. Should any defects in materials, workmanship, or equipment be made known to Contractor within the one (1) year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.

C. All centrifugal, reciprocating, screw or scroll type refrigeration compressors shall

bear five (5) year non-pro-rated parts warranty.

D. All gas fired air furnaces shall bear ten (10) year prorated heat exchanger warranties.

E. After completion of the work, Contractor shall operate the equipment which he installs for a period of ten (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment. Furnish necessary oral and written operating instructions to the Owner's representative.

F. Provide five (5) sets of manufacturer's operating and maintenance manuals and parts lists including nearest manufacturer's sales and service representative by name, address and phone for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency. Include all warranty dates on equipment and guarantees. Include names, address and phone of any subcontractor and work performed. Bind above items in loose leaf three (3) ring binders with tab for each class of equipment.

G. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.

H. Supply initial charges of refrigerant, refrigeration lubricating oil; and anti-freeze necessary for the correct operation of the equipment. Maintain these charges during the guarantee period, with no additional cost to the Owner, unless loss of charge is the fault of the Owner.

I. Make available to the Owner, without additional cost, service and adjustment of the equipment for the guarantee period.

1. Service shall include:

a. On call nuisance issues.

b. Replenishing refrigerant and antifreeze if loss occurs due to system failure.

2. Service shall not include:

a. Routine maintenance of the equipment unless specified in specific equipment specification section(s).

3.18 Project Close-Out Documents:

A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:

1. A letter signed by the subcontractors for HVAC, Electrical, and Temperature Control work stating that they have jointly checked each power circuit and control circuit and mutually agrees that controls and power circuits will function properly.

2. Record drawings - sheet metal work (reproducible).

3. Record drawings - piping (reproducible).

4. Record drawings - control systems (reproducible).

5. Control manufacturer's letter of certification (3).

6. Air balance report (3).

8. Equipment Submittal Data (3).

9. Equipment operating and maintenance manuals (3).

10. Maintenance schedule (3).

11. Equipment warranty dates and guarantees (3).

12. List of Owner's Personnel who have received maintenance instructions.

13. All required factory start-up reports.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this section apply to all HVAC work.

B. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 48 hour notice is required prior to performance of test.

C. Provide complete report to Engineer for approval TEN (10) working days prior to Engineer's final site visit.

D. Commissioning: Each subcontractor and supplier of equipment shall include in his/her quoted price the cost of furnishing the material requested and the manpower necessary for the operation and maintenance manuals, training and system verification as specified under Section 15995 - HVAC Commissioning.

1.2 Qualifications

A. All TBA work shall be performed by an independent Test and Balance Agency specializing in Testing, Balancing and Adjusting of HVAC Systems.

B. All TBA work shall be under supervision of a qualified registered professional engineer regularly engaged in the TBA Agency.

C. TBA Agency shall be an AABC or NEEB Member and/or shall obtain written approval from the Architect prior to Bidding.

1.3 Approval

A. Application for approval of the TBA agency shall be submitted prior to Bid.

B. Submittal information regarding the TBA agency to include:

1. List of at least five (5) projects successfully completed of similar size and scope.

2. Copy of reporting forms to be used for this project indicating scope of TBA work.

3. Name of registered engineer in charge with resume of qualifications. List of personnel that will perform TBA work on project and qualifications.

4. List of instruments to be used with dates of latest calibrations.

5. List of memberships in AABC, NEBB or other similar organizations.

2.0 - PRODUCTS

2.1 Instruments

A. All instruments used for the TBA work shall be calibrated within six (6) months and checked for accuracy prior to start of work.

3.0 - EXECUTION

3.1 General Requirements

A. After HVAC system has been installed, Test, Balance and Adjust System for proper operation, air distribution, flow rates, temperatures and humidities. Correct any noise and/or vibration conditions.

B. Include a "Deficiency List" with the TBA air and water balance report. Deficiency list shall include TBA items which are not in accordance with Contract Documents.

C. Perform all tests as required by local codes. Contractor shall furnish testing equipment.

D. If local Codes are more stringent, local Codes shall govern.

3.2 Air System

A. When system has been completed, remove all trash and dirt, set grille bars and diffuser patterns for required throws and adjust and balance air duct systems so air quantities at outlets are as directed and distribution from each supply outlet is free from drafts and excessive noise, and uniform over the face of each outlet. Do all testing and balancing with filters blanked to provide pressure drops midway between clean condition and manufacturer's recommended change-out condition. Balance air quantities to within 10% of indicated air quantities.

B. Make adjustments so dampers and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Obtain additional pressure drop required for balancing of shorter runs by adjusting dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Change sheaves on drives larger than 15 HP. Provide additional sheaves as required.

C. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but measure air quantities in ducts having velocities of 1000 feet per minute or more with pitot tubes. Cap pitot tube openings in low pressure ducts with plastic plugs. Cap pitot tube openings in medium and high pressure ducts and kitchen and laboratory exhaust ducts with Duro-Dyne test ports.

D. Permanently mark settings of dampers and other volume adjusting devices so they can be restored if disturbed.

E. When air balancing has been completed, submit to Architect an air balance log, including design and actual air quantities, pressures, etc., in each branch duct and at each grille, register, and outlet. Individual outlet air rates are required for boots on boot-box systems.

F. Include for each system the following information:

1. Fan rpm, motor amps, motor nameplate amps, and amp rating of starter heater.

2. Total air quantity supplied by each system and/or fan.

3. Total outside air quantity supplied by each system.

4. Provide velocity pressure across each duct mounted smoke detector and

list manufacturer's required velocity pressure range.

5. Air flow at all grilles.

6. Static pressure profile thru each air handler.

3.3 Coils

A. Provide the following:

1. Entering and leaving air temperatures.

2. Outside air temperature at time of test.

3. Air pressure drop.

3.4 Start-Up and Service

A. At the beginning of the first heating season, adjust and balance operating phases and repeat at the beginning of the first cooling season or vice-versa, as the case may be, all without charge.

B. The Contractor and Factory Representative of the AC units and major HVAC equipment shall place every item of such equipment into satisfactory operation with all automatic and safety devices. Further, all adjustment service required shall be performed during the warranty period. Adjustment services does not include lubricating fans or motors and does not include changing filters or adjusting belts.

C. In addition, submit equipment manufacturers' start-up reports for items listed above. See "Project Close-Out".

END OF SECTION

1.0 - GENERAL

1.1 SCOPE:

A. Include Section 15010, "GENERAL PROVISIONS - HVAC", with this Section.

2.0 - PRODUCTS

2.1 MATERIALS:

A. All pipe, fittings and valves shall be manufactured in the United States of America.

2.2 HVAC DRAIN PIPING:

A. Standard weight galvanized steel pipe ASTM A-120 with galvanized malleable iron fittings, type "L" hard copper with wrought copper sweat fittings or Schedule 40 PVC, at Contractor's option.

B. Provide drain traps for AC Unit drain pans. Size traps as required to drain under operating conditions.

2.3 REFRIGERATION PIPING:

A. ACR hard drawn copper tubing with wrought copper sweat fittings. Joints: Silfossed with continuous flow of dry nitrogen through lines.

B. Size suction and discharge lines so as to insure oil return at minimum loading.

C. Small lines 5/8" OD and smaller may be soft copper with flare fittings, provided that all joints are exposed for visual inspection.

D. Refrigerant piping shall be sized and installed as recommended by the equipment manufacturer. Provide lift traps or double suction risers as required for oil return.

2.4 PIPE HANGERS:

A. General: Pipe hangers, Grinnell, PHD, Michigan Hanger, or Elcen. Grinnell figure numbers are given for reference. Provide copper clad or plastic coated hangers on bare copper lines. Provide stainless steel or plastic coated hangers in Pool areas subject to chlorine atmosphere.

B. Equip pipe hangers with vibration isolators as specified under sub-section 2.15 "VIBRATION ISOLATORS".

C. Pipe hangers for lines 3" and smaller (other than steam and condensate lines), adjustable wrought ring hangers, Grinnell Fig. 97 or wrought clevis hangers, Grinnell Fig. 260.

D. Pipe hangers for lines 4" and larger (other than steam and condensate lines), adjustable wrought ring hangers, Grinnell Fig. 260.

E. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to)

trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.

F. Beam Clamps: Grinnell Fig. 229.

G. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Grinnell Fig. 282.

H. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (power driven anchors are not acceptable).

I. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8" and 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.

J. Space pipe hangers at maximum: 5' intervals for cast iron pipe. Pipe hanger spacing for screwed, solder joint and welded piping: 1/2", 6 ft.; 3/4" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3", 12 ft.; 4", 14 ft.; 5", 12 ft. 6", 10 ft., 8" and over, 6 ft. Polypropylene and PVC plastic pipe 4 ft. horizontally maximum or as directed by manufacturer if closer, and 10 ft. vertically. Install additional hangers at change of direction and valve clusters.

K. Install pipe hangers on insulated pipe (other than steam and condensate lines) over pipe covering. Provide factory fabricated insulated pipe shields equal to Pipe Shields, Inc. "Thermal Hanger Shields" at hangers. Provide shield insulation of waterproofed calcium silicate for hot water piping and foamglass for chilled water piping, same thickness as adjacent pipe covering. At Contractor's option, pipe shields may be field fabricated using waterproof calcium silicate or foam glass insulation with ASJ and 20 gauge galvanized steel protector. Shield length: 1.5 times nominal pipe size but not less than 4".

L. Wrap bare copper refrigerant lines with sheet lead at hangers.

2.5 VIBRATION ISOLATION:

A. General: Mount all piping and rotating equipment using vibration isolators as specified below. Amber Booth, Korfund, Mason Industries, Peabody, Vibration Eliminator Co., or VMC. Mason Industries part numbers are given for reference. Minimum 95% isolation efficiency.

B. Isolators for Suspended Equipment: Combination steel spring and rubber in shear isolators, #30N. Static deflections: As required to provide 95% isolation efficiency or 1" static deflection, whichever is greater. Provide isolators for all suspended rotating equipment.

C. Mount air handling unit sections in contact with concrete pad on single layer of ribbed neoprene on top of housekeeping pads as shown. Neoprene vibration pad shall cover the entire surface of the unit in contact with the concrete pad.

D. Provide snubbing isolators, similar to those specified above for pipe hangers for flexible connections at fans.

E. Bellows type flexible connections in water lines: Laminated 3-ply corrugated type 304 stainless joints designed for 150 psig WP. Joints shall be flanged with Van-Stone flanges and have 5" relaxed face-to-face dimension. For each joint furnish a control unit consisting of four plates, two tie bolts with required nuts, 1" deflection springs, washer, and stop and lock nuts. Flexible connections Keflex, Flexonics, or approved equal. Provide samples if specifically requested (samples will be returned to vendor).

F. Isolators for Pipe Hangers:

1. Equip all pipe hangers on chilled water, hot water and condenser water lines in equipment rooms with 1" static deflection combination neoprene and spring isolators, #PC-30N.

2. Mount piping riser supports on chilled water and hot water lines using 0.1" static deflection all directional neoprene anchors: #ADA.

G. Mount air handling unit sections in contact with concrete pad on single layer of ribbed neoprene on top of housekeeping pads as shown. Neoprene vibration pad shall cover the entire surface of the unit in contact with the concrete pad.

2.6 THERMOMETERS AND GAUGES:

A. Mercury in glass red reading separable socket industrial thermometers with die cast metal or high impact plastic casings of appropriate pattern for each installation, 9" scale lengths and ranges shown, Palmer, Trerice, Weksler, Marsh or equal. Install thermometers in brass or stainless steel wells. Equip thermometers installed in insulated lines with 1" extension stems or long enough to permit unions to clear insulation whichever is greater.

B. Where shown install brass thermometer wells with screwed caps. Install wells at an angle to retain oil. Size well to fit thermometers specified.

C. Enlarge pipe 2" and smaller to 2-1/2" at thermometers and thermometer wells.

D. Install 4-1/2" dial pressure gauges where shown. Gauges shall have bronze or stainless steel bourbon tubes, 316 stainless steel or brass movement, non-ferrous or phenolic solid front cases, and accuracy not less than 1% of full scale over the entire range. Gauges shall be Ashcroft, Trerice, Weksler, U.S., Marsh or equal. Gauge with minimum bourbon tube diameter of 3". Provide brass or stainless bar stock needle valves for all pressure gauges. Provide siphons for steam gages.

E. Where shown, provide temperature and pressure measurement plugs and caps, equal to Peteron Equipment Co., Inc. "Pete's plug with Nordel seats and seals", flow design or approved equal. Provide one Pressure and Temperature Kit consisting of 0-100 psi pressure gauge with adapters, two (2) thermometers (25E - 125E F and 0E - 220E F), all in carrying cases.

3.0 - EXECUTION

3.1 PIPE INSTALLATION:

A. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.

B. Provide welding material and labor in accordance with the welding procedures of

the Heating, Piping, and Air Conditioning Contractors' National Association or other approved procedure conforming to the requirements of ANSI B31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxactylene welding. Provide full perimeter wells at both face end and collar end of each slip-on flange.

C. Install piping to allow for expansion. Make connections to all equipment to eliminate undue strains in piping and equipment. Furnish necessary fittings and bends to avoid spring of pipes during assembly.

D. Pitch air conditioning unit drain lines down in direction of flow 1" in 20'.

E. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.

F. Make horizontal water and steam supply line size reductions using eccentric reducers with tops flat in water lines and bottoms flat in steam lines.

G. Install 3/4" ball or gate valve drains with hose adapters at low points of water piping and at bases of all risers or where shown provide large drains.

H. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment. Provide rubber grommets at pipe penetrations to equipment casings.

I. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulation unions or couplings, equal to EPCO.

J. Near heating and air conditioning equipment requiring water valved and capped water outlets of sizes shown, for connection to equipment, including reduced pressure principal backflow preventers shall be provided. Make final connections under HVAC work. Note that all piping and insulation downstream of backflow preventer must be painted yellow.

K. Run piping concealed, except where specifically shown or specified exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise. All piping shall be ran as high as practical and not on the floor unless otherwise indicated.

3.2 INSTALLATION OF VALVES:

A. Provide shut-off valves in supply and return to each item of equipment. Locate valves to isolate each item to facilitate maintenance and/or removal.

B. Provide check valve in discharge line adjacent to each pump.

C. Locate valves in piping connections to boilers, heat exchangers, water heaters, refrigeration machine, etc., so heads and tube bundles can be removed without disconnecting equipment or piping other than union or flange connections immediately adjacent to heat exchangers.

D. Provide seat to screw adapters where required.

3.3 REFRIGERATION SYSTEM:

A. Split Systems: When system is complete, but before the pipe covering has been installed, test components with dry nitrogen and make tight at equipment manufacturer's recommended test pressures. Then evacuate the system to 26" Hg. vacuum which the system shall hold for 24 hours. After passing the above tests, charge and leak test under operating conditions using electronic leak detector.

B. Split and Packaged Systems: Check operation of refrigeration cycle and report head pressure, suction pressure and oil pressure.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this section apply to all HVAC work.

2.0 - PRODUCTS

2.1 Specialties – Refrigerant

A. Install molded desiccant core filter dryer in each liquid line. Provide throw away dryers for lines 1/2" and smaller. Provide replaceable core dryers for lines 5/8" and larger. Dryers shall be Sporlan "Catchall".

B. Install moisture indicating sight glass in each liquid line.

C. Service valves: Wing cap valves, Henry, or approved equal.

D. Expansion valves: Thermostatic valves with external equalizers, Sporlan, or approved equal.

E. Hot gas bypass valves: Self-contained valves sized to pass gas flow at last step of compressor unloading and shall discharge between expansion valve outlet and distribution. Sporlan, or approved equal.

F. Install solenoid valve in each liquid and hot gas bypass line where recommended by manufacturer. Hot gas solenoid valve shall be equipped with a high temperature coil.

G. Install suction line accumulators in all outdoor heat pumps and condensing units where refrigerant lines exceed 85' in length, or where recommended by manufacturer.

H. Refrigerant circuit access ports located outdoors shall be fitted with locking-type, tamper-resistant caps. Provide owner with any tools necessary to un-lock the caps.

3.0 - EXECUTION

3.1 Installation

A. Specialties shall be installed in accordance with manufacturer's recommendations.

B. See Details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 SCOPE:

A. Include Section 15010 "GENERAL PROVISIONS - HVAC", with this Section.

B. Repair existing insulation at points of connection to existing work.

C. "Exposed" is defined as: Exposed to view when construction is complete. Items which are not "exposed" are "concealed".

D. "Attic" is defined as any ceiling space that is adjacent to the roof.

E. Insulate all items subject to sweating or loss of heat.

F. All insulation shall be installed by licensed applicator and applied in accordance with the Manufacturer's Recommendations.

1.2 INSULATION REQUIREMENTS:

A. Comply with NFPA 90A.

B. Pipe hanger shields are specified in Section 15050 "MATERIALS AND METHODS - HVAC".

C. Use insulation and adhesives with Underwriter's Laboratories flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding 50 for all other pipe, duct and equipment insulation.

2.0 - PRODUCTS

2.1 FOAM PLASTIC PIPE COVERING:

A. Fire retardant foamed plastic pipe covering, maximum K factory at 75EF mean temperature not exceeding 0.27 BTU/(hr) (sq. ft.) (EF/in). Armstrong "Armaflex II", or approved equal.

B. Pipe covering may be seamless insulation slipped over piping before erection or may be slit longitudinally and installed over erected piping.

C. Make fitting covers from segments of pipe covering.

D. Cement all joints and seams in accordance with manufacturer's instruction using Armstrong 520 adhesive.

E. Fit pipe hangers over insulation (See PIPE HANGERS). Use hanger shields as specified under pipe hangers.

F. Thermal performance shall be as follows:

1. 1" thick: R=4.2.
2. 2" thick: R=8.0.

2.2 ALUMINUM JACKET PIPING COVER:

A. 0.010" thick corrugated aluminum jacket with laminated polyethylene and draft paper adhered liner.

B. Securely rivet jacket in place and band with flat aluminum bands 18" o.c.

C. Finish fittings on aluminum jacketed lines with 1/8" thick (dry) coat of vinyl acrylic mastic reinforced with glass cloth.

2.3 DUCT INSULATION, INTERNAL:

A. Glass fiber acoustical/thermal insulation complying with NFPA 90A and UL 181 and having an erosion resistant anti-microbial membrane equal to Johns Manville, Linacoustic ARC@ on the air side. Edge coating shall be factory applied to the edges of the liner core. Shop fabrication cuts and field cuts or tears shall be coated with Superseal Duct Butter. NRC (1" thick) not less than 0.70, minimum density 3 lb/cu. ft., and maximum friction correction factor at 2000 fpm average velocity 1.15 (per TIMA test method AHS-1S2-76U). Thermal performance shall be as follows:

1. 1" thick: R=4.2.

2. 1 1/2" thick: R=6.3.

3. 2" thick: R=8.0.

2.4 DUCT INSULATION, EXTERNAL FOR CONCEALED:

A. Formaldehyde free flexible glass fiber insulation with foil-scrim-craft (FSK) facing equal to Johnson Manville Micro-Lite AXG@. Flame spread classification, 25 or less, smoke developed rating not exceeding 50. Minimum density, 3/4 lb./cu. ft., 3" thickness, installed R=8.3 minimum.

3.0 - EXECUTION

3.1 HVAC PIPING INSULATION:

A. Refrigerant Suction Lines and Hot Gas Bypass Lines: "Foam Plastic Pipe Covering", 1" thick. Jacket piping located outdoors or exposed to view with aluminum jacket.

B. AC Unit Drain Lines: "Foam Plastic Covering", 3/4" thick. Jacket piping located outdoors or exposed to view with aluminum jacket.

3.2 AIR TERMINAL DEVICES:

A. Ceiling Mounted Supply Diffusers: 2" thick duct insulation on back of diffuser, external for concealed.

B. Fire Dampers for Internally Lined Ducts and Externally Insulated Ducts: 2" thick duct insulation on all sides, external for concealed.

3.3 DUCT INSULATION INTERNAL (AND EXTERNAL WHERE INDICATED):

A. Apply in accordance with SMACNA "Duct Liner Application Standard" over full

coverage adhesive. Coat all edges with adhesive and seal all punctures or tears with mastic before installing ducts. Cut liner to assure overlapped and compressed longitudinal corner joints. Fasteners shall be sized appropriately for thickness of liner utilized. Provide mechanical fasteners and metal nosings as noted below:

1. For all velocities, provide metal nosings on upstream edge of liner at connections to equipment: Fans, coils, dampers, AC Units, sound absorbers, etc.

2. For velocities up to 2,000 feet per minute: Start fasteners within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and space them a maximum of 12"o.c. around the perimeter of the duct, except that they may be a maximum of 12" from a corner break. Elsewhere locate fasteners a maximum of 18" o.c., except that they shall be placed not more than 6" from a longitudinal joint of the liner nor more than 12" from a corner break.

3. For velocities from 2,001 to 4,000 feet per minute: Start fasteners within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and space them a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere locate fasteners a maximum of 16" o.c., except that they shall be placed not more than 6" from a longitudinal joints of the liner nor more than 12" from a corner break. In addition to the adhesive edge coating of transverse joints, coat and longitudinal joints with adhesive.

4. For velocities from 4,001 to 6,000 feet per minute: Same as 2 above except that metal nosing shall be installed to secure liner at all upstream transverse edges.

5. Duct size shown does not include allowance for insulation.

6. Where ducts are listed to be lined and wrapped, install wrap per section below "Duct Insulation, External, for Concealed Ducts"

B. Thickness and Extent:

1. Rectangular Return Duct: 1" thick.

2. Rectangular Exhaust Duct Connected to an ERU: 1" thick.

3. Exposed supply duct or exposed OSA duct connected to an ERU: 1" thick.

3.4 DUCT INSULATION, EXTERNAL, FOR CONCEALED DUCTS:

A. Adhere insulation to duct surface with approved adhesive applied in strips above 6" wide on approximately 12" centers. Flare door staples may be used for securing the insulation until the adhesive sets. Lap jacket and vapor seal all joints and seams with suitable mastic.

B. On rectangular and flat oval ducts 30" wide and wider, additionally support insulation with weld pins and speed clips 18" on centers. Seal weld pins with mastic and FSK tape.

C. Thickness and Extent:

1. Supply duct: 2" thick. Supply duct located in Attic: 3" thick.

2. ERU outside air duct: 2" thick. ERU outside air duct located in Attic: 3" thick.

3. Exhaust duct connected to exhaust fans.

4. 2 hour fire wrap on grease exhaust duct equal to Firemaster.

NOTE: Conical and straight spin-ins on both lined and unlined ducts shall be insulated. Insulation shall be slit at damper rods, at spin-ins and sealed vapor tight.

3.5 INSULATION WETTED DURING CONSTRUCTION:

A. Contractor shall replace any and all insulation wetted during construction at his own expense.

END OF SECTION

1.00 GENERAL:

1.01 DESCRIPTION OF WORK:

A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.02 REFERENCED CODES & STANDARDS:

A. The following codes and standards are referenced through out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867 including ozone chamber test required as of December 21, 2007

1.03 RELATED WORK:

1. Testing, Adjusting and Balancing
2. Facility Access and Protection
3. Ductwork
4. Filters
5. Water and Refrigerant Piping
6. Electrical Wiring
7. Control Wiring

1.04 QUALITY ASSURANCE:

A. Basis of design is Top Product Innovations. Global Plasma Solutions and Phenomenal Aire shall be considered equal subject to meeting all specifications herein.

B. The Air Purification System shall be a product of an established manufacturer within the USA.

C. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

D. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.

E. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2013 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted.

F. The Air Purification System have been tested by UL or Intertek/ETL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers shall submit their independent UL 867 test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

G. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.007 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.0042 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

1.05 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.

2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.

3. Performance data for each type of plasma device furnished.

4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2013 to validate acceptable indoor air quality at the quantity of outside air scheduled (when projects are designed with outside air reduction).

5. Product drawings detailing all physical, electrical and control requirements.

6. Copy of UL 867 independent ozone test.

B. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending.

B. Store in original cartons and protect from weather and construction work traffic.

C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.07 WARRANTY:

A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twenty-four months after shipment, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

2.00 PRODUCTS

2.01 GENERAL:

A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

B. Basis of Design: Top Product Innovations Type C unit

C. All other Suppliers of comparable products requesting prior approval shall:

1. Submit for prior approval in accordance with the requirements of Section 15010.

2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2013 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included.

3. Submit independent test data from ETL or UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.

2.02 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA"

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.

B. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).

2. Controlling gas phase contaminants generated from human occupants, building structure and furnishings.

3. Capable of reducing static space charges.

4. Increasing the interior ion levels, both positive and negative, to a minimum of 800 ions/cm^3 measured 5 feet from the floor.

C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable.

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.

2. Velocity Profile: The air purification device shall not have maximum velocity profile.

D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

E. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):

a. Each Plasma Generator with Bi-polar Ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity. Unit shall be capable of treating 6,000 CFM (C6.0) or 10,000 CFM (C10.0). Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, performance output reduction over time, ozone production and corrosion.

b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating. Electrodes shall be made from carbon fiber to prevent oxidation over time.

c. Electrode pair shall provide a minimum of 140 million ions per cubic centimeter (C6.0) or 200 million ions per cubic centimeter (C10.0), both positive and negative ions in equal quantities. Devices providing less than the rated ion densities shall not be acceptable.

F. Air Handler Mounted Units:

1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it to the AHU control power (24VAC) as instructed by the Air Purification Manufacturer's instructions or line voltage subject to power available. Each unit shall be designed with an integral illuminated LED and dry contacts to prove ion output is operating properly. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per AHU is required to interface to the BAS or the optional DDC controller. Dry contacts proving power has been applied in lieu of the ion output is actually operating, are not acceptable.

G. Plenum/Duct Mounted Units: Where so indicated on the plans and/or schedules, Plasma Generators(s) shall be supplied and installed. The generator shall be installed through the duct wall and into the air stream with the external power head in a convenient location for visual indication of power, removal and servicing, by the mechanical contractor. The dry contacts shall close to prove the ion generator is working properly and may be daisy chained in series such that only one dry contact per duct is required to interface to the BAS or the optional DDC controller.

H. Ionization Requirements:

1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.

a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed and powered by 24VAC.

b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced. Imbalanced levels shall not be acceptable.

c. Ionization output from each electrode shall be a minimum of 140 million ions/cc (C6.0) and 200 million ions/cc (C10.0) when tested at 1" from the ionization generator.

d. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

A. MRSA - >96% in 30 minutes or less
B. E.coli - > 99% in 15 minutes or less
C. TB - > 69% in 60 minutes or less
D. C. diff - >86% in 30 minutes or less

Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELEC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable.

2. Ozone Generation:
The operation of the electrodes or Bi-polar ionization units shall conform to UL 867-2007 with respect to ozone generation. There shall be no ozone generation during any operating condition, with or without airflow.

I. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

J. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.

2. Integral airflow sensing shall modulate the Plasma output as the air flow varies or stops. A mechanical air flow switch shall not be acceptable as a means to activate the Plasma device due to high failure rates and possible pressure reversal.

3. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

4. All Plasma devices shall have a means to interface with the BAS system. Dry contacts shall be provided to prove there are ions being produced. Systems providing indication that power is applied to the Plasma device, but not directly sensing the power at the ion output, shall not be acceptable.

5. Plasma systems that use multiple modules with ion output alarm wires wired to the same terminal such that all ion modules must fail to show an alarm status shall not be acceptable.

3.00 EXECUTION:

3.01 GENERAL:

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.02 ASSEMBLY & ERECTION: PLASMA GENERATOR WITH BI-POLAR IONIZATION:

A. All equipment shall be assembled and installed in a workman like manner to the satisfaction of the owner, architect, and engineer.

B. Any material damaged by handling, water or moisture shall be replaced, by the mechanical contractor, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.03 TESTING:

A. Provide the manufacturers recommended electrical tests.

3.04 COMMISSIONING & TRAINING:

A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this Section shall apply to all HVAC work.

2.0 - PRODUCTS

2.1 Coils

A. ARI Standard 410-89 rated with capacities and dimensions shown.

B. Provide coils with aluminum fins and seamless copper tubes.

C. Headers may be iron castings or steel or copper tubing. Braze return bends.

D. Space fins not closer than 10 per inch, maximum coil depth of 8 rows.

E. Prove coils tight with 200 psig under water air test.

F. Coil casings: Stainless steel and flanges drilled for mounting.

3.0 - EXECUTION

3.1 Installation

A. Coils shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this Section shall apply to all HVAC work.

2.0 – PRODUCTS

2.1 Heat Pump - (MINI-Split)

A. The Heat Pump system shall be a Trane, Daikin, Carrier or approved equal split system with Variable Speed Inverter Compressor technology. The system shall consist of a ceiling-suspended indoor section with wired, wall mounted controller and a horizontal discharge, single phase outdoor unit.

B. Quality Assurance

1. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

2. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

3. The units shall be rated in accordance with Air-conditioning Refrigeration Institute's (ARI) Standard 210 and bear the ARI Certification label.

4. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

5. A dry air holding charge shall be provided in the indoor section.

6. The outdoor unit shall be pre-charged with R-410a refrigerant.

7. System efficiency shall meet or exceed 13.0 SEER.

C. Delivery, Storage and Handling

1. Unit shall be stored and handled according to the manufacturer's recommendations.

2. The wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without
adverse effect.

D. Warranty

1. The units shall have a manufacturer's parts and defects warranty for a period one (1) year from date of installation. The compressor shall have a warranty of 6 years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

2. Manufacturer shall have over 25 years of continuous experience in the

U.S. market.

E. Performance

1. Each system shall perform in accordance to the ratings shown in the table below. Cooling performance shall be based on 80°F DB, 67°F WB (26.7°C DB, 19.4°C WB) for the indoor unit and 95°F DB, 75°F WB (35°C DB, 29.3°C WB) for the outdoor unit. Heating performance shall be based on 70°F DB, 60°F WB (21.1°C DB, 15.6°C WB) for the indoor unit and 47°F DB, 15°F WB (8.3°C DB, 6.1°C WB) for the outdoor unit.

F. Indoor Unit

1. The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

2. Unit Cabinet

The casing shall be ABS plastic and have a Munsell 0.70Y 8.59/0.97 finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.

3. Fan

The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four (4) speeds: Low, M1, M2, and Hi.

4. Vane

There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five (5) vertical airflow patterns selected by remote control: 100% horizontal flow, 80% horizontal flow (plus 20% downward airflow), 60% horizontal airflow (plus 40% downward airflow), 40% horizontal airflow (plus 60% downward airflow), and swing. The horizontal vane shall significantly decrease downward air resistance for lower noise levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.

5. Filter

Return air shall be filtered by means of an easily removable washable filter.

6. Coil

The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver

alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.

7. Electrical

The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The power to the indoor unit shall have an option of being supplied from the outdoor unit, using Mitsubishi Electric A-Control system or separate power source for indoor and outdoor units.

8. Control

a. The control system shall consist of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices.

b. For A-Control, a three (3) conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

c. Where separate power is supplied to the indoor and outdoor units, a two (2) 20 ga. AWG wire shall be run between the units to provide forbid-directional control communication..

d. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

e. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.

f. The indoor unit shall be connected to a wall mounted wired controller to perform input functions necessary to operate the system. The wired controller shall have a large multi-language DOT liquid crystal display (LCD) presenting contents in eight (8) different languages, including English, French, Chinese, German, Japanese, Spanish, Russian, and Italian.

g. There shall be a built-in weekly timer with up to eight pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Dry/Fan mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Vane Position selector, a Louver Swing button, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C). Temperature changes shall be by increments of 1°F (1°C) with a range of 67°F to 87°F (19°C to 30°C).

h. The wired controller shall display operating conditions such as set temperature, room temperature, pipe temperatures (i.e. liquid,

discharge, indoor and outdoor), compressor operating conditions (including running current, frequency, input voltage, On/Off status and operating time), LEV opening pulses, sub cooling and discharge super heat.

i. Normal operation of the wired controller shall provide individual system control in which one wired controller and one indoor unit are installed in the same room. The controller shall have the capability of controlling up to a maximum of sixteen systems at a maximum developed control cable distance of 1,500 feet (500 meters).

j. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Up to two wired controllers shall be able to be used to control one unit.

k. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off and mode switching. The controller shall have the capability to provide sequential starting with up to fifty seconds delay.

G. Outdoor Unit

1. The outdoor unit shall be compatible with the three different types of indoor units (PKA - wall mounted, PCA - ceiling suspending, and PLA - four way ceiling cassette). The connected indoor unit must be of the same capacity as the outdoor unit.

2. Models PUY-A24NHA and PUY-A36NHA shall have the option to connect to two indoor units, within the same confined space, to improve air distribution (total capacity shall be equivalent to outdoor unit).

3. The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions.

4. The outdoor unit shall be capable of operating at 0°F (-18°C) ambient temperature
without additional low ambient controls (optional wind baffle may be required).

5. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.

6. System shall have a maximum refrigerant tubing length of 165 feet (50 meters) between indoor and outdoor units without the need for line size changes, traps or additional oil.

7. Models PUZ-A24NHA, PUZ-A30NHA and PUZ-A36NHA shall be pre-charged for a maximum of 70 feet (20 meters) of refrigerant tubing. Model PUZ-A42NHA shall be pre-charged for a maximum of 100 feet (30 meters) of refrigerant tubing. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

8. Cabinet

The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a munsell 3Y

7.8/1.1 finish. The fan grille shall be of ABS plastic.

9. Fan

Models PUZ-A24NHA, PUZ-A30NHA, and PUZ-A36NHA shall be furnished with an AC fan motor. Model PUZ-A42NHA shall have two (2) DC fan motors. The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.

10. Coil

The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.

11. Compressor

The compressor for models PUY-A24NHA, PUY-A30NHA and PUY-A36NHA shall be a DC rotary compressor with Variable Compressor Speed Inverter Technology. The compressor for model PUY-A42NHA shall be a scroll compressor with variable speed technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

12. Electrical

The electrical power of the unit shall be 208volts or 230 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

2.2 <u>HEAT PUMP-VERTICAL WALL MOUNTED:</u>

A. Furnish and install a self-contained wall mount air-to-air heat pump suitable for outdoor use. Unit shall be manufactured by Marvair, Bard or approved equal. The wall mount unit shall be completely factory assembled and tested, and shall include compressor, indoor and outdoor coils, fans, motors, hot gas reheat coils, exhaust fans, commercial ventilators as required, prewired controls, interconnecting refrigerant tubing, wiring, disconnects, and other necessary components mounted in a corrosion resistant cabinet. Unit shall be shipped from the factory with a full operating R-410A refrigerant and oil charge. All field wiring shall be in accordance with the National Electric Code and local codes.

B. The complete package shall be ETL Listed and tested to UL Standard 1995, 2nd

Edition and CAN/CSA-C22.2 No. 236-95 2nd Edition for safety. The unit shall be certified to the current version of the Air Conditioning and Refrigeration Institute (ARI) Standard 390. The manufacturer of the heat pump shall be ISO 9001 2000 certified.

C. COOLING. Rated at ARI standard 390.

D. HEATING. Rated at ARI standard 390. Supplemental electric heat shall be provided to satisfy heat loss at winter design conditions.

E. The exterior cabinet shall be constructed of 20 gauge zinc-coated, galvanized G60 steel with a satin beige polyester finish and shall meet the corrosion protection requirements of ASTM standard A 653/A. The finish shall be highly resistant to abrasion, metal marking, staining, pressure mottling and require minimal maintenance. The cabinet shall include a sloped top and built-in mounting flanges. The conditioned air section shall be insulated with 1/2 inch, 2 pound dual density fiberglass.

F. Cooling: Scroll compressors for quiet, efficient cooling. Designed with R-410A (HFC) non ozone depleting refrigerant in compliance with the Montreal protocol and 2010 EPA requirements. A liquid line filter-drier to protect the system from moisture is standard on all units
M1, M2, and Hi.

G. The outdoor coil shall be constructed of aluminum plate fins mechanically bonded to seamless copper tubes.

H. Outdoor fan shall be direct driven, propeller type for quiet operation. The outdoor motor shall be equipped with a thermal protector. The condenser shall be horizontal discharge design with a heavy duty vinyl coated wire coil guard.

I. The indoor coil shall be constructed of aluminum plate fins mechanically bonded to seamless copper tubes.

J. The indoor blower motor shall be an electronically commutated type motor. The motor's control shall be encapsulated to prevent water from reaching its electronic components. The motor shall automatically deliver constant airflow over a wide range of external static pressures by changing its torque and speed without external sensors. The motor shall be factory programmed to slowly ramp up the speed to eliminate the abrupt change in sound when the motor starts.

K. An integrated circuit board shall provide control of the indoor blower motor, the compressor, the high refrigerant pressure switch, the low refrigerant pressure switch, compressor short cycle protection, the defrost cycle, the ventilator and amount of outside air and exhaust air and the dehumidification cycle. In addition, for heat pumps with electric resistance second stage heat, the circuit board shall control the operation of the electric heat during the defrost cycle and when the compressor is operating.

L. The heat pump shall have a factory installed disconnect on all models designed for use on 208/230V power supply. A disconnect shall be available on all models designed for a 460V power supply.

M. The return air filter grille shall be an aluminum grille (color by Architect) with integral filter, factory provided.

N. HOT GAS REHEAT DEHUMIDIFICATION. The heat pump shall have hot gas reheat coil to allow dehumidification through continued cooling with supply air reheated to avoid over cooling the room. The hot gas reheat (HGR) coil shall be

constructed of aluminum plate fin mechanically bonded to seamless copper tubes. The HGR coil shall be sized to provide a heating capacity to keep space from over cooling.

O. Digital Humidity Controller. The hot gas reheat function shall be controlled by a programmable humidity controller. Controller shall be capable of setting the time of day for dehumidification function. Controller shall have permanent memory retention of set points and be capable of field calibration. Controller shall have field selectable high & low dehumidification set points. Outdoor temperature and humidity sensor shall be included. Controller shall display temperature in either °F or °C.

P. Heat pump thermostat shall be a digital, programmable thermostat. Two stage heat/Two stage cool. Manual or auto changeover. Fan: Auto & On. Permanent retention of setting on power loss. Field adjustable temperature calibration. Adjustable max. setpoint for heating and min. adjustable setpoints for cooling with external signal for start/stop. Adjustable temperature differential. Keypad lockout. Status LED. °F or °C selectable.

Q. All external control devices shall be wired to the appropriate terminals within the heat pump's control box.

R. Heat Pumps shall be Marvair, Bard or approved equal.

2.3 HEAT PUMP - SINGLE PACKAGE:

A. Each unit shall be UL listed, ARI certified horizontal single package air to air heat pump unit designed for outdoor installation. All operating components shall be mounted on vibration isolators and assembled together in a weatherproof casing designed for outdoor installation. Casing shall be curb mounted and supply and return air ducts shall pierce the bottom of the unit within the curb.

B. Casing shall be constructed of galvanized steel not lighter than 18 gauge with epoxy primer and baked enamel finish. Portions of casing in contact with return or supply air shall have 1" thick fiberglass insulation. Casing shall be mounted on galvanized steel curb mounting frame contoured to fit unit. Mounting frame shall be equipped with a wood nailer for flashing attachment.

C. Components shall include hermetic compressors with crankcase heater, low ambient controls for use down to temperatures scheduled, safety cutouts for high and low pressure and motor temperature, defrost controls, outdoor coil with centrifugal or propeller fan motor and drive, and attendant change over valves, refrigeration piping and specialties. Outdoor fan shall be equipped with discharge guard.

D. Components shall include indoor coil with centrifugal fan with adjustable speed V belt drive sized for 50% overload and heater section with electric resistance heaters. All sheet metal parts of heater section located in air stream shall be aluminized or galvanized steel. Heaters shall be listed in the Underwriters Laboratories, Inc, Electrical Appliance and Utilization Equipment List. Heaters shall have ceramic supported nichrome wire elements, control box and 1/2" insulation between casing and control box. Provide spaces at terminal end of heater so that internal duct insulation will not cause hot spots. Provide NEMA I control boxes for indoor heaters and weather tight control boxes for heaters located outdoors. Connections between control box and duct shall be airtight under 1" WG static pressure. Control box shall contain 3 phase contactors for 3 phase heaters and single phase contactors for single phase heaters. Contactors shall be factory wired to terminal strips. Heaters shall have factory wired automatic high limit control and bulb and capillary type and in addition a supplementary independent thermal

device shall be provided to disconnect all power circuits in case automatic high limit fails.

E. Filter section with 2" throwaway filters shall be provided.

F. Provide comparative enthalpy economizers with low leak dampers where called for. Provide relief fan or barometric relief dampers where called for.

G. Two position outside damper motor with adjustable minimum position switch and outside air return air dampers shall be provided for each unit.

H. Provide five (5) year non pro rated compressor parts warranty.

I. Shall be manufacturer by Trane, Carrier, Daikin or approved equal.

3.0 - EXECUTION

3.1 Installation

A. Heat pumps shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

1.00 GENERAL:

1.01 SCOPE:

A. Provisions of this section apply to all HVAC work.

2.00 PRODUCTS:

2.01 PACKAGED ENERGY RECOVERY UNITS (DX COOLING / ELECTRICAL HEAT):

2.02 ACCEPTABLE MANUFACTURERS:

A. The contractor shall furnish and install packaged outdoor air unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Valent, Trane, Daikin, or approved equal.

2.03 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be packaged outdoor air unit (s) as scheduled on contract documents and these specifications. Unit(s) shall consist of an enthalpy wheel with a permanently bonded silica gel desiccant coating. The wheel design shall consist of removable segments mounted in a stainless steel rotor and insure laminar flow. insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, air filters, Blowers shall be quiet running, forward curved type and enable independent balancing of exhaust and supply airflows by providing separate motors for exhaust and supply blowers with adjustable sheaves. All internal electrical components shall be prewired for single point power connection. Weather proof disconnect and motor starters shall be supplied as standard components.

B. For units greater than 30 nominal tons cooling, the condenser coils must be aluminum fin, mechanically bonded to copper tubing. For units 30 tons or less, coil shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion-resistant coating.

C. Direct-drive, vertical discharge condenser fans must be provided with built-in thermal overload protection.

D. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

E. Unit(s) shall be dedicated downflow or dedicated, thru curb horizontal airflow as manufactured.

F. Wiring internal to the unit shall be colored and numbered for identification.

2.04 UNIT CASING

A. Cabinet: Zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned,

phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B45. Structural members shall be a minimum of 16 gauge with access doors and removable panels of minimum 20 gauge.

B. Panels: 2" double-wall foamed panel construction throughout the indoor section of unit to provide nonporous, cleanable interior surfaces. All interior seams exposed to airflow shall be sealed.

C. Insulation: 2"metal encapsulated with no exposed edges. Initial R value of 6.6 per inch of thickness.

D. Cabinet construction shall provide access panels for all parts requiring service

E. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket-sealed.

F. Panels: Water- and air-tight hinged panels with handles shall provide access to filters, heating section; optional ERV and power exhaust fan section, supply air fan section, evaporator coil section, and unit control section. Door hardware shall be oriented to allow the door swing to be reversed. Latches with hold down hooks will be factory installed on hinged access doors.

G. Type 304 Stainless steel drain pan sloped in two directions to ensure positive drainage. Pan shall have a minimum depth of 2". Seams exposed to standing water shall be welded liquid tight. Base of pan shall be insulated with 1" thick foam insulation.

H. Provide openings either on side of unit or thru the base for power, control and gas connections.

I. The base of the unit shall have provisions for forklift and crane lifting

J. If a plenum curb is provided, a full perimeter OSHA compliant catwalk shall be provided in order to access unit components without the need for a ladder or scaffolding.

2.05 POWER WIRING

A. Field wiring access to be provided thru unit base into isolated enclosure with removable cover.

B. Power wiring to be single point connection.

C. Unit shall be factory wired to field wiring terminal block mounted in isolated enclosure.

D. Factory mount and wire unit main power disconnect device overcurrent and SCCA rated for total unit power connection

E. Factory installed safety barrier shall isolate all high voltage components, mounted inside electrical compartment, to protect service personnel from incidental contact.

F. Factory to mount and wire optional 120 volt convenience outlet. Field wiring of convenience outlet not acceptable.

G. Factory mount and wire all necessary controls required for control sequence specified (see 15900 Controls). Coordinate with controls sub contractor.

2.06 FANS AND MOTORS

A. Indoor fan shall be direct drive plenum fan, factory installed and wired to on-board Variable Frequency Drive and shall be equipped with slide out service access.

B. All fan motors shall meet the U.S. Energy Policy Act of 2005/10 (EPACT).

C. All fan motors shall either be permanently lubricated and/ or have internal thermal overload protection.

D. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

E. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.07 ELECTRIC HEATING SECTION

A. Electric Heaters:

1. All heaters shall be listed in the Underwriters Laboratories, Inc. Electrical Appliance and Utilization Equipment list.

2. Heaters shall have ceramic supported nichrome wire elements, flanged mounting plate, NEMA I control box containing contactors for heaters, factory wired to terminal strips and 1/2" insulation between mounting plate and control box. All sheet metal parts in air stream aluminized or galvanized steel. Provide spaces at terminal end of heater so that internal duct insulation will not cause hot spots.

3. Equip heaters with factory wired automatic high limit control and a supplementary independent thermal device to disconnect all power circuits in case automatic high limit fails. Equip heaters shall be supplied with control circuits suitable for 24 volt control, factory wired to terminal blocks in control box.

4. Provide staging as required by Code, but no fewer stages than those shown.

2.08 EVAPORATOR CONDENSOR AND REHEAT COILS

A. Evaporator coils shall be constructed of copper tubes mechanically bonded to a configured aluminum plate fin. For units greater than 30 nominal tons cooling, the hot gas reheat coils must be aluminum fin, mechanically bonded to copper tubing. For units 30 tons or less, hot gas reheat coil shall have a series of flat tubes containing a series of multiple, parallel flow microchannels layered between the refrigerant manifolds. Coil construction shall consist of aluminum alloys for fins, tubes, and manifolds in combination with a corrosion-resistant coating.

B. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil, reheat coil and condenser coil shall be leak tested to 500 psig and pressure tested to 500 psig.

C. The condenser coil shall have a fin designed for ease of cleaning.

D. Evaporator coil shall have six interlaced rows for superior sensible and latent cooling.

E. Reheat coil shall be fully integrated into the supply air and fan system and capable of delivering design supply air temperature.

F. To prevent re-evaporation of condensate from evaporator coil, the evaporator coil face and the

hot gas reheat coil face shall be separated a minimum of six inches.

2.09 CONDENSER SECTION

A. Outdoor Fans: vertical discharge, direct drive fans with polymer blades. Fans shall be statically balanced.

2.10 REFRIGERANT CAPACITY CONTROL

A. Units with scroll compressors shall be equipped with Refrigerant Capacity Control (RCC) on the lead circuit to modulate compressor capacity during Dehumidification or Cooling modes to maintain evaporator Dehumidification or Cooling setpoint and prevent evaporator frosting or freezing. RCC shall be (standard mechanical / optional electrical).

B. The RCC setpoint is factory set, and field adjustable, to maintain desired suction pressure and compressor discharge pressure.

C. Capacity control for units equipped with digital scroll compressors, or variable speed compressors, shall be accomplished through compressor controls.

2.11 REFRIGERATION SYSTEM

A. Compressor(s): All units shall have direct-drive, hermetic, scroll type compressors or digital scroll with centrifugal type oil pumps.

B. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage.

C. Internal overloads shall be provided with the scroll compressors.

D. Each compressor shall have a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

E. Provide each unit with minimum of (2) hermetically sealed refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, liquid line charging port, suction and liquid line pressure ports.

2.12 POWER EXHAUST/RETURN SECTION

A. Provide, a factory supplied field installed power exhaust assembly that shall be designed to ventilate return air to atmosphere.

B. Fan wheel shall be airfoil configuration welded aluminum. Other fan construction not acceptable.

C. Direct drive motor, VFD control and plenum fan shall comply with section 204. Fan mount to be fixed.

D. Exhaust to ventilate through automatic louver located on side of unit cabinet.

2.13 OUTDOOR AIR SECTION (ERV)

Energy Recovery Wheel

A. The rotating wheel heat exchanger shall be composed of a rotating cylinder in an insulated cassette frame complete with seals, drive motor and drive belt.

B. The total energy wheel shall be coated with silica gel desiccant permanently bonded by a patented and proprietary process without the use of binders or adhesives, which may degrade desiccant performance

C. The substrate shall be a lightweight polymer and will not degrade nor require additional coatings for applications in marine or coastal environments. Coated segments should be washable with detergent or alkaline coil cleaner and water. Desiccant will not dissolve nor deliquesce in the presence of water or high humidity.

D. As the wheel rotates between the ventilation and exhaust air stream it picks should pick up sensible and latent heat energy and release it under the colder air stream. The driving force behind the exchange is the difference in temperature between the opposing air streams which is also called the thermal gradient.

E. A face and bypass damper shall be provided in parallel with the media for economizer and frost control.

Enthalpic Plate – Core heat exchanger (where called for)

A. Energy recovery shall be an integral part of unit from the manufacturer. No field assembly, ducting, or wiring shall be required with the energy recovery option.

B. Latent and sensible energy transfer shall be provided through a flat-plate heat exchanger core, with a minimum total energy recovery effectiveness of 50% tested and certified to AHRI 1060-2005. No additional moving parts or drive mechanisms shall be required to enable energy recovery.

C. The heat exchanger frame shall be constructed with extruded 6063 aluminum rails.

D. The heat exchanger core shall be constructed of a polymer membrane with a 0.5% exhaust air transfer ratio (EATR) tested and certified to AHRI 1060-2005.

E. The core shall be capable of handling regular contact with liquid water from either condensation or periodic cleaning while maintaining both the energy recovery effectiveness and 0.5% EATR rating.

F. The core shall be mold and bacteria resistance tested to ISO 846a and 846c with a rating of 0 for both.

G. The core shall be freeze tolerance tested to 40 freeze thaw cycles from -4°F to +68°F while maintaining both the energy recovery effectiveness and 0.5% EATR rating.

H. The heat exchanger core shall comply with UL 723 and have a flame spread index of 25 or less and a smoke index of 50 or less.

I. Stainless steel drain pans shall be provided under entire heat exchanger to catch and drain condensation or water used in periodic cleaning.

J. Energy recovery media shall be accessible through a 2" thick, foam-injected, double-wall, hinged access door with quarter-turn latches.

K. A face and bypass damper shall be provided in parallel with the media for economizer and frost

control.

2.14 ROOF CURB

A. Contractor shall provide factory supplied roof curb, 18 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.

B. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

3.00 EXECUTION:

3.01 INSTALLATION:

A. Units shall be installed in accordance with manufacturer's recommendations.

B. See Details for mounting instructions and accessories.

C. Manufacturer shall provide field start-up of all units.

END OF SECTION

1.0 GENERAL:

1.1 SCOPE:

A. Provisions of this Section shall apply to all HVAC work.

2.0 PRODUCTS:

2.1 HOT GAS REHEAT PACKAGED ROOF TOP AIR CONDITIONING UNITS

A. Unit(s) furnished and installed shall be cooling with hot gas reheat as scheduled on contract documents and these specifications. Unit(s) shall consist of insulated weather tight casing with compressor(s), hot gas reheat coil, modulating face and by-pass dampers for hot gas reheat control, air cooled condenser coil, condenser fans, evaporator coil, return air filters, supply motors and drives, and DDC microprocessor controls . The DDC controller must control and modulate Face and By-pass dampers for discharge air temperature, or space temperature, or space humidity control.

B. Unit(s) shall be factory run tested and fully charged with R-410a.

C. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

D. Units shall be dedicated downflow or dedicated horizontal airflow as shown on plans.

E. Wiring internal to the unit shall be colored and numbered for identification.

F. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge. **Unit construction shall be Double-wall** with insulation sandwiched between inner and outer wall. No insulation shall be in the airstream. Double wall panels must be easily removable with separable panels to inspect the sandwiched fiberglass insulation. Provide horizontal discharge curbs as required.

G. Units cabinet surface shall be tested 500 hours in salt spray test in compliance with ASTM B117.

H. Cabinet construction shall allow for all service/ maintenance from one side of the unit. Insulation on the doors must not be exposed to the airstream. Unit must be double-wall construction.

I. Cabinet top cover shall be one piece construction or where seams exist, it shall be double hemmed and gasket sealed.

J. Access Panels: Water and air tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.

K. Downflow unit's base pans shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.

L. Insulation: Provide 1/2 inch thick coated fiberglass insulation sandwiched between outer and inner double walls on all exterior panels in contact with the return and conditioned air stream.

M. The base of the unit shall have provisions for forklift and crane lifting.

N. Air Filters: 30% efficient factory installed filters shall mount integral within the unit and shall be accessible thru access panels. Two inch thick pleated media glass fiber disposable media filters shall be provided.

O. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.

P. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.

Q. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.

R. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.

S. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

T. Provide heavy duty nickel chromium heating elements internally wired. Heater shall have pilot duty or automatic reset line voltage limit controls and any circuit carrying more than 48 amps shall have fuse protection in compliance with N.E.C.

U. Heater shall be factory supplied and field installed internal to unit cabinet.

V. Heater shall be UL and CSA listed and approved and provide single point power connection.

W. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.

X. Provide a thermal expansion valve for each refrigeration circuit. Factory pressure test at 450 psig and leak tested at 200 psig.

Y. Provide drain pan for base of evaporator coil constructed of PVC or galvanized steel with external connections.

Z. Provide a hot gas reheat coil mounted after the fan discharge with a modulating face and by-pass damper to modulate air thru or around reheat coil as needed to meet programmed air temperature or humidity setpoint. Hot gas reheat coil must be piped in series to condenser coil. Parallel piping is unacceptable.

AA. The **Hot Gas Reheat Coil must be mounted at least 24" away from the DX coil** to prevent radiated heat from evaporating moisture back into the air stream.

BB. The DX coil must be **intertwined**; horizontal split coils are not acceptable. The vendor will be responsible for changing the coil out in the field if a horizontal coil is substituted with or without approved submittals.

CC. Provide internally finned 3/8 " seamless copper tube mechanically bonded to aluminum fins. Factory pressure tested to 450 psig.

DD. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced.

Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

EE. Compressor(s): Provide scroll compressors with direct drive operating at 3600 rpm. Integral centrifugal oil pump, inlet dirt separator, rolling element bearings, crankcase heater, completely enclosed compression chamber with no leakage paths. Provide suction gas cooled motor with over temperature and over current protection.

FF. Compressor(s) shall be manufactured by the HVAC unit manufacturer.

GG. Units shall have cooling capabilities down to 60° F.

HH. Provide with thermostatic temperature control in the compressor windings, to protect against excessive temperatures, high and low pressure conditions.

II. Provide 100% outside air hood with birdscreen and multi position osa damper with air flow measuring station (RTU-KIT).

JJ. Provide Differential Enthalpy controlled economizer and barometric relief damper.

KK. Provide microprocessor unit mounted control (UCM) which when used with an electronic discharge air sensor mounted on the DX coil provides proportional, integral, and derivative supply air control. This UCM shall perform all unit functions by making all heating, cooling and ventilating decisions through resident software logic. The microprocessor shall include several temperature functions. A discharge air sensor mounted after the evaporator coil shall maintain the specified dehumidification temperature. The second temperature sensor shall modulate the hot gas reheat coil face and by pass damper to maintain the specified supply or space air temperature. The third temperature sensor shall monitor suction temperature and lockout compressors to keep the evaporator coil from freezing. The fourth temperature sensor shall monitor liquid line temperature to modulate condenser fans to maintain head pressure. The fifth sensor is a space adjustable temperature or humidity input. The last temperature sensor monitors outdoor air temperature and makes the decision on when to lock out the compressors. All functions of the microprocessor shall be fully programmable and have the capability to be monitored and adjusted thru a laptop computer and/or remote LCD keypad. The UCM shall be Bacnet compatible.

LL. Units shall be Trane, Carrier, Daikin or approved equal.

3.0 EXECUTION:

3.1 INSTALLATION:

A. Units shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF ROOF-TOP UNITS - HVAC

1.0 - GENERAL

1.1 Scope

A. Provisions of this Section shall apply to all HVAC work.

2.0 - PRODUCTS

2.1 Electric Wall Heaters:

A. UL listed recessed convection heaters with finned sheathed heating elements, resiliently mounted direct driven propeller fan with motor heat shield, circuit breaker, concealed thermostat, concealed "On-Off" switch, high limit controls, and junction box for connecting power wiring.

B. Cabinets: 16-gauge steel, with pencil proof welded steel bar grilles (bars 1/16" X 3/8" minimum). Equip cabinet with adjustable recessing frame. Finish: Baked enamel, over bonderizing. Architect will select the color from manufacturer's standard selections.

C. Electric Wall Heaters: 2 KW and larger, Markel 3400 Series, less than 2 KW, Markel Series 3420, or approved equal.

3.0 - EXECUTION

3.1 Installation

A. Units shall be installed in accordance with manufacturer's recommendations.

B. See Details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this Section shall apply to all HVAC work.

2.0 - PRODUCTS

2.1 Fans, Centrifugal – General

A. Fan Rating: Certified in accordance with AMCA Standard 210 for capacity and sound. Provide fans of class required for service based on static pressures 20% greater than those scheduled. All fans are to be rated for continuous duty.

B. Provide forward curved blade, radial blade, backward curved blade or air foil blade fans statically and dynamically balanced with L (10) 80,000 hour rated self-aligning, grease lubricated ball or roller bearings rigidly supported by bearing stands.

C. For all fans furnish adjustable motor bases or rails.

D. Size V-belt drives for 50% overload, and provide adjustable pitch motor pulleys for drives of 15 BHP and smaller.

E. For all fans outside casings provide belt and drive guards.

F. Provide scroll access doors with quick-operating latches for all exhaust fans.

G. Equip all fans with flanged outlets and casing drains.

H. Sound power levels shall not exceed those shown.

I. Size fan motors to provide at least 5% drive loss, with motor service factors not exceeding 1.0. Provide premium efficiency motors as specified under "MOTORS".

J. Vibration isolators: See "MATERIALS AND METHODS" Section 15050.

2.2 FANS, CENTRIFUGAL ROOF EXHAUST:

A. Centrifugal power roof ventilators with AMCA certified air and sound ratings, belt or direct driven as shown. Provide permanently oiled bearings, statically and dynamically balanced backward curved blade wheels and spun aluminum housing with curb cap, disconnect switches, back-draft damper and outlet birdscreen. For belt driven fans provide V-belt drive sized for 50% overload, adjustable pitch motor pulley and adjustable motor base. For each fan furnish an 18 gauge galvanized steel insulated prefabricated curb with integral cant. Furnish baffled sound absorbing curbs where required to obtain noise level specified. Static pressure scheduled are external to sound curbs.

B. For kitchen range hood furnish up-blast discharge fan without sound curb, UL-762 labeled for grease laden air and fan wheels are to be Teflon coated. Fan shall be hinged onto curb for access to cleaning the fan.

C. All roof mounted fans to be factory painted to match louvers, color by Architect

D. Fans shall be manufactured by Greenheck, Cook, Acme, Penn, or approved equal.

3.0 - EXECUTION

3.1 Installation

A. Fans shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Include Section 15010, "GENERAL PROVISIONS - HVAC", with this section.

B. Provisions of this Section shall apply to all HVAC work.

1.2 Shop Drawings

A. Ductwork shop drawings shall include details of duct constructions: seams, joints, gauges, reinforcing and hanger details for each pressure class and size range together with details of turning vanes, branch connections, dampers and access doors and elevations of all ductwork.

2.0 - PRODUCTS

2.1 Ductwork – General

A. Unless otherwise shown or specified construct ducts of galvanized steel sheet metal using gauges and recommended details as contained in the current edition of the SMACNA HVAC Duct Construction Standards. Ductwork shall include supply air, exhaust air, return air, and outdoor air ducts, together with all necessary fittings, splitters, dampers, quadrants, flexible connections, sleeves, hangers, support, braces, etc. Hang and install ducts in a neat and workmanlike manner from structural members (not roof deck) with adequate bracing and cross breaking to prevent breathing, rattling, and vibration.

B. No flexible ductwork on return, exhaust or outside air.

C. Install Duro-Dyne locking quadrants and Duro-Dyne end bearings on all splitters and manual volume dampers located above accessible ceiling and Young #1 regulator, C.P., and Duro-Dyne end bearings elsewhere.

D. Duct dimensions shown are net inside dimension and do not include insulation thickness.

E. Duct Turns: Wherever possible, duct turns shall have a centerline radius equal to 1.5 times the duct width in the plane of the turn. Vane other duct turns to provide a dynamic loss co-efficient ("C") not greater than 0.2. No reducing ells or tees to be used.

F. Duct Sealing: Seal duct seams and joints as noted below. Seal entire circumference of all branch duct connections, tapping collars and spin-ins. Seal ducts using mastic sealant equal to United Duct Sealer.

1. Class "A" Seal: Seal all joints and seams and leak test as specified.

2. Class "B" Seal: Seal entire circumference of all transverse joints, seal all longitudinal joints.

3. Class "C" Seal: Seal entire circumference of all transverse joints.

4. Class "D" Seal: Seal corner of transverse joints.

2.2 Ductwork - Low Pressure

A. Ductwork: Low Pressure, Pressure and Seal Class shall include: all supply, return, exhaust and outside air ductwork, 2" pressure class, "B" seal.

B. Construct ducts in accordance with SMACNA Duct Construction Standards for pressure and seal classes noted.

2.3 Ductwork Located Outdoors:

A. Construct ducts served by exhaust fans as specified for respective exhaust ducts, above. Seal all seams weather tight using glass cloth tape and carbolastic or United Duct Sealer.

2.4 Ductwork, Plenum Casing:

A. Include all plenum chambers and enclosures for air passage between air intakes, filters, heating and cooling coils and fans. Unless otherwise shown the floors under casings shall serve as the bottom and sides and tops shall be constructed of sheet metal. Provide concrete pads (4" min. height) under all casings. Any passage definitely shown above and clear of floor shall not be classed as a casing and shall be constructed as specified for ducts.

B. Construct all exterior walls of casings, partitions between decks and fan discharge partitions of 4" thick factory furnished insulated panels having 20 gauge galvanized steel outer skin, 20 gauge perforated galvanized steel inner skin, fiberglass insulation (flame spread 10 20, fuel contributed 10 15, smoke developed 0 20) (and 0.002" thick mylar film between insulation and perforations). Assemble casing panels with joining members to provide structural rigidity to 10" WG pressure differential. Reinforce and support panels as recommended by panel manufacturer. Minimum "U" value (still air both sides) 0.06 Btu/hr sq. ft. F. Minimum NRC 0.95, minimum STC 37. Casing joints and seams shall be air tight under 8" WG pressure and casing joints will be fully insulated to prevent sweating.

C. Construct portions of casings other than the panels specified above of 18 gauge galvanized steel with standing seams 42" on center. Locate 2" standing seams on casing perpendicular to direction of air flow. Seal seams with United Duct Sealer and fastened with bolts or tinnier's rivets 6" O.C., reinforce casings with members sized and spaced as follows: I = 3 X SP X C X L/1000 X L/1000 X L/1000. Where I = moment of inertia of section, inches fourth, SP= static pressure, ins. WG, C = member spacing inches, L = member length, inches.

D. Brace casings diagonally with 2 X 2 X 3/16 angles and stay as required.

E. Calk casing floor angles to pads and secure with expansion bolts 12" O.C.

F. Construct drain pans inside with double construction with insulation between pans and 16 gauge type 304 stainless steel inner pan with welded joints.

G. Install coil racks of galvanized angle iron inside casings to permit removing coils without dismantling casings. Equip cooling coils with intermediate drip troughs and eliminators as shown. Pipe drip troughs to main drain pans.

H. Provide access doors where shown and/or required for access to equipment and/or controls. Construct doors with 1" insulation between two (2) sheets 24 gauge galvanized steel. Set doors in frames arranged so that doors will be flush with exterior of casing. Equip each door with at least two (2) hinges and two (2) sets of double acting latches. Latches shall be made from non ferrous metal, with a lever handle on the outside and a lever handle on the inside of the casing. Lever handle on the outside of the casing shall cam over a door pull with a stop. Latches shall be Vent Fabrics #310 Ventlok latch, or equal. Doors shall be reinforced to prevent wracking and warping. Provide 3" butt hinges and weld to doors and to door frames.

2.5 Flexible Ducts

A. Flexible duct connectors: A two (2) element spiral construction composed of galvanized steel supporting spiral and coated woven textile fabric with metal or mineral base, UL listed as Class I Air Duct and Connector (UL 181) minimum R=6.0.

B. Flexible connectors shall not exceed 5 feet in length.

C. Make connections between flexible ducts and other equipment using galvanized steel draw bands with plated screws and buckles and United Duct seal for high and medium pressure ducts and nylon draw bands for low pressure ducts.

D. Factory insulate cold flexible ducts using insulation equivalent to that specified for cold ducts.

E. Flexible ducts: Thermoflex M-KC, Wiremold 57K, Technaflex 57K, or Flexmaster Type 4M. Submit sample for approval of any other manufacturer.

3.0 - EXECUTION

3.1 Installation

A. Ductwork shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Provisions of this Section shall apply to all HVAC work.

2.0 - PRODUCTS

2.1 Sheet Metal Specialties

A. Make rectangular take-offs in low pressure supply, return and exhaust ducts using 45 degrees entry tap (SMACNA Duct Construction Standards Figure #2-8) with manual damper with end bearings and locking quadrant in branch. End bearings and quadrants shall have air tight duct connections and shaft seals: Ruskin, Duro-Dyne, or approved equal.

B. Manual balancing dampers: Comply with SMACNA Duct Construction Standards, Figure 2-14 and 2-15. Equip all dampers with locking quadrants and end bearings. End bearings and quadrants shall have air tight duct connections and shaft seal, Ruskin, Duro-Dyne, or approved equal.

C. When damper quadrants are located other than above lay-in ceilings.

1. Provide all necessary accessories for remote control of balancing dampers without requiring access doors. Substitute Young #1 regulators and an additional end bearing or Ventlock #688 regulators and an additional end bearing for the quadrant (regulators shall be chrome plated), or, Architect/Engineer option.

2. Provide access door for access to the quadrant (See sub-section 2.04 "ACCESS DOORS", hereinafter).

D. Provide "Stand-Offs" (hat sections) for damper quadrants, controls, etc., on externally insulated ducts.

E. Branch duct connections for connecting round low pressure branches to rectangular low pressure trunks: spin-in fittings with integral dampers with end bearings, stand-off and beaded collars. Seal Class of components penetrating duct shall be consistent with duct pressure class. Spin-in shall be Flexmaster – FLD or equal. Submit sample for approval of other manufacturers for prior approval.

2.2 Fire Dampers

A. Install UL labeled 1-1/2 hour fire dampers wherever sheet metal ducts pass through chase walls, floors, outside fire chases, and elsewhere as shown or required by local Code. Install dampers per SMACNA "Fire Damper Guide" and UL 555.

1. Fire dampers shall be Type "B" "Venation Blind" dampers. Unless otherwise shown folded blades shall not obstruct duct. Dampers in floors shall be spring loaded.

2. Provide factory fabricated steel integral wall sleeve 3" longer than wall thickness for each fire damper and install sleeve using bolts and angles as detailed in Figure #1 of SMACNA "Fire Damper Guide".

3. Provide rectangular, round and/or flat-oval collars. See Drawings for sizes and locations.

4. For aluminum ductwork provide stainless steel fire dampers.

B. Install access door in low pressure ducts at each fire damper. Install wall or ceiling access door for access to fire dampers not accessible through lift-out ceilings. See sub-section 2.4 "ACCESS DOORS", below.

C. Install three (3) hour fire dampers where sheet metal ducts pierce 4 hour fire walls. Three (3) hour fire damper shall consist of a three (3) hour UL labeled fire door pivoted in a 3" X 3" X 1/4" angle frame bolted through wall. Equip door frame with angle flange and latch. Install Fire Door as shown in Figure 25 and 26 of SMACNA "Fire Damper Guide".

2.3 Automatic Dampers

A. Factory fabricated dampers with extruded aluminum airfoil blades and frame with full gasket stops for blades ends. Equip blades with air tight plastic or butyl rubber seals and bronze or nylon bearings. Provide jamb seals. Damper widths from 12" to 60" wide shall not leak any greater than 8 cfm sq. ft.at 4" w.g. and a maximum of 3 CFM sq. ft. at 1" w.g Ruskin Model CD50 or approved equal.

B. Automatic dampers located near fan outlets or in ducts having maximum velocities exceeding 1500 FPM shall have extruded aluminum air-foil blades and all linkages shall be located outside of airstream. Such dampers shall have leakage rates not exceeding 1% maximum design flow at 4" WG pressure differential.

2.4 Access Doors

A. Access doors in plenum casings are specified under "DUCTWORK - PLENUM CASINGS".

B. Access doors in low pressure ducts: Galvanized steel frame with gasket permanently secured to duct with a removable gasket access port held in place with screw driver or thumb operated latches. Door in insulated ducts: Double thickness with insulation. Doors in non-insulated ducts: A single thickness. Weld door frames to kitchen exhaust ducts. Size doors to permit removal of equipment or maintenance. Minimum size 12" X 12".

C. Mark access points in lift-out ceilings with brass paper brads. Bend points of brads over top of ceiling.

2.5 Smoke Detectors

A. Smoke detectors will be furnished and wired under Electrical Work but shall be installed in ducts under this Section.

B. Install access door in duct at each smoke detector. (See sub-section 2.4 "Access Doors").

2.6 Flexible Duct Connections

A. Install Neoprene coated glass cloth flexible connections at all duct connections to all fans and AC Units.

B. Install flexible connections in all ducts at building expansion joints.

2.7 Electrical Grounding

A. Ground all fans.

B. Install braided copper jumpers around all flexible connections, taking care that jumpers do not bind flexes.

2.8 Air Flow Measuring Stations (Afms):

A. Thermal dispersion airflow measurement station. Shall be provided with insertion type mounting style, 304 stainless steel mounting bracket, aluminum alloy tube with individual sensors and BMS connectivity. Using recommended placement guidelines for the specified probe sensor density, measurement accuracy of 3% shall be provided.

B. Air flow measurement stations shall be Ebtron Advantage series or approved equal.

C. Install an access door in duct immediately upstream from each airflow measuring station.

2.9 INTAKE AND RELIEF HOOD:

A. Gravity roof ventilators shall be constructed of heavy gauge aluminum as specified.

B. Hoods shall be constructed of precision formed, arched panels with interlocking seams.

C. Bases shall be constructed so that the curb cap in 8" larger than the throat size. Provide 12" bases.

D. Hood support members shall be constructed of galvanized steel and fastened so that the hood can be either removed completely from the base or hinged open.

E. Birdscreens constructed of 1/2" galvanized steel mesh shall be mounted horizontally across the intake/discharge area of the hood.

F. Intake units with throat widths through 42" shall ship assembled when throat lengths do not exceed 84". Relief units with throat widths through 48" shall ship assembled when throat lengths do not exceed 96".

G. Units shall be factory painted to match roof.

H. Gravity hoods shall be Fabra Hood Model FHI for intake or Model FHR for relief (as specified) as manufactured by Greenheck, Cook or equal.

2.10 GRAVITY ROOF VENTILATORS:

A. Factory fabricated spun aluminum ventilator with integral curb cap and birdscreen. Equip hood with galvanized steel curb with wood nailer. Minimum material gauges,

hood 20 gauge, base 18 gauge, curb 18 gauge.

B. Gravity Roof Ventilators shall be manufactured by Greenheck, Cook, or approved equal.

3.0 - EXECUTION

3.1 Installation

A. Duct shall be installed in accordance with SMACNA Standards.

B. Equipment shall be installed in accordance with manufacturers recommendations.

C. See details for mounting instructions and accessories.

END OF SECTION

1.0 - GENERAL

1.1 Scope

A. Include section 15010 "GENERAL PROVISIONS" with this section.

B. Provisions of this Section shall apply to all HVAC work.

2.0 - PRODUCTS

2.1 Grilles, Registers and Diffusers

A. General: Air devices may be Titus, Price, Nailor, Krueger or approved equal. Where fire dampers are required at grilles, provide steel grilles, not aluminum.

B. Supply Registers (SR): Adjustable vertical deflection, adjustable horizontal deflection, removable core, opposed blade damper and multi-blade scoop and baked aluminum enamel finish. Titus "1700".

C. Wall Return Grilles (WRG): Horizontal bars fixed at about 15° angle, close spacing and plaster frames. Baked aluminum, enamel finish. Titus "1700".

D. Bar Return Grille (BRG): All steel, heavy duty, 16 gauge border, 14 gauge blades, 1/2" spacing, 38° deflection. Provide all frames. Titus "33R". All BRG's are to appear as a one piece grille. BRG's are to be painted as selected by architect. Submit color chart to architect.

E. Ceiling Return Grilles (R), Ceiling Exhaust Grilles (E) and Transfer Air Grilles (T): All aluminum, 1/2" X 1/2" X 1/2" cube core and plaster frames as needed. Off-white baked enamel finish. Provide 24 x 24 panel so grille will fit in 24 x 24 ceiling grid. Titus "50F".

F. Architectural Supply Diffuser (S): The diffuser shall have a heavy gauge aluminum face panel, which shall be a one piece assembly, removable by means of four positive locking posts. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners. The face panel shall project 1/4" below the outside border of the diffuser back pan. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern. The back pan shall be one piece precision die-stamped and shall include an integrally drawn inlet. The diffuser back pan shall be constructed of heavy gauge aluminum. The finish shall be #26 white. The pencil hardness must be HB to H. Directional blow clips shall be provided to restrict the discharge air in certain directions. The manufacturer shall provide published performance data for the square panel diffuser. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991. Diffuser shall be Titus "OMNI-AA".

2.2 Weather Louvers

A. Louvers shall be 6" thick extruded aluminum louvers with 12 gauge blades with drainable head frame, drainable blades, water stop, and with angled sill. 57% F.A. minimum. Equip with 1/2" mesh aluminum birdscreen on inside of louver. Finishes: Kynar. Submit color sample to Architect (20 year warranty on finish). Ruskin ELF6375DX, Louvers & Dampers, Greenheck, Airolite, or approved equal.

3.00 EXECUTION:

3.1 INSTALLATION:

A. Equipment shall be installed in accordance with SMACNA Standards and manufacturer's recommendations.

B. See details for mounting instructions and accessories.

C. Secure louver to structure to comply with FEMA 361 and the following:

END OF SECTION

1.00 GENERAL:

1.01 SCOPE:

A. Provisions of this section apply to all HVAC work.

2.00 PRODUCTS:

2.01 FILTERS - AIR:

A. 30% Filters, 1" or 2" Thick (Maximum allowed by MFR): Throwaway deep pleated filters, maximum face velocity 350 fpm. Maximum initial pressure drop 0.1" WG, UL Class 1, 30% efficiency per ASHRAE Test Standard 52-76, minimum ratio of media area to face area 4.4:1. Turn system over to Owner with clean filters and provide one (1) set of spare filters. Farr 30/30 or approved equal.

3.00 EXECUTION:

3.01 INSTALLATION:

A. Filters shall be installed in accordance with manufacturer's recommendations.

B. See details for mounting instructions and accessories.

END OF SECTION

1.00 GENERAL:

1.01 SCOPE:

A. Include Section 15010 "GENERAL PROVISIONS", with this Section.

B. Provisions of this Section shall apply to all HVAC work.

2.00 PRODUCTS:

2.01 CONTROL SYSTEMS:

A. Equipment manufacturer shall provide and install all controls for a complete working system. Provide control points and sequences as shown on drawings.

B. Products of a manufacturer maintaining complete service and parts facilities in Alabama continuously for the last three (3) years: Trane, Daikin, Carrier, or approved equal.

C. Control equipment, except for items comprising an integral part of the water or refrigeration piping, shall be installed by trained mechanics employed by the Control Manufacturer.

D. Include the services of a full time control technician for calibrating and adjusting controls for the first 10 working days after Owner has occupied building.

E. Before installation, submit for approval five (5) copies of complete power and control wiring and piping diagrams. Hang a photostatic copy of the approved diagram, framed behind glass, in each equipment room. Provide one (1) set of reproducible sepias of "As-Built" control diagrams at completion of project for the Owner's use.

F. Provide permanent nameplates for control switches and motor starters. Nameplates: engraved laminated plastic with letters legible under normal operating conditions. (White on black).

G. Permanently identify control devices other than room thermostats, so they may be identified on control diagrams. Provide engraved plastic nameplates for items mounted outside of or on faces of panels. Mark other instruments with indelible ink.

2.02 CONTROL WIRING:

A. Include control and interlock wiring and power wiring for control panel in this Section. Install in conduit in accordance with provisions of Electrical Work where exposed, concealed in walls or above ceilings other than lay-in type. Provide plenum rated cable above lay-in ceilings (for plenum or non-plenum).

B. Waterproof and firestop all conduit floor penetrations. Firestop conduit penetrations of fire rated walls partitions.

C. Wire all devices individually to terminal strips in control panels.

D. Furnish necessary relays and auxiliary contactors and other accessories required. Provide interlock relays per NEC. Coordinate start-stop stations, auxiliary contacts, etc., with supplier of Starters, Variable Frequency Drive (VFD) and Motors Control Centers specified in Electrical Work.

2.03 CONTROL DEVICES:

A. Room Thermostats: Provide seven (7) day occupied/unoccupied, 24 hour, multi-stage programmable thermostats, with 3-hour override, and battery back-up Unless otherwise shown provide proportional action relay thermostats with key operated adjustments. Thermostats to be provided with local control, limited range of local control. Thermostat covers: high impact plastic. Mount room thermostats with tops 4 feet above floors. Thermostats located in Gymnasiums shall have metal impact resistant ventilated covers, painted to match the wall.

B. Remote Bulb Thermostats and Temperature Transmitters: Unless otherwise shown use averaging elements not less than 12 feet long for duct or casing cross sections for each 24 square feet of face area.

C. Thermometers: Pipe line thermometers are specified in another Section. Install digital readout thermometers in ducts where shown on control diagrams, providing averaging bulbs where shown and/or required.

D. Freezestats: Manual reset, pneumatic not permitted. Locate freezestat bulbs between preheat and chilled water coils in units with chilled water coils and downstream from DX coils in units with DX coils. Provide coverage for each 3' X 3' coil face area section.

E. Firestats: Single pole double throw, electric, manual reset, pneumatic not permitted. Firestats shown to be connected to the fire alarm system: compatible with fire alarm system, furnished and installed under Controls, wired under Electrical Work. Firestats to be installed in all fans where smoke detectors are not furnished.

F. Program Clocks / Timers:
Provide digital time clock with 365 day holiday capabilities with 24 single dates, 99 setpoints, separate scheduling for each day of the week, AM/PM format, one minute programming resolution, portable memory module, optional programmer for integration into a Windows based PC for program duplication and modifications, LCD display, daylight savings or standard time, automatic leap year correction, permanent schedule retention, 100 hours of backup, manual override, Nema 3 indoor/outdoor enclosure. Clock/Timer to be Tork or approved equal.

G. Valve and Damper Operators: Of sufficient power to close/open valves and dampers under operating conditions. Electric valve and damper motors shall have oil immersed gear trains and spring return to normal position. Valves and damper operators to have DDC Controls.

H. Wells: Install pipe line mounted control and indicating devices in stainless steel or brass thermometer wells.

I. Capillary Supports: Securely support all duct-mounted and casing- mounting thermostat capillaries using factory fabricated copper bulb supports.

J. Provide stand-offs for control devices mounted on externally insulated ducts and equipment.

K. Anchor all items mounted on gypsum board (dry-wall) using toggle bolts or moly bolts, not expansion shields.

L. Air flow Measuring Station (AFMS): Provide AFMS with probe, transmitter and cable. Unit to average velocity profile thru multiple probes and provide average readout in CFM on transmitters LED screen. Provide O-10VDC and 4-20MA output (field selectable) to BMCS. Sensor accuracy to be 2%, installed accuracy to be 3%. ARMS to be Ebrron model GTX116.

M. Hand-Off-Auto switches (H-O-A): Provide 3 position dial switches (one for each exhaust/supply fan as scheduled). Switches for fans shall be grouped together in panels by building section. Locate panels in nearest Mechanical / Electrical room (coordinate location with G.C. & owner).

2.04 CONTROL POWER:

A. All 120 Volt wiring shall be the responsibility of the Control Sub-Contractor from circuit furnished under Electrical Section. Coordinate circuit locations with General and Electrical Contractors.

B. Power wiring to all automatic dampers shall be included under this section.

C. Wiring and relays between light and fans for interlock shall be included under this section.

2.05 CONTROL PANELS:

A. Local Control Panels: Construct of galvanized steel with baked enamel finish or

aluminum-plywood-aluminum fronts and backs and extruded tops, bottoms, and ends. All panels shall have piano hinges and key locking latches (key panels alike). Permanently label instruments located in panels consistent with labeling on control diagram. Cement photostat of approved diagram inside each panel cover. (Include Local-Remote switching for control point adjusters on face of each panel).

2.06 CONTROL SEQUENCES:

A. As shown on drawings.

3.00 EXECUTION:

3.01 INSTALLATION:

A. Control diagrams on drawings and/or Control Sequences are intended to indicate, in general, control arrangements. Provide all instruments, relays, operators, switches, etc. required to accomplish control sequences whether or not such devices are actually shown.

END OF SECTION 15900

PLUMBING AND FIRE PROTECTION - TABLE OF CONTENTS - SECTION 15400

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following plumbing identification materials and their installation:
   1. Pipe markers.
   2. Valve tags.
   3. Valve schedules.
   4. Equipment labels.
   5. Warning signs and labels.

1.02 SUBMITTALS

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

B. Valve numbering scheme.

C. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.04 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Self-Adhesive Pipe Markers: Are not allowed

2.02 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.
1. Material: 3/32-inch thick laminated plastic with 2 black surfaces and white inner layer.
2. Valve-Tag Fasteners: Brass wire-link chain, beaded chain or S-hook.

2.03 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.04 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Color Coding:

System	Background Color	Letters
Other equipment	Black	White

3. Temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Letter shall be a minimum of 1/2" high. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

2.05 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: Minimum 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information as indicated elsewhere in the specifications and on the Drawings.

PART 3 - EXECUTION

3.01 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
   1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
   2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, [**at least ¾ inch**] [**1-1/2 inches**] wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
   3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
   4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and non-accessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. Label 2 psi gas piping at 6 foot intervals.

3.03 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
   1. Valve-Tag Size and Shape:
      a. Cold Water: **2 inches square**.
      b. Hot /HWR Water: **2 inches square**.
      c. Fire Protection: **2 inches square**.
      d. Gas: **1-1/2 inches round**.
   2. Valve-Tag Color:
      a. Cold Water: **Natural**.
      b. Hot Water: **Blue**.
      c. Fire Protection: **Red**.
      d. Gas: **Yellow.**
   3. Letter Color:
      a. Cold Water: White
      b. Hot Water: **White**.
      c. Fire Protection: **White**.
      d. Gas: **White**.

3.04 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

END OF SECTION 15405

1.00 GENERAL:

1.01 SCOPE:

A. Provisions of this Section apply to all Plumbing and Fire Protection work.

B. Include the provisions of General, Supplementary and Special Conditions and provisions of the Specifications shall apply to and form a part of this Section.

C. Provide all labor, materials, equipment, and services necessary for the completion of all work shown or specified, except work specifically specified to be done or furnished under other sections of the Specifications. Include performing all operations in connection with the complete installation in strict accordance with the specification and applicable drawings subject to the terms and conditions of the Contract, for the following system:

1. A system of sanitary waste and vent piping.

2. A system of domestic water piping.

3. A system of fire protection piping.

D. Give required notices, file drawings obtain and pay for permits, deposits and fees necessary for the installation of the work. Obtain and pay for inspections required by laws, ordinances, rules, regulations or public authority having jurisdiction. Obtain and pay for certificates of such inspections, and file such certificates with Owner.

E. "Provide" means to furnish and install, complete and ready for operation.

1.02 DRAWINGS:

A. Drawings are diagrammatic and subject to requirements of Architectural Drawings. Drawings indicate generally the location of components and are not intended to show all fittings or all details of the work. Coordinate with Architectural, Structural, Electrical, HVAC and other Building Drawings.

B. Follow the Drawings closely, check dimensions with Architectural Drawings and field conditions. DO NOT scale Drawings for location of system components.

C. Make no changes without Architect's written permission. In case of doubt, obtain Architect's decision before proceeding with work. Failure to follow this instruction shall make the Contractor liable for damage to other work and responsible for removing and repairing defective or mis-located work.

D. Do not scale Drawings to locate sprinkler heads. Coordinate with lighting, ceiling grids, ceiling diffusers and/or reflected ceiling plans. Install Sprinkler Heads in center of ceiling tiles.

1.03 APPLICABLE CODES AND STANDARDS:

A. Comply with the current editions of the following Codes and Standards:

1. ANSI/ASHRAE 15 - Code for Building Services Piping.

2. NFPA 70 - National Electrical Code.

3. NFPA 101 – National Life Safety Code.

4. Other Standards as referenced in other Sections of Division 15.

5. Local Building Code (International Building Code if no local Building Code in effect).

6. Local Plumbing Code (International Plumbing Code if no local Plumbing Code is in effect).

7. Local gas code (International Gas Code if no local code is in effect).

8. NFPA 13 - Sprinkler System installation.

9. NFPA 24 – Installation of Private Fire Service Mains.

10. NFPA 110 - Emergency and standby power.

12. NFPA 72 - National Fire Alarm and Signaling Code.

1.04 QUALIFICATIONS OF SUBCONTRACTOR:

A. The Plumbing Contractor shall meet the following qualifications:

1. The Plumbing Contractor must be approved by the Architect.

2. The Plumbing Contractor shall have been in business as a Plumbing Contractor for at least three (3) years prior to Bid Date. He shall have a current Master's Plumber's Certificate and Gas Certificate of competency issued by the State of Alabama and the city and county in which work occurs.

3. The Plumbing Contractor shall have a satisfactory experience record with Plumbing installations of character and scope comparable with this project, and for at least three (3) years prior to the Bid Date and shall have had an established service department capable of providing service inspection or full maintenance contracts.

B. The Fire Protection Sub-Contractor shall meet the following qualifications:

1. The Fire Protection Contractor shall be approved by the Architect,

2. The Fire Protection Contractor shall have been in business as a Fire Protection Contractor for at least three (3) years prior to the Bid date and shall be licensed by the State, County and City in which the work will be performed.

3. The Fire Protection Contractor shall have a satisfactory experience record with Fire Protection installations of character and scope comparable with this project and shall have completed three (3) such installations in the past three (3) years.

4. The Fire Protection Contractor shall be a Registered Engineer in the State in which the work occurs or be a Nicet Level 3.

5. The Fire Protection Contractor shall be the employer of the NICET Level 3 Designer. The NICET Level 3 designer will oversee installation and provide in closeout documentation.

1.05 CONFLICTS AND INTERFERENCES:

A. If systems interfere or conflicts, the Architect shall decide which equipment to relocate regardless of which was first installed.

1.06 WORKMANSHIP:

A. Do all work in a neat and first-class manner. Remove and replace work not done in such manner as directed by the Architect.

1.07 COOPERATION:

A. Cooperate with all other crafts. Perform work in a timely manner. Do not delay the execution of other work.

1.08 VISITING SITE:

A. Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

2.00 PRODUCTS:

2.01 MATERIALS, SUBSTITUTIONS AND SUBMITTALS:

A. Unless otherwise noted, provide new, standard, first-grade materials throughout. Equipment and materials furnished shall be fabricated by manufacturers regularly engaged in their production and shall be the standard and current model for which replacement parts are available. Equipment shall be substantially the same equipment of a given manufacturer which has been in successful commercial use and operation for at least three (3) years.

B. Where materials or products are specified by manufacturer's name, brand, trade name, or catalog reference, such named materials or products shall be the basis of the Bid, without substitution, and shall be furnished under the Contract unless requests for substitutions are approved as noted below. Where two or more brands are named the choice of these shall be optional with the Contractor.

C. Substitutions will be considered only if written request for approval has been received by the Architect TEN (10) DAYS prior to the date established for receipt of Proposals. Each request shall include the name of the material or equipment for which substitution is proposed and a complete description of the proposed substitute including drawings, cuts, performance and test data, samples and any other information necessary for evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

D. If the Architect approves any proposed substitution prior to receipt of Proposals, approval will be set forth in an Addendum. DO NOT rely upon approvals made in any other manner.

E. No substitutions will be considered after the Contract has been executed, except as described in the General Conditions.

F. Submittal data and shop drawings shall be submitted at one time, partial submittals will not be considered. Within 30 days of execution of Contract and before ordering materials and equipment, submit to Architect and obtain his approval of a detailed list showing each item which is to be furnished by make, trade name, catalog number, or the like; together with manufacturer's specifications, certified prints, and other data sufficient for making comparisons with items specified. When approved, such schedule shall be of equal force with these specifications in that no variation there from shall be allowed except with Architect's written approval. Number of Shop Drawings and procedure shall be as directed by the Architect.

G. All pressure vessels shall be constructed and tested in accordance with applicable ASME Codes and shall bear ASME stamps. Certificates of inspection and approval shall be submitted to Architect.

H. Similar items of equipment shall be the product of the same Manufacturer.

I. See section, "ALTERNATES" in other sections of the Specifications and Bid accordingly.

2.02 SHOP DRAWINGS:

A. Before starting work, submit and obtain approval of the following:

1. Equipment piping.

2. Plumbing Equipment, Products and Fixtures.

B. Thirty (30) days before starting work, submit Fire Protection Shop Drawings bearing the Seals of the Owner's underwriters and all governmental agencies having jurisdiction. Shop Drawings will not be considered without these seals. Complete shop drawings are required to be submitted at one (1) time.

1. Piping routing showing sizes, dimensions, elevations, and head locations (coordinate with reflected ceiling plan). Provide minimum six (6) sets of blue line drawings.

2. Provide a sprinkler head layout on a reflected ceiling plan. Indicate on plan all lights, HVAC ceiling air devices, smoke detectors, exit lights and any other ceiling attachments. Adjust locations of heads after Architectural review.

2.03 RECORD DRAWINGS:

A. When work starts obtain from Architect two (2) complete sets of white prints of the **Plumbing.** All corrections, variations, and deviations, including those required by change orders, if any, must be recorded in colored ink or colored pencil at the end of each working day on these drawings. The marked prints shall be available at all times for the Architect's inspection.

B. Prior to examining the request for final payment or making any response thereto, the Architect shall receive from the Contractor one (1) complete set of the white prints, marked as stated above, indicating the actual completed installation of the work included under this Contract.

C. The Architect will forward the marked white prints to the Consulting Engineers for review. They will then be returned by the Architect to the Contractor for use in preparing record drawings.

D. When work is completed Contractor shall purchase from the Architect (At Architects' printing cost) one (1) set of reproducible electronic files and prints of Plumbing Drawings for use in preparing record drawings. Contractor shall transfer the information from the marked white prints to the dwg record drawings, removing all superseded data in order to show the actual completed conditions.

1. Accurately show location, size and elevation of new exterior piping work and its relationship to any existing piping and utilities, obstructions, etc., contiguous to the area of work.

2. Block out areas modified by change-order and identify them by change-order number.

2.04 ELECTRICAL EQUIPMENT:

A. Provide electrical equipment compatible with the current shown on electrical drawings. Verify current characteristics before ordering equipment.

B. Should the Contractor with the Architect's/Engineer's approval make changes in electrical equipment from those shown on the Electrical Drawings, he shall be responsible for the coordination and cost of required changes.

C. Provide factory installed fuses in all equipment requiring fusing for branch circuit protection.

D. Verify electrical characteristics of all equipment and voltages available with Electrical Section prior to ordering any electrical equipment.

2.05 SLEEVES:

A. Refer to the Architectural Life Safety Drawings for wall ratings and close all openings to match rating of wall.

B. Submit details of all pipe penetrations thru rated walls indicating wall construction, penetrating material and method of closing penetration including materials and listing of detail.

C. All Penetrations thru walls are to be closed. If the wall is not rated, sheet rock joint compound may be used to close space around piping. For walls with ratings opening shall be closed with a U.L. Listed rating system compatible with wall rating. Insulation is to be continuous thru all openings.

D. For pipe through floors inside rated chases or through non-fire-rated walls: 20 gauge galvanized steel sleeve 1/2" larger than pipe or pipe covering. Pipe insulation to be continuous thru sleeve. Seal opening between sleeve and pipe or pipe covering

E. For uninsulated pipe through 2 hour fire rated walls, partitions or floors outside chases: Hilti FS605 with sleeve, U.L. Listing #WL1056.

F. For insulated pipe passing through fire rated partitions or walls or floors outside chases: Hilti #FS611A with no sleeve, U.L. Listing #WL5029. Insulation: 1" thick fiberglass continuous thru wall.

G. For pipe passing thru concrete floor, concrete walls, and concrete block walls:

1. Uninsulated Schedule 40 steel and copper: Hilti #FS605 with sleeve, U.L. #CAT1155.

2. Insulated Schedule 40 steel and copper: Hilti #FS611A, U.L. #CAT5045.

H. For 4" and smaller acid waste or PVC pipe passing thru 3 hour concrete floor, wall or concrete block wall - Hilti #FS611A with collar, UL System #CAJ095.

I. For 2" and smaller acid waste or Schedule 40 PVC pipe penetrating a 1H12 concrete floor or wall - Hilti #FS611A sealant, UL #CAT2062 or UL #CAJ2066.

J. Under this Section, the Contractor shall be responsible for closing and making fire safe all openings exposed during construction (both new and existing) in the floor and deck above. Closing of opening shall be compatible with rating and shall not compromise the rating of the wall or floor being sealed.

K. Set sleeves before concrete is poured or masonry is erected. In existing construction, grout sleeves firmly in place.

L. In Mechanical Rooms extend sleeves 1-1/2" above finish floor and waterproof.

M. Where exposed pipes pass through walls and partitions in finished or exposed spaces, provide chrome plated F & C plates or escutcheons. Seal wall penetration and case work penetration with silicone prior to installing escutcheon.

N. All wall floor penetrations shall be closed in a neat manner. The method used to the close penetrations shall be compatible with the rating of the wall and shall in no way compromise the integrity of the partition or floor.

2.06 ACCESS DOORS:

A. Provide access doors for valves, and other items requiring maintenance located above hard ceilings or behind partitions or walls. Doors in fire rated walls and ceilings: UL labeled with fire rating equal to fire rating of wall or ceiling. Provide door styles, sizes and colors as specified under the Architectural section.

B. Mark lay-in ceilings with paper brads at valve locations and maintenance access points. Bend ends of brads over above ceiling tile.

3.00 EXECUTION:

3.01 PROTECTION OF EQUIPMENT:

A. During construction all fixtures and equipment shall be protected from damage caused by weather, masonry, plaster, paint and job accidents.

B. When installation is complete, clean equipment and make ready for painting. Adjust all flush valves.

3.02 INSTALLATION OF FIXTURES AND EQUIPMENT:

A. Install fixtures and equipment to provide normal service access to all components.

B. Provide sufficient space for removing components, install fixtures and equipment to provide such clearance.

C. Install fixtures and equipment in accordance with manufacturer's instructions. If manufacture's instructions conflict with contract documents, obtain Architect's decision before proceeding.

D. All fixtures and equipment shall be firmly fastened in place:

1. All wall hung fixtures shall be installed on a floor mounted fixture support with anchoring bolts in all holes of each leg. Bolts shall be sized as per manufacturer's recommendation.

3.03 CUTTING AND PATCHING:

A. Set sleeves and inserts and lay-out and form openings in walls, beams, girders and structural floors in this Section.

B. Cut, patch and repair as required to accomplish work and finish to match adjacent work. Architect's approval required before cutting any part where strength or appearance of finished work is involved.

C. Cutting, patching and repairing of walls, floors, etc., where noted in paragraph "A" above, have been located or sized incorrectly are included in this Section.

3.04 INCIDENTAL WORK:

A. All power wiring is included in Electrical Section.

B. Permanent drain and relief connections for **Plumbing Equipment** to nearest floor drain or to grade are included in this Section whether shown or not.

C. Items obviously omitted from drawings and/or specifications shall be called to attention of the Architect prior to submitting Bid, after award of Contract any changes or rearrangements necessary to complete Contract shall be at no additional cost to Owner.

3.05 FLASHING:

A. Vent Pipe and Roof Drain Flashing: Specified in "Architectural Roofing Section".

B. Coordinate all roofing penetrations with Roofing Section.

3.06 EXCAVATION AND BACKFILLING:

A. Include all excavation and backfilling required to bring the work to line and grade shown, including excavation of rock and all other materials which may be encountered.

B. Excavate trenches wide enough for proper installation of work. Grade trench bottoms evenly. Provide bell holes as necessary to insure uniform bearing for pipes. Excavate minimum 6" below pipe. Refill cuts below required pipe grade with sand or compacted gravel. Support pipe continuously along its entire length. Do not use piers to support piping.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas with "Engineered Fill", sand or fine gravel in accordance with requirements of "Sitework". Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe. Restore or repair pavements and the like after backfilling, to meet the requirements of the authority having jurisdiction.

3.07 PAINTING:

A. Refinish equipment damaged during construction to new condition.

B. Paint all non-potable water pipe and insulation with two (2) coats of bright yellow paint in compliance with the Local Plumbing Code and these specifications. Paint piping prior to installing insulation. Paint type to be equal to Paint Specified in Painting Section of the Specifications.

C. Other painting is specified in "PAINTING SECTION, Finishes Division".

3.08 PIPE IDENTIFICATIONS:

A. Identify all piping exposed to view or accessible through removable ceilings or access panels with plastic snap-on pipe line markers. Color code markers in accordance with ANSI A13.1. Show pipe contents and direction of flow. Markers on lines 8" OD and smaller shall be taped in place; on lines over 8" OD secure with spring clips.

B. Submit samples of all nameplates, tags, chains and etc., for approval.

C. Protect all factory identification tags, nameplates, model and serial numbers, stenciling, etc., during construction and replace if damaged.

D. Label Spacing and Extent:

1. On straight run of pipes; Above suspended ceilings space labels approximately 10 feet on center; elsewhere, 20 feet on center.

2. Wherever a pipe enters or leaves a room or building.

3. At change of direction.

4. At main valves and control valves (not equipment valves).

5. On risers, just above and below floors.

3.09 VALVE TAGS:

A. 2" X 3" laminated plastic with 1/2" numbers engraved at top, leaving space for further engraving by others. Secure tags with chains to valve yoke or stem, not handles.

B. Valve tags colors:

1. Plumbing: Red tags with white numbers.

C. Valve tag locations: At all valves on mains, risers and branches.

D. Valve tag numbers: Starting with Number 1, number tags in sequence from the lowest point to the highest point in the building. In existing building extend existing sequences.

E. Starting with Number 1, number valve tags on this floor extending existing sequence. If there are no valve tags on existing valve, provide tags for all existing valves and new valves beginning floor sequence with Number 1.

3.10 VALVE CHARTS:

A. In all mechanical rooms, provide charts showing number and locations of all valves, type of service, etc. Frame with aluminum, under glass.

B. In existing buildings include existing valves in the charts of new valves.

3.11 WARRANTY AND INSTRUCTIONS:

A. See General Conditions - One-Year Warranty.

B. Contractor shall and hereby does warrant all materials, workmanship and equipment furnished and installed by him to be free from defects for a period of one (1) year after date of substantial completion of the Contract. Should any defects in materials, workmanship, or equipment be made know to Contractor within the one (1) year warranty period, Contractor shall replace such materials, workmanship, or equipment without charge.

C. After completion of the work, Contractor shall operate the equipment which he installs for a period of ten (10) working days, as a test of satisfactory operating conditions. During this time, Contractor shall instruct the Owner's operating personnel in the correct operation of the equipment. Furnish necessary oral and written operating instructions to the Owner's representative.

D. Provide three (3) sets of manufacturer's operating and maintenance manuals and parts lists including nearest manufacturer's sales and service representative by name, address and phone for all equipment and materials furnished. Provide a maintenance schedule listing routine maintenance operations and suggested frequency there of. Include all warranty dates on equipment and guarantees. Include names, address and phone of any subcontractor and work performed. Bind above items in loose leaf three (3) ring binders with tab for each class of equipment.

E. During the period of tests, adjust all controls, regulators, etc., to comply with these Specifications.

F. Make available to the Owner, without additional cost, service and adjustment of the equipment for the guarantee period.

3.12 PROJECT CLOSE-OUT DOCUMENTS:

A. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:

1. Record drawings – Plumbing & Fire Protection (reproducible). Electronic drawings dwg format and pdf format.

2. Equipment and Fixture Submittal Data: List of manufacturers representative including name, address and telephone number that supplied requirement (3).

3. Equipment operating and maintenance manuals including: Spare parts required (3).

4. Maintenance schedule (3).

5. Equipment warranty dates and guarantees (3).

6. List of Owner's Personnel who have received maintenance instructions.

7. Record of inspections indicating what system was tested, type of tests, date of tests and those parties witnessing tests.

8. Valve Tag Chart.

9. Current flow test.

1.00 GENERAL:

1.01 SCOPE:

A. Provisions of this section apply to all Plumbing and Fire Protection work.

B. Include Section 15410, "GENERAL PROVISIONS - PLUMBING AND FIRE PROTECTION", with this Section.

C. All tests shall be witnessed by the Architect in addition to authorities having jurisdiction. A minimum of 48 hour notice is required prior to performance of test.

2.00 PRODUCTS:

2.01 NOT APPLICABLE

3.00 EXECUTION:

3.01 GENERAL REQUIREMENTS:

A. After system have been installed, Test, Balance and Adjust System for proper operation, flow rates, pressures and temperatures. Correct any noise and/or vibration conditions.

B. Perform all tests as required by local codes. Contractor shall furnish testing equipment. Keep a record of all tests indicating dates of tests, those persons witnessing tests and results of tests.

C. Provide with the Close-Out Documents a Testing Record.

D. If local Codes are more stringent, local Codes shall govern.

3.02 SANITARY WASTE AND VENT SYSTEMS:

A. Test piping by stopping lower outlets and filling with water to 10' hydrostatic head. Stop leaks and repeat test until watertight. All joints shall be exposed throughout test.

B. Provide "Ball Test" on all piping 3" and larger with ball 1/2" smaller than pipe diameter.

C. Provide visual inspection of all building drain piping below grade. Visual inspection shall be by means of a video camera routed through the drain system. Where the drain piping is connected to existing drain piping, the visual inspection shall include the existing drain piping from the point of connection, downstream to the point of connection to the public utility. A video tape and written report, noting any defects, on the findings of the visual inspection shall be provided to the owner with the close-out documents. The Plumbing Contractor shall provide personnel and equipment required for the visual inspection.

3.03 DOMESTIC WATER PIPING:

A. On completion of roughing-in, cap all outlets, make connections with house supply line, and put under full water pressure. Test by applying additional pressure (by temporary pump or compressed air connection) to total hydrostatic pressure 1-1/2 times street pressure but not less than 150 psig for not less than 4 hours.

B. Immediately and completely stop all leaks and retest until system is watertight. After testing, leave general pressure on until ready to install fixture (except when necessary to drain to avoid freezing during construction). After completion of all tests, repairs and installation of fixtures, flush all domestic hot and cold water piping with water to remove all sediment scale and until water runs clear, then disinfect.

C. Disinfect piping with hypochlorite solution of chlorine or compressed chlorine gas applied through on approved chlorinator. Operate all valves and faucets several times to insure the chlorine reaches all parts of the system. Feed water and chlorination agent into the system at rates that will provide a residual chlorine content of not less than 50 ppm after a retention period of 6 hours and 10 ppm after a retention period of 24 hours. Upon completion of treatment, flush treated water from each system until the water supply is satisfactory to the public health authority having jurisdiction. Provide Architect a certificate of compliance from the local Health Department.

D. Clean air aerators, hose sprays, flush valves, etc. and adjust to proper flow rates.

3.04 FIRE PROTECTION PIPING TEST:

A. Test in accordance with NFPA Pamphlets 13 and 20. Architects, Owner's, Underwriters and local Fire Marshall shall witness test. Provide certificate of inspection to the Architect/Engineer including the name of those witnessing the test.

B. On completion of roughing-in and before connection to existing piping, cap all outlets, make connections with house supply line, and put under full water pressure. Test by applying additional pressure, by temporary pump or compressed air connection, to total hydrostatic pressure 1 1/2 times street pressure, but not less than 200 psig for a period of not less than four (4) hours. Immediately and completely stop all leaks. Retest when system is watertight.

C. After testing, leave general pressure on until ready to install sprinkler heads and fire department valves, etc. except when necessary to drain to avoid freezing during construction.

3.05 COMPLETION OF TEST:

A. Upon completion of all testing, Contractor shall provide to the Architect copies of test results and include a listing of all personnel witness to the tests.

1.00 GENERAL:

1.01 SCOPE:

A. Include Section 15410, "GENERAL PROVISIONS – PLUMBING AND FIRE PROTECTION", with this Section.

2.00 PRODUCTS:

2.01 MATERIALS:

A. Pipe and fittings to be the same manufacturer.

2.02 SANITARY - WASTE AND VENT PIPING:

A. PVC plastic pipe: PVC-DWV, ASTM D-2665 to be installed above and below a slab, except in return air plenums. "Foam Core" piping is not acceptable.

B. Cast iron soil pipe: Cast iron non-hub pipe and fittings. CISPI Standard 301 shall be installed in all plenum return areas.

C. Joints for PVC plastic pipe: Solvent welded, ASTM B-2564

D. Joints for hubless cast iron pipe and fittings: Hubless pipe and fittings shall be joined by a heavy-duty coupling. Approved manufacturers: Husky SD 4000, Clamp All 125 or MG Couplings.

E. Joints in galvanized pipe: Screwed with Teflon tape applied in male threads.

F. Install vent stacks through roof. Terminate 12" above finish roof. Flashing is specified under Roofing Section.

G. Connect to site sanitary 5'-0" from Building. Verify with Civil Site Drawings exact size, location and invert of site sewer prior to beginning work.

2.03 DOMESTIC WATER PIPING:

A. Domestic Water Piping: Copper tube.

B. Copper Tube: ASTM C-88, copper water tube, Type "L" hard temper inside building, Type "K" outside building and below slab on grade. Fittings, cast brass or wrought copper water tube fittings, ANSI B-16.18 or B-16.22.

C. Joints on copper tube:

1. Inside Building: Properly cleaned fluxed and soldered as recommended by manufacturer, using 95-5 solder and 100% lead free flux.

2. Outside Building and below slab on grade: "Sil-Fos".

D. Provide temporary construction water at site as required.

E. Connect to water service 5'-0" from building, provided and installed under Civil Section. Verify exact location with Civil Drawings.

F. All water piping installed below slab on grade to be type "K" soft copper bent up on both ends with no joints below slab.

2.04 VALVES:

A. Domestic Water Piping Valves:

1. Ball Valves: All bronze, 150 psig WP, chrome plated bar stock ball, full port Teflon seats, stem packing seal and thrust washer, Watts B-6080 or B-6081, Apollo 20-100, Red White 5044F or 5094F, Kitz 56 or 57. Provide valve handle extension to (minimum 1") clear insulation.

2. Check valves 2" and smaller: All bronze, 125 psig WP, bronze disc, swing check, Stockham B-309, Crane 1342, Nibco S-413-B, Milwaukee 1509, Red White 237, Kitz 14.

3. Check valves 2-1/2" and larger: Iron body, bronze trim, switch check, 125 psig WP, Stockham G-931, Crane 373, Nibco F-918-B, Milwaukee F2974, Red White 435, Kitz 78.

B. Water pressure reducing valves: Watts, Wilkins, or Cash Acme, complete with inlet strainer, unions, inlet and outlet pressure gages and shut-off valve up stream of strainer.

2.05 PIPE HANGERS:

A. General: Pipe hangers, Grinnell, PHD, Michigan Hanger, or Elcen. Grinnell figure numbers are given for reference. Provide copper clad hangers on bare copper lines.

B. Pipe hangers for lines 3" and smaller, adjustable wrought ring hangers, Grinnell Fig. 97 or wrought clevis hangers, Grinnell Fig. 260.

C. Pipe hangers for lines 4" and larger, adjustable wrought clevis hangers, Grinnell Fig. 260.

D. Parallel piping graded in same direction may be grouped on trapezes. Trapezes for line 4" and smaller, Unistrut P2000 channel, or equal, with rods sized as specified below for largest pipe on trapeze. Guide lines on (but not anchor to) trapezes using Unistrut Series P1100 clamps. Trapezes shall not exceed 3' in length. Space lines to allow at least 3" clear between adjacent pipe or pipe covering and between pipes or pipe covering and rods. Space trapezes as specified for pipe hangers based upon smallest size of pipe on trapeze.

E. Provide riser clamps on pipe risers on each floor. Clamps in contact with copper or plastic pipe, plastic coated.

F. Beam Clamps: Grinnell Fig. 229.

G. Inserts for hangers in concrete structures: Underwriter's listed cast iron inserts. Grinnell Fig. 282.

H. For fasteners in existing concrete structures use drilled in expansion anchors with load rating at least 150% of pipe hanger rating (power driven anchors are not acceptable).

I. Size rods for pipe hangers not smaller than the following: 3/8" rods for pipe up to 2", 1/2" for 2-1/2" and 3" pipe, 5/8" rods for 4" and 5" pipe, 3/4" rods for 6" pipe, and 7/8" rods for 8" and 10" and 12" pipe, 1" rods for 14" and 16" pipe and 1-1/8" rods for 18" pipe.

J. Space pipe hangers at maximum: 5' intervals for cast iron pipe with additional hanger at each fittings. Pipe hanger spacing for screwed, solder joint and welded piping: 1/2", 6 ft.; 3/4" to 1-1/4", 8 ft.; 1-1/2" to 2-1/2", 10 ft.; 3", 12 ft.; 4" to 6", 14 ft.; 8" and over, 16 ft. Polypropylene and PVC plastic pipe 4 ft. horizontally maximum or as directed by manufacturer if closer, and 10 ft. vertically. Install additional hangers at change of direction and valve clusters.

K. Install pipe hangers on insulated pipe over pipe covering. Provide sheet metal saddle under hanger length to be 1-1/2 times the pipe diameter, minimum 12" long.

J. On sanitary piping requiring insulation, hanger may be installed directly on pipe and insulation installed over hanger.

3.00 EXECUTION:

3.01 PIPE INSTALLATION:

A. All piping shall be securely anchored in place to the Building Structure.

B. Cut pipe square and ream full size after cutting. Clean pipe. Make threaded joints with Teflon tape. Do not spring pipe into place.

C. Provide welding material and labor in accordance with the welding procedures of the Heating, Piping, and Air Conditioning Contractor's National Association or other approved procedure conforming to the requirements of ANSI B-31.9 "Building Service Piping". Employ only welders fully qualified in the above specified procedure and currently certified by recognized testing authority. Use either electric arc or oxactylene welding. Provide full perimeter wells at both face end and collar end of each slip-on flange.

D. Install piping to allow for expansion. Make connections to all equipment to eliminate undue strains in piping and equipment. Furnish necessary fittings and bends to avoid spring of pipes during assembly.

E. Install chrome plated floor and ceiling plates on pipe passing through finished surfaces in finished spaces.

F. Make pipe size reductions using reducing fittings. Bushings are prohibited.

G. Install 3/4" ball or gate valve drains with hose adapters at low points of water piping and at bases of all risers or where shown provide large drains.

H. Make connections to equipment using screwed unions in sizes 2" and smaller and flanged unions in sizes 2-1/2" and larger. Install unions in all piping connections to each piece of equipment.

I. Wherever ferrous pipes or tanks and copper tubing connect, provide dielectric insulation unions or couplings, equal to EPCO.

J. Run piping concealed, except where specifically shown or specified exposed. Plumb all vertical lines and run mains parallel to building walls unless specifically shown otherwise.

K. Lay underground pressure piping so top of pipe is at least 18" below finished grade. Provide deeper bury if required by local regulations. Support all underground piping solidly along body of pipe. Strongly suspend other piping from building construction.

L. Run no piping or tubing in direct contact with slag fill. Where necessary to pass through slag, protect piping with not less than two (2) wrappings of polyvinyl chloride tape or equivalent protection approved by Architect.

M. Install shock arrestors as manufactured by J. R. Smith, Josam, Zurn or Wade as required by the IPC Plumbing Code and where indicated on drawings. Size in accordance with manufacturer requirements.

3.02 INSTALLATION OF VALVES:

A. Provide shut-off valves where shown and detailed on Drawings. Locate valves to isolate each item to facilitate maintenance and/or removal.

B. Locate valves in piping connections to water heaters, etc., so heads and tube bundles can be removed without disconnecting equipment or piping other than union or flange connections immediately adjacent to heat exchangers.

C. Provide sweat to screw adapters where required.

D. In Buildings with water pressure exceeding 80 psig, provide and install a water pressure reducing valve(s) immediately upon entering building or as shown on Drawings. The P.R.V. shall be line size and have an integral strainer or separate WYE strainer up stream of P.R.V. Provide a ball or gate valve immediately upstream of P.R.V. and strainer.

SECTION 15451 - GENERAL FIRE PROTECTION REQUIREMENTS

1.00 GENERAL:

1.01 RELATED DOCUMENTS

A. Division 1 – Section "ALTERNATES": Coordinate related Division 15 work and modify surrounding work to integrate the Work of each Alternate.

1.02 SUMMARY

A. Description of General Fire Protection Requirements. Applies to all Division 15, Section 15450's (Fire Protection).

1.03 DEFINITIONS

A. "Provide" means to furnish and install, complete and ready for operation.

1.04 REFERENCES

A. ASME: American Society for Mechanical Engineers.

B. ASTM: American Society of Testing and Materials.

C. AWWA: American Water Work Association.

D. FM: Factory Mutual.

E. NEMA: National Electrical Manufacturer's Association.

F. NFPA: National Fire Protection Association.

G. MSS: Manufacturer's Standardization Society of the Valve and Fitting Industry.

H. UL: Underwriters Laboratories, Inc.

1.05 REGULATORY REQUIREMENTS

A. Comply with current edition, unless otherwise noted, of the following codes and standards.
   1. ANSI B31.9 - Building Services Piping.
   2. ADA - American's with Disabilities Act.
   3. NFPA 13 – Installation of Sprinkler System.
   4. NFPA 24 – Installation of Private Fire Service Mains.
   5. NFPA 30 – Flammable and Combustible Liquids Code.
   6. NFPA 31 – Installation of Oil-Burning Equipment.
   7. NFPA 45 – Fire Protection for Laboratories Code.
   8. NFPA 54 – National Fuel Gas Code.
   9. NFPA 70 - National Electrical Code.
   10. NFPA 101 - Life Safety Code.
   11. IBC - International Building Code with Fire, Mechanical, Plumbing and Gas Codes; 2015 Edition.

B. Permits, Licenses, Inspections and Fees.

1. Obtain and pay for all permits, licenses, inspections and fees, and comply with all rules, laws and ordinances pertaining to the Contractor's portion of the Work.
2. Obtain and pay for certificates of required inspections, and file certificates with Owner.

1.06 PRODUCT REQUIREMENTS

A. Provide new standard, materials throughout.

B. Multiple items of similar equipment shall be the product of the same manufacturer.

C. Substitutions:
1. Comply with the provisions of Division 1, Section "Product Requirements" and the following:
2. When several manufacturers are named in the specifications, the corresponding products and models made by the specified manufacturers will be accepted and Contractor may base his bid on any one of those products. However, if the Contractor's bid is based on products other than the scheduled or specified **basis of design**, it shall be understood that there will be no extra cost involved whatsoever, and the effect on other trades has been included in the Contractor's proposal. Coordination with other trades for substituted equipment or use of products other than the named basis of design shall be the responsibility of the Contractor furnishing the equipment.
3. The basis of design manufacturer's equipment has been used to determine space requirements. Should another approved manufacturer's equipment be used in preparing proposals, Contractor shall be responsible for determining that said equipment will fit space allocated. Submission of shop drawings or product data on such equipment shall be considered as indicating that the Contractor has reviewed the space requirements and the submitted equipment will fit the space allocated with due consideration given to access required for maintenance and code purposes.
4. The basis of design manufacturer's equipment and scheduled Fire Protection equipment electrical requirements have been used to coordinate the electrical requirements of the plumbing equipment with the electrical systems serving that equipment.
   a. Contractor shall coordinate the electrical requirements of the equipment actually furnished on this project and provide the electrical systems required by that equipment at no additional cost to the Owner.
   b. Equipment of higher or lower electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner.
   c. Prior to approval of submittals of Fire Protection equipment with electrical requirements that are greater or lower than those shown on the Drawings, Contractor shall submit letter verifying that required changes to the electrical system, serving the specific piece of equipment in question, have been coordinated with the electrical contractor. Letter to be included with the associated equipment submittal, addressed to the Architect with a copy to the electrical engineer.
5. Each bidder may submit to the Architect a list of any substitutes which he proposes to use in lieu of the equipment or material named in the specifications with a request for the approval of proposed substitutes. To be considered, such requests must be delivered to the office of the Architect not later than 10 days prior to bid due date. The submittal shall include the following:
   a. Specific equipment or material proposed for substitution giving manufacturer, catalog and model number.

b. All performance and dimensional data necessary for comparison of the proposed substitute with the equipment or material specified.
c. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute may require.

6. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution is final.

1.07 SUBMITTALS

A. Submit under provisions of Division 1, Section "Submittal Procedures" and the following:

B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be provided under the 15450 Sections of Division 15.
1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
2. Call attention to deviations from specified items as to operation and physical dimensions.
3. Performance curves for pumps shall be included.
4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

C. Shop Drawings: Before starting work, submit and obtain approval from Architect of detailed drawings of the following, fully dimensioned and drawn to 1/8" to 1'-0" scale. Submit six (6) prints of each drawing. Engineer will return five (5) of the prints with comments noted. Failure to submit shop drawings will make the Contractor responsible for changes required to facilitate installation.
1. Fire Protection Systems. See Division 15, Section "Fire Protection System."
2. For multi-story buildings, submit detailed floor penetration sleeve layout drawings. See Division 15, Section "Plumbing Basic Materials and Methods," Article "Informational Submittals."

1.08 COORDINATION DRAWINGS

A. General:
1. Within 60 days of Notice to Proceed provide Coordination Drawings for the following areas of the building:
a. Auditorium (Include all Rigging)
2. Do not base Coordination Drawings on reproduction of Contract Documents or standard printed data.
3. Submitted Coordination Drawings are for information only and typically will not be returned to the Contractor. Architect will not take any action, but may define coordination conflicts or problems and inform the Contractor of such conflicts or problems.

B. Content:
1. Project specific information, drawn accurately to scale.
2. Show sequencing and spatial relationship of separate units of work that must function in a restricted manner to fit in the space provided, or function as indicated.
3. Indicate dimensions shown on Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum

clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

C. Format:
   1. Coordination shop drawings shall be drawn to a scale of not smaller than ¼" = 1'-0".
   2. Provide drawings on electronic media in AutoCad .dwg format.
   3. Provide layering system separate from wall outline and unique to each discipline.
   4. In addition to plan view, provide sections as required to clarify congested situations and verify vertical clearances.
   5. Base drawings and building sections in .dwg format will be provided by Architect.

D. Fire Protection Shop Drawings: Fire Protection subcontractor shall add all fire protection equipment, piping, sprinkler heads and other elements to database.
   1. Upon completion of Fire Protection shop drawings, transmit electronic database to Electrical subcontractor.

E. General Contractor's Final Coordination: General Contractor shall thoroughly review shop drawings, adding additional building elements where appropriate, and shall resolve conflicts, coordinating with the Architect, and the various subcontractors.

F. Submit Coordination Shop Drawings: Upon completion of final coordination, General Contractor shall approve coordination shop drawings and transmit 3 sets of hard copies and electronic files on CD's to Architect.

G. The Architect will not process fire protection shop drawings until such time as the coordination drawings have been sufficiently completed and conflicts resolved.

1.09 QUALITY ASSURANCE

A. Installer's Qualifications: Firm experienced in installation of systems similar in size and complexity to those required for this project, plus the following:
   1. Acceptable to, or licensed by, manufacturer.
   2. Not less than 3 years experience with systems.
   3. Successfully completed not less than 5 comparable scale projects using systems similar to those for this project.
   4. Professional Engineer licensed in the State in which the work occurs; or NICET Level 3 and licensed by the State Fire Marshall in the State in which the work occurs. NICET Level 3 designer must be an employee of the Fire Protection Contractor. NICET Level 3 designer must oversee installation of shop drawings.

1.10 SUMMARY OF WORK

A. Scope: Provide all labor, materials, equipment and services necessary for the completion of all fire protection work shown or specified, except work specified to be done or furnished by others, complete and ready for operation.

1.11 DRAWING INTERPRETATION AND COORDINATION

A. Drawings are intended to show size, capacity, approximate location, direction and general relationship of one phase to another, but not exact detail or arrangement.

B. Do not scale drawings for location of system components. Check all measurements, location of pipe, ducts, and equipment with the detail architectural, structural, and electrical drawings and conditions existing in the field and lay out work so as to fit in with

ceiling grids, lighting and other parts.

C. Make minor adjustments in the field as required to provide the optimum result to facilitate ease of service, efficient operation and best appearance.

D. Where doubt arises as to the meaning of the Drawings and Specifications, obtain the Architect's written decision before proceeding with parts affected; otherwise assume liability for damage to other work and for making necessary corrections to work in question.

E. Refer to Architectural Drawings for all dimensions and location of lights, ceiling diffusers and sprinkler heads.

1.12 PROJECT/SITE CONDITIONS

A. Visiting Site: Visit site and become familiar with location and various conditions affecting work. No additional allowance will be granted because of lack of knowledge of such conditions.

B. Determine sizes and locations, and inverts of existing and new utilities near site.

C. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption in advance with Owner, authorities having jurisdiction, and all affected trades.

1.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit under provisions of Division 1 Sections - "Closeout Procedures" and "Project Record Documents" and the following.

B. Record Drawings:
1. Keep accurate record of corrections, variations, and deviations, including those required by change orders to the Fire Protection drawings.
2. Accurately show location, size and elevation of new exterior work dimensioned from permanent structure.
3. Record changes daily on a set of prints kept at the job site.
4. Submit prints marked as noted above to Architect for review prior to request for final payment.
5. Marked prints will be returned to Contractor for use in preparing Record Drawings.
6. The Fire Protection Contractor shall use marked up drawing showing as-built conditions provided by Contractor to prepare Record Drawings. Asbuilt drawings shall be incorporated on electronic files.

C. Prior to the issuance of a certificate for final payment, submit to Architect and obtain his approval of the following:
1. Record drawings – fire protection piping/shop drawings, bond and electronic files in AutoCAD *.dwg & PDF format.
2. Equipment Submittal Data (2).
3. Equipment operating and maintenance manuals (2).
4. Equipment warranty dates and guarantees (2).
5. List of Owner's Personnel who have received operating and maintenance instructions.
6. Install valve charts and valve location plans in main mechanical room. (See Division 15, Section "Plumbing Identification.")

7. Submit factory start-up/field reports for:
   a. Pressure Reducing Valve

D. Contractor's Material and Test Certificate for above ground piping.

E. Contractor's Material and Test Certificate for underground piping.

END OF SECTION 15451

SECTION 15453 - BASIC FIRE PROTECTION MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SUMMARY

A. Description of common piping, equipment, materials and installation for Fire Protection systems.

B. This Section includes the following:
1. Piping materials and installation instructions common to most Fire Protection piping systems.
2. Sleeves.
3. Concrete.
4. Grout.
5. Escutcheons.
6. Access doors - Building.
7. Flashing
8. Workmanship.
9. Cutting and patching.
10. Excavation, trenching and backfilling.
11. Piping systems installation - Common Requirements.
12. Equipment installation - Common Requirements.
13. Painting and finishing.
14. Concrete bases.
15. Supports and anchorages.
16. Protection and cleaning of equipment and materials.

1.02 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.03 SUBMITTALS

A. Product Data: For the following:
1. Transition fittings.
2. Escutcheons.
3. Access doors - building.

1.04 INFORMATIONAL SUBMITTALS

A. Shop Drawings: For multi-story buildings, submit detailed drawings of the floor penetration sleeve sizes and locations, including the following information:
   1. Fully dimensioned off column lines with location respective to adjacent walls shown.
   2. Sleeve size.
   3. Pipe size.
   4. Pipe service.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture. If pipes do not ship with end caps, cover ends of pipe stored on site with 6 mil plastic.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.06 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for Plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves and inserts in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate installation of building access doors for fire protection items requiring access that are concealed behind finished surfaces.

D. Electrical Characteristics for Fire Protection Equipment:
   1. Coordinate electrical system installation to match requirements of equipment actually furnished on this project.
   2. Include a letter with the respective equipment submittal from the electrical contractor and approved by electrical design consultant, detailing changes to the electrical system required to accommodate changes in the power distribution system to accommodate Fire Protection equipment that has different electrical power requirements from that equipment used as basis of design, or power provisions, as shown on the electrical drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

2.02 PIPE, TUBE AND FITTINGS

A. Refer to individual Division 15 Fire Protection Piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. All piping and fittings prior to PRV shall be rated for 250psi.

2.03 JOINING MATERIALS

A. Refer to individual Division 15 Fire Protection Piping Sections for special joining materials not listed below.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 20 gauge minimum thickness; round tube closed with longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Firestopping Sealant: See Division 7 Sections "Through-Penetration Firestop Systems" and "Fire Resistive Joint Systems" for firestopping sealant requirements.

D. Stuffing Insulation: Glass fiber type, non-combustible.

2.05 CONCRETE

A. Nominal weight concrete (145 PCF) using Type I Portland Cement, 1-inch maximum size coarse aggregate to provide a minimum 28 day compressive strength of 3000 psi.

2.06 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 5000-psi 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.07 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
   1. Finish: Polished chrome-plated.

2.08 ACCESS DOORS – BUILDING

A. Manufacturers:
   1. Bilco.
   2. Milcor.
   3. Nystrom.

B. Construction:
   1. Door: 14-gauge, cold rolled steel.
   2. Frame: 16-gauge, cold rolled steel of configuration to suit material application.
   3. Hinge: Concealed spring hinge.
   4. Latch: Screwdriver cam latch.
   5. Finish: Phosphate dipped and prime coated.
   6. UL labeled when in fire-rated construction with rating to match construction.
   7. Stainless steel (Type 304) shall be used in ceramic tile or glazed structural tile.

C. Size: 18 inch x 18 inch minimum, as indicated on drawings, or as required to allow inspection, service, and removal of concealed items.

2.09 FLASHING

A. Flexible Flashing: 47 mil thick sheet butyl compatible with roofing.

B. Lead Flashing: Waterproofing, 5 lb/SF sheet lead.

C. Pitch Cups: 20 gauge galvanized steel, minimum 8 inches deep, bases mitered and soldered and extending at least 4 inches horizontally.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. First class and in accordance with best practice. Work to be orderly, neat, workman-like in appearance and performed by skilled craftsman.

B. Poor or improper workmanship shall be removed and replaced as directed by the Architect without additional cost to the Owner or design professionals.

3.02 CUTTING AND PATCHING

A. Comply with the requirements of other Divisions for the cutting and patching required to accommodate the installation of Fire Protection work. Repair and finish to match surrounding.

B. Architect's approval required before cutting any part where strength, or appearance of finished work is involved.

C. Openings are to be laid out and built-in, set sleeves and inserts and furnish detailed layout drawings to other trades in advance of their work.

D. Core drill or saw cut openings in existing masonry construction.

3.03 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide trenching, excavation, backfilling necessary for performance of work, including excavation of rock and all other materials which may be encountered.

B. Grade bottom of trenches evenly and excavate bell holes to insure uniform bearing for the full pipe length. Excavate minimum 6 inches below pipe. Refill cuts below grade with sand.

C. Backfill after inspection by Architect and authorities having jurisdiction. Backfill compacted areas (engineered fill) with sand or fine gravel in accordance with requirements in Division 2. Section "Earthwork" no less than 95% compactancy. Backfill paved areas with sand or fine gravel compacted to meet requirements of Paving Section. Backfill shall be free of rock, wood, steel, brick, etc. Do not disturb pipe.

D. Refer to Division 15, Fire Protection Piping Sections for specific bedding and backfill requirements.

E. Restore existing pavement, curbs, sidewalks, sodding, bushes, etc., matching surroundings.

F. Restore all pavement cuts to meet the requirements of the cuts of the local authority.

3.04 PIPING SYSTEMS INSTALLATION - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Fire Protection Piping Sections specifying piping systems.

B. Drawings, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas and stairwells.

D. Install piping indicated to be exposed and in service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections. No mitering or notching for fittings permitted.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install escutcheons where exposed piping penetrates walls, ceilings, and floors in finished spaces.

3.05 SLEEVES

A. Sleeves are not required for core-drilled holes.
   1. In mechanical room floors and other potentially wet areas, provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
   1. Cut sleeves to length so that sleeve extends out ½ inch from both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas, or other potentially wet areas, 1-1/2 inches above finished floor level. Caulk space outside of sleeves water tight.
   2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
   3. Use the following sleeve materials:

a. Sleeves for Piping Through Concrete Beams, Concrete Walls, Footings, and Potentially Wet Floors: Steel pipe.
b. Sleeves for Piping through Masonry Walls and Gypsum Board Partitions: Steel sheet sleeves 1/2 inch larger than pipe or pipe covering.

4. Where piping penetrates non-rated equipment room wall, floors or roofs outside of a shaft, close off space between pipe or duct and adjacent work with stuffing insulation and caulk air tight.
5. Above ground, non-rated, exterior wall penetrations: Seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
6. Provide for continuous insulation wrapping thru sleeve.
7. Seal space around the outside of sleeves with grout at masonry walls and floors and dry wall mud at gypsum board partitions.

C. Fire-Rated Penetrations: Where pipes pass through fire-rated and fire-resistive floors, walls, and partitions, install appropriately rated sleeves and firestopping sealant. Firestopping materials and installation methods are specified in Division 7 Sections "Through Penetration Firestop Systems" and "Fire Resistive Joint Systems".

3.06 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Fire Protection Piping Sections specifying piping systems.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

D. Flanged Joints:
1. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
2. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.07 PIPE CLEANING

A. Keep pipe clean and free of dirt. Keep caps on ends of pipe when it is stored on site and reinstall caps on ends of installed piping at the end of each day.

3.08 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. Install equipment in accordance with manufacturer's instructions. If manufacturer's instructions conflict with Contract Documents, obtain Architect's decision before proceeding.

E. Install equipment to allow right of way for piping installed at a required slope.

F. All equipment shall be firmly fastened in place:
1. Pad mounted equipment shall be secured to pads using poured in place anchor bolts or cinch anchors.
2. Vibration isolators shall be secured to floors or pads and equipment shall be bolted to the isolators.

3.09 PAINTING AND FINISHING

A. Except as specified below or noted on the Drawing, requirements for painting of Fire Protection systems, equipment, and components are specified in Division 9 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

C. Painting of fire piping:
1. The following piping within boiler and chiller room shall be painted in its entirety under Division 9: Painting. Color codes are listed here for information only.
   a. Fire Protection Piping: Red Metaltex B47R3.
2. Should there be a conflict of colors in existing installations, contact the Architect.

3.10 CONCRETE BASES

A. Provide concrete foundations with nominal dimensions conforming to the following schedule for floor-mounted equipment:

Equipment	Foundation
Equipment and piping stands and supports	4" high pad
Equipment located in equipment rooms, not listed above	4" high pad or as indicated on the Drawings

B. Concrete bases shall be continuous and shall have beveled edges and smooth float finish. Concrete bases shall be reinforced with No. 3 bars a maximum of 12" on center each way, and held in place with dowel rods at each corner anchored in the slab. Dowel rods shall not penetrate through the slab.

C. Roughen and clean exposed slabs before pouring foundations. Apply bonding agent to surfaces in contact.

D. Concrete pads shall extend a minimum of 4" beyond the equipment footprint in all directions, including appurtenances, vibration isolators, base elbow supports, and motors.

E. Equipment attached directly to foundations or inertia bases; bases provided with grout holes; and bases consisting of a structural frame shall have voids filled with grout after attachment to foundation.

F. Fill voids between baseplates and foundations, and level equipment, with grout.

3.11 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" requirements.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing and fire protection materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.12 GROUTING

A. Mix and install grout for Fire Protection equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.13 ACCESS DOORS – BUILDING

A. Provide access doors in wall and inaccessible ceilings to allow access to service and maintain concealed Plumbing equipment, valves, etc.

B. Coordinate installation of access doors with Divisions responsible for Building System in which panels are being installed.

3.14 PROTECTION AND CLEANING OF EQUIPMENT, FIXTURES, AND MATERIALS

A. Equipment and materials shall be carefully handled, properly stored, and protected from weather, dust-producing procedures, or damage during construction.

B. At completion of all work, thoroughly clean exposed materials (pipe, etc.) and equipment and make ready for painting.

END SECTION 15453

SECTION 15455 - FIRE PROTECTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, Fittings, Valves for:
   1. Service from the water main to the building.
   2. Fire Booster Pump.
   3. Wet sprinkler system.

B. System design and installation. Base system design hydraulic calculations using the area/density method on the following criteria and in accordance with NFPA 13 latest edition.
   1. Sprinkler Protection:
      a. Offices, gymasiums, classrooms, lobbies, waiting areas, educational areas, dining areas, and corridors: Light hazard, 0.10 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
      b. Kitchen, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Shafts, Elevator Machine Rooms, Refrigeration Service Rooms, and storage between 100 and 250 sq. ft.: Ordinary Hazard, Group 1, 0.15 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
      c. Utility and Maintenance rooms, laundry, laboratory and storage rooms, storage rooms over 250 sq. ft., loading docks, energy centers areas: Ordinary Group 2, 0.20 gpm/sq. ft. over the hydraulically most remote 1500 sq. ft.
      d. Provide sprinklers in accessible shafts per NFPA 13 latest edition.
   2. Add water allowance of 250 gpm for inside and outside hose streams to the sprinkler requirements at the connection to the distribution main.
   3. Hydraulic Calculations: The calculated demand including hose stream requirements shall fall no less than 10 percent below the available supply curve.
   4. Comply with IBC (2009 Edition), NFPA 13 (2009 Edition), NFPA 30, Flammable and Combustible Liquid Code, NFPA 45, Standard on Fire Protection for Laboratory Using Chemicals, NFPA 54, National Fuel Gas Code, NFPA 58, Liquefied Petroleum Gas Code, NFPA 70, National Electric Code, NFPA 72, National Alarm and Signaling Code, and NFPA 101, Life Safety Code (2009 Edition).

1.02 RELATED SECTIONS

A. Section 15405 – Plumbing Identification.

B. Section 15451 – General Fire Protection Requirements.

C. Section 15453 – Basic Fire Protection Materials and Methods.

1.03 SYSTEM

A. A wet sprinkler system providing coverage for the entire building.

B. A fire booster pump.

C. Fire service from approximately 5ft outside the building to inside the building.

1.04 SUBMITTALS FOR REVIEW

A. Submit under provisions of Division 1, Section "Submittal Procedures" and the following:

B. Product Data: Submit to the Architect and obtain his approval of a complete list of materials and equipment which are to be furnished under Division 15.
   1. List shall be complete with manufacturer's names, catalog number, dimensions, specifications, rating data and options utilized. Capacities shall be in the terms specified.
   2. Call attention to deviations from specified items as to operation and physical dimensions.
   3. Performance curves for equipment such as pumps shall be included.
   4. Final equipment orders shall not be placed until submittals have been returned marked "No Exceptions Noted" or "Make Corrections Noted".
   5. Bind all equipment submittals and provide index tab for each type of equipment. Submit all at one time. Reserve two sets for project close-out documents.

C. Shop Drawings:
   1. A reflected ceiling plan indicating locations of sprinkler heads, lights, HVAC devices, smoke detectors, exit lights and any additional items attached to ceiling. In lift out ceilings, sprinkler heads are to be centered in ceiling tiles. In hard ceilings, sprinkler heads to follow the general arrangement of the ceiling. After review by the Architect, revise layout as required.
   2. Prepare a working pipe shop drawing based on hydraulic calculations. The piping shop drawing shall indicate routing and configuration of piping, size of pipe, piping support, elevation of piping and coordination of piping with ductwork. Shop drawings shall include low point drain downs.
   3. Hydraulic calculations are to be prepared utilizing a current water flow test (maximum 90 days old). If current flow test is not available, obtain a current flow test and pay for all fees required.
   4. If water flow information is not available due to new main extension or other construction which prohibits the availability of flow information at the start of construction, the contractor shall estimate probable flow information based on information available. Once permanent water is available at the site, the Contractor shall perform a flow test, incorporate the information into the calculation and make any modifications to the system as may be required.
   5. When drawings and hydraulic calculations are submitted to the Engineer for review, they shall bear the seals of review and approval of the Architect, General Contractor, the Owners Insurance Underwriter, and the Nicet Level 3 Designer. The Nicet registered designer shall be an employee of the Fire Protection Installing Contractor and shall oversee installation of Project. Nicet registration seal shall be included on shop drawings.
   6. Contractor to provide to the State reviewing Agency a set of shop drawings reviewed and approved by Engineer of Record as required by the State of Alabama.
   7. The Contractor shall incorporate all comments for approval by local Fire Marshall's Office and any State of Alabama Reviewing Agency. Contractor shall provide signed, and approved set of plans to Engineer upon approval by state and local authorities.
   8. Each system calculations, components and alarming to be on shop drawings.

1.05 SYSTEM INSTALLATION AND INSPECTION

A. Required Inspections:
   1. All underground and above ground fire line piping must be inspected by owner's representative prior to being covered or concealed.

B. Fire Stopping:
   1. All fire stopping of any and all fire rated assemblies must be inspected and approved by a State Inspector prior to the work being concealed.

C. Hydrostatic Testing Requirements:
   1. The required hydrostatic testing of the underground and above ground fire line piping must be witnessed and approved by City Inspector prior to being covered or concealed.

D. Underground Fire Line Pipe Flush Test Requirements:
   1. The required flush test of the underground fire line piping must be witnessed by an Owners representative prior to being connected to the above ground piping or riser.

E. Acceptance Inspections & Testing:
   1. Allow fire protection and life safety systems installation and acceptance test must be inspected, test, witnessed and approved by an AHJ and Owner's representative.

F. Plans Review & Approval:
   1. All fire protection and life safety system drawings and specifications must be reviewed by this office to ensure code compliance prior to start of any work.

1.06 REGULATORY REQUIREMENTS

A. Materials: Conform to UL and FM Global Requirements and Standards.

B. Sprinkler System: Conform to NFPA 13, State of Alabama Fire Marshall Requirements, Hueytown Fire Requirements and Alabama State Building Commission Requirements.

C. Stationary Fire Pumps, NFPA 20.

D. Private Service Mains: Conform to NFPA 24.

E. NFPA 25, Inspections, Testing and Maintenance of Water-Based Fire Protection Systems.

F. NFPA 72, Standard for the Installation, Maintenance and Use of Protective Signaling Systems.

G. NFPA 72E, Standard on Automatic Fire Detectors.

H. Applicable Building Codes.

I. Welding Materials and Procedures: Conform to ASME Code.

J. Valves: Bear UL, FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

K. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.07 EXTRA MATERIALS

A. Provide extra sprinklers under provisions of NFPA 13, State and Local requirements.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet in location designated. (Designate location).

PART 2 - PRODUCTS

2.01 PIPING BELOW GRADE AND BELOW SLAB ON GRADE

A. Ductile Iron: Cement lined ANSI A-21.50.

B. Joints on Ductile Iron: Standard mechanical joint ANSI A-21.11. Provide with retainer glands at all fittings and thrust blocks minimum 1 cubic yard of concrete at all changes of direction.

2.02 WET SPRINKLER SYSTEM

A. Wet System - Above Ground Piping:
   1. Black Steel Pipe:
      a. All piping 1-1/2" and smaller, all piping larger than 1-1/2" with cut grooves on threaded and all welded piping, Schedule 40 black steel ASTM A53, ASTM A795, ASTM A135.
      b. Piping larger than 1-1/2" for roll grooving only, Schedule 10 ASTM A795, ASTM B36.10. Schedule 10 pipe may not be used for threading or cut grooving. Schedule 7 pipe will note be accepted.
      c. Cast iron threaded fittings ANSI B16.4 cast iron flanges and flanged fittings ANSI B16.1.
      d. Malleable iron threaded fittings, ANSI B16.3.
      e. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts and washers; galvanized for galvanized pipe.
      f. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement into pipe.
      g. Malleable Iron Fittings 175 lb. (250 lb.); ASME B16.3, threaded fittings.

      Black Steel Piping and fittings shall be domestic manufacturer. Bull Moose Tube, Victaulic, or Wheatland are approved manufacturers. Substitutions require prior approval.

      All piping and fittings prior to PRV shall be rated for 250psi.

   2. Copper Tubing: ASTM B75; ASTM B88; Type K, hard drawn.
      a. Fittings: ASME B16.22, wrought copper and bronze, solder joint, pressure type.
      b. Joints: AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.

      Copper Piping and fittings shall be domestic manufacturer. Bull Moose Tube, ARGCO, Mueller, or Cerro are approved manufacturers. Substitutions require prior approval

B. Sprinklers:
   1. Sprinklers to be UL approved glass bulb quick response type.
   2. All sprinkler heads to be rated for 175°F, unless otherwise noted on drawings.
   3. Suspended Ceiling (Lay-in and Gypsum):
      a. Manufacturers:
         1) Viking Model M.
         2) Tyco, Reliable, Victaulic.
      b. Type: Quick response concealed pendant type with painted cover plate.
      c. Cover Plate: White. Unless indicated otherwise. Provide color chart to Architect for color selection.

d. Finish: Sprinkler Head – chrome plated.
e. Fusible Link: Glass bulb type temperature rated for specific area hazard.

4. Exposed Area Type:
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.
   b. Type: Quick response upright type with guard.
   c. Finish: Brass or chrome plated.
   d. Fusible Link: Glass bulb type temperature rated for specific area hazard.
   e. Guards: Finish to match sprinkler finish.

5. Sidewall Type:
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.
   b. Type: Quick response recessed sidewall type.
   c. Finish: Chrome plated.
   d. Escutcheon Plate Finish: Chrome plated in color.
   e. Fusible Link: Glass bulb type temperature rated for specific area hazard.

6. Dry Pendent Sprinklers (Cooler/Freezer and all areas subject to temperature below 40 deg F.):
   a. Manufacturers:
      1) Viking Model M.
      2) Tyco, Reliable, Victaulic.
   b. Type: Quick response recessed sidewall type with matching push on escutcheon plate.
   c. Escutcheon Plate Finish: Chrome plated.
   d. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Pipe Hangers and Supports:
1. Conform to NFPA 13.
2. Hangers for Pipe Sizes ½ to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Plate Support: Carbon steel ring, adjustable, copper plated.
10. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for drop.

Pipe hangers and supports shall be of one manufacturer. Grinnell, Anvil or Tolco are approved manufacturers. Substitutions require prior approval.

D. Gate Valves:
1. Up to and including 2 Inches:
   a. Manufactures:
      1) Nibco Model T-104-O.
      2) Where Nibco is listed, Victaulic, Stockham, Watts, Tyco and Milwaukee are equal.
   b. Bronze body, bronze trim 175 psi WP, UL Listed, rising stem, handwheel, solid wedge or disc, threaded ends.

2. Over 2 Inches:
   a. Manufactures:
      1) Nibco Model F-607-OTS.
      2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.
   b. Iron body, bronze trim 175 psi WP, UL Listed, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid bronze or cast iron wedge, flanged or grooved ends.

E. Butterfly Valves:
1. Cast or Ductile Iron Body
   a. Manufactures:
      1) Nibco Model GD-4765-4/8.
      2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.
2. Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, lug, or grooved ends, extended neck, handwheel and gear drive and integral indicating device, and internal tamper switch rated, UL / FM approved.

F. Check Valves:
1. Up to and including 2-1/2 inches to 6 inches:
   a. Manufacturers:
      1) Nibco Model G-917-W.
      2) Where Nibco is listed, Victaulic, Watts, Tyco and Milwaukee are equal.
   b. Iron body and swing disc, bronze seat, stainless steel spring, grooved ends, 175 psi WP.

G. Water Flow Switch:
1. System sensor WFD water flow detector. Poetter Reomer, Viking, and Tyco are acceptable manufacturers.

H. Supervisory Switches:
System sensor OSY2 Model tamper detector. Poetter Roemer, Viking, and Tyco are acceptable manufacturers.

I. Fire Department Siamese Connection:
1. Crocker Figure No. 6410-PC chrome plated exposed with clappers, caps and chains.
2. Location to be coordinate with Fire Chief and Architect.

Elkhart, Croker and Guardian Fire are acceptable manufacturers

J. Test and Drain Assembly:
1. Viking Model A-1 complete with sight glass and ½" orifice for test purpose. Pipe discharge to drain riser on to exterior and spill on splash block.

Tyco, Victaulic, and Reliable are acceptable manufacturers.

K. Fire Pump:
1. The pump shall be an electronically driven vertical mounted inline, single stage U.L. 448 factory assembled and tested electrically. Pump approved for fire pump use in accordance with the requirements of NFPA 20. Pump shall be ISO 9001 Certified.
2. The pump shall be rated at 1000 GPM with a 125 psi boost. The pumping unit shall deliver not less than 150% of its rated capacity at not less than 65% of total rated head with the shut off pressure not exceeding 140% of the total rated head.
3. The pump impeller shall be cast bronze statically and dynamically balanced and keyed to the shaft.
4. The pump shaft shall be made of SAE 1045 steel with bronze sleeves, key locked and threaded to tighten with shaft rotation. Shaft bearings shall be grease-lubricated ball

bearings in case-iron housing and seals shall be stuffing box type with bronze packing grand.

5. The pump shall be coupled to the ending drive with a flexible coupling capable of absorbing torsional vibration and shaft misalignment. Provide a metal coupling guard.
6. The pump shall be driven by U.L. listed and FM approved Nema MG-1, open-drip proof, squirrel cage 100HP motor, 460 Volts 3 phase, manufactured in full compliance with NFPA 20 and NFPA 70.
7. The fire pump shall be provided with all NFPA required accessories including automatic air release, circulation relief valve, suction and discharge pressure gages, concentric tapered reducing fitting on pump discharge, eccentric-tapered reducing fitting on pump suction and base elbow supports.
8. Provide a low suction control valve on the pump discharge piping to maintain a 20 psi suction pressure.
9. The pump and drive unit shall be factory assembled and tested and mounted on a common base. Install on a 4" high housekeeping pad.
10. The pump and driver shall be a Patterson 6x6 VIP UL-FM. Approved equals are Aurora and Allis-Chalmers.

L. Automatic Pump Controller:

1. Provide and install a U.L. 218 listed NFPA 20 automatic control panel listed for fire pump control.
2. The control cabinet shall be floor mounted on a concrete pad against an outside wall. Provide in panel two separate compartments, one for the starter and associated controls and one compartment for an automatic transfer switch.
3. The controller shall not exceed 70" in height, 58" in width and 20" in depth.
4. The controller shall provide "soft start" starting for the pump motor and short-circuit with stand rating at least equal to the short-circuit current available at the controller location. The controller shall be manual and automatic with manual-off-automatic selection switch, power on lamp, connection points to the fire alarm system to include motor running, condition, loss-of-line power and line-power phase reversal, pressure switches to start and shut down pump. Provide a minimum run timer set for 15 minute run time and automatic controller to test run pump a minimum 30 minutes each week. Provide on controller panel a visual indicator connected to the power conductors on the line side of the motor starter indicating operating voltage is available at the starter coil. Controller model ECRT-40-46-XG4,PPE0,SP1,48E,48J,83LT manufacturer by Master Controller.
5. Provide in a separate compartment in the control panel an automatic transfer switch to transfer from normal power to emergency and to switch from emergency to normal power.
6. The pump shall be started by fire alarm relay, deluge valve relay or push button starter.
7. The automatic control panel shall be factory assembled, wired and tested such that the only field wiring required shall be power in and motor circuit out.

2.03 JOCKEY PUMP

A. Pressure-Maintenance Pump (Jockey Pump)

1. Provide and install a pressure-maintenance jockey pump, electrically driven, cast iron or stainless body, bronze or stainless steel impeller with mechanical seals. The pump shall be rated for 10 GPM at 90 psi boost. Pump shall be equal to an Patterson 1.5 HP, 480/3. Model #PM3-8 Series.

B. Pressure Maintenance Pump (Jockey Pump) Controller

1. Provide and install a UL 508 factory assembled, wired and tested for combined automatic and non-automatic operation.
2. The enclosure shall be UL 508, Nema 250 type 2.

3. The controller shall be rated for the specified more power and includes fusible disconnect switch, pressure switch.
4. Controller shall be a Master Model JPC-1.5-3-46 complete.

2.04 FIRE PUMP ALIGNMENT

A. The pump/motor shall be "rough" aligned at factory to assure proper fit for final alignment.

B. Pre-Alignment: After the pump has been properly secured to its concrete base and properly grouted, then pump/motor shall be pre-aligned with a straight edge and calipers prior to piping. Assure that the pump is level, all bots secured and the grout is completely dry before piping is fitted to the pump. The flange bolts must easily slide into place and pipe flanges must not place any strain on the pump.

C. Final Alignment: Final alignment shall be done after the system is filled. The pump/motor alignment shall be done with laser alignment equipment and shims are to be new and calibrated. The alignment technicians shall have been trained and certified by the manufacturer of the specific laser unit being used.

D. Alignment must be to the following specifications:
1. Parallel Misalignment – 0.004" T.I.R.
2. Angular Misalignment – 0.002" T.I.R.
3. T.I.R. – Total Indicated Run Out.
4. Alignment must be done from the pump/motor shafts, not from the coupling.

E. A laser alignment report is to be completed on each pump/motor giving job name, equipment name, identification number of pump and motor, initial vertical and horizontal values and final vertical and horizontal values.
1. The pump manufacturer's representative shall be responsible for the pump/motor alignment. The mechanical contractor shall verify this by co-signing the alignment report.

2.05 FIRE PUMP DOWELING

A. After final coupling alignment is complete, motor feet and pump base to be doweled to base.

B. Drill holes through diagonally opposite feet and into pump base. Hole diameter to be 1/64 inch less than dowel pins.

C. Clean out chips, ream holes in feet and base for "light push fit."

D. Insert pins approximately flush with feet

E. Installation:
1. The installation must meet all established standards and be according to all applicable laws, regulations and codes.

F. Training:
1. The contractor must plan and organize a training session of a minimum two hours for the building maintenance staff, in the presence of building owner or his representative.
2. The training session must include the normal operation, emergency procedures and system maintenance.
3. Training personnel roster shall be included in closeout documents.

G. Test & Verification:
1. Hydrostatic tests must be performed on the entire sprinkler piping system, as required by NFPA 13.
2. In addition to the standard hydrostatic test, an air pressure leakage test at 40 psi (2.8 bars) shall be conducted for 24 hours. Any leakage that results in a loss of pressure in excess of 1 1/2 psi (0.1 bar) during the 24 hours shall be corrected.
3. A drain test using the auxiliary drain valve fully open (drain located on water supply side, deluge valve inlet) must be performed to make sure that no back pressure in drain piping exists, which could affect the proper operation of the preaction system.
4. An air supply test must be performed, to confirm that normal air pressure can be restored within 30 minutes.
5. The verification of the fire alarm system must be done in accordance with the NFPA 72, Chapter 7 (and CAN/ULC-S537 in Canada).

H. Report & Certification:
1. An inspection report and a certificate must be supplied to the engineer at the completion of the project. All tests results shall be registered in a booklet to be included with the inspection report.

The proper operation and coordination for the system's installation, including the automatic sprinkler system, detection system, signaling system and initial start-ups are all under the responsibility of the fire protection contractor.

2.06 FIRE STOP SYSTEMS

A. All wall and floor penetrations are to be closed. Refer to the Arch. Life Safety Plans and close all openings with a U.L. listed assembly compatible with the rating of the wall or floor being penetrated.

B. Non-rated walls – sheet rock joint compound may be used to seal opening.

C. For piping passing through listed sheet rock walls or partitions:
1. Uninsulated pipe passing through 2 hour walls or partitions – minimum 5/8" depth of Hilti FS 605 filling annular space between wall and pipe on both sides of wall. U.L. Listing #WL1056.
2. Uninsulated pipe passing through 2 hour walls or partitions – minimum 1-1/4" depth of Hilti FS 601 filling annular space between pipe and wall on both sides of wall, U.L. Listing #WL1054.

D. For piping passing through concrete floors, concrete walls or concrete block walls.
1. Uninsulated Schedule 40 steel pipe; fill annular space between pipe and opening with Hilti #FS 605. U.L. Listing #CJ1184.

PART 3 - EXECUTION

3.01 PREPARATION

A. Install piping in accordance with NFPA 13 for sprinkler systems, NFPA 14 for standpipe and hose systems, and NFPA 24 for service mains.

B. Connect to site fire service installed under another section. Verify the site with civil drawings for the exact size and location of the service prior to beginning work.

C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

D. Install piping to conserve building space, to not interfere with use of space and other work.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers form reinforcement concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

H. Pipe Hanger and Supports:
1. Install in accordance with NFPA 13 and NFPA 14.
2. Hangers on branch lines to comply with NFPA 13, 9.2.3.
3. Hangers on mains to comply with NFPA 13, 9.2.4.
4. All hangers to be a maximum of 12 inches from the end of a branch line or an arm-over for a drop.
5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple trapeze hangers may be used.
7. Provide copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

I. Slope piping and arrange systems to drain at low points.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coast of zinc rich primer to welding.

K. Do not penetrate building structural members unless indicated.

L. Provide sleeves when penetrating floors and wall. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

N. Die cut threaded joints with full cut standard taper pipe threads and connect with Teflon tape or Teflon pipe compound applied to male threads.

O. Install valves with stems upright or horizontal, not inverted.

P. Provide valves for shut-off or isolating service and where shown on plans.

Q. Provide drain valves at main shut-off valves, low points of piping and apparatus.

R. Install piping in attic directly on top of joists. Install plastic sheeting over top of pipe and secure joists. Insulation to be installed over pipe and plastic sheeting.

S. Provide automatic sprinkler coverage at the bottom of hydraulic elevator shafts and elevator machine room in Accordance with NFPA 13 and local requirements.

T. Exterior exposed equipment shall be chrome plated.

U. All fire department or maintenance connections shall be coordinated with the Fire Department.

V. The fire protection contractor is responsible for coordination and labelling of fire devices supplied under this specification.

W. Where pipes penetrate exterior or finished surfaces escutcheons shall be used. Escutcheons shall be chrome finished and single piece design.

X. All devices and equipment shall be labelled as required by NFPA 13, 20, 24.

1.00 GENERAL:

1.01 SCOPE:

A. Include Section 15410 "GENERAL PROVISIONS - PLUMBING AND FIRE PROTECTION", with this Section.

B. Repair existing insulation at points of connection to existing work.

C. "Exposed" is defined as: Exposed to view when construction is complete. Items which are not "exposed" are "concealed".

D. Insulate all items subject to sweating or loss of heat.

E. All insulation shall be installed by licensed applicator and applied in accordance with the Manufacturer's Recommendations.

1.02 INSULATION REQUIREMENTS:

A. Comply with NFPA 90A.

B. Pipe hanger saddles are specified in Section 15450 "MATERIALS AND METHODS - PLUMBING"

C. Use insulation and adhesives with Underwriter's Laboratories flame spread rating not over 25 without evidence of continued progressive combustion, and smoke developed rating not exceeding:

1. 50 for pipe covering located in air ducts, plenum or casing.

2. 150 for all other pipe, and equipment insulation.

2.00 PRODUCTS:

2.01 FIBERGLASS PIPE COVERING:

A. Snap-on glass fiber insulation minimum density 5#/cu. ft. maximum thermal conductivity at 75°F mean temperature 0.25 BTU/(hr) (sq. ft.) (°F/in.) with UL rated vinyl coated and embossed vapor barrier laminate of aluminum foil and kraft reinforced with glass fiber yarns (ASJ).

B. For all lines seal jacket with self sealing lap and staple with outward clinching staples 3" o.c. Butt adjoining sections of insulation tightly and seal with self-adhering butt joint strips.

C. Cover fittings to thickness of adjacent covering with factory pre-molded fitting covers. Cover flanged valve bodies with flanged unions. Do not cover screwed unions on hot lines. Finish fittings with a skim-coat of insulating cement and when cement is dry fitting shall be covered with glass fab and vinyl acrylic mastic. Finish fittings exposed in equipment rooms, boiler room, and in finished spaces with vinyl acrylic mastic over glass fab.

D. At Contractor's option, concealed tees may be insulated with field fabricated tee covers consisting of straight pipe covering on run of tee with notch at branch together with pipe covering on branch contoured to fit notch. Glass fab shall be applied around main, lapping contoured joint at branch by 1" minimum for the full circumference of joint. Cover entire fitting covering with vinyl- acrylic mastic over glass fab, 1/8" thick (dry) coat. Submit sample of fabricated tee covering to Architect for approval before work is begun.

2.02 ALUMINUM JACKET PIPING COVER:

A. 0.010" thick corrugated aluminum jacket with laminated polyethylene and draft paper adhered liner.

B. Securely rivet jacket in place and band with flat aluminum bands 18" o.c.

C. Finish fittings on aluminum jacketed lines with 1/8" thick (dry) coat of vinyl acrylic mastic reinforced with glass cloth.

2.03 MANUFACTURERS

A. Acceptable Manufactures for Fiberglass Insulation Materials:
1. Owens-Corning.
2. Certaniteed.
3. Knauf.
4. Manville Corporation

B. Acceptable Manufacturers for Foamed Plastic Closed Cell Elastometric Insulation Materials:
1. Armstrong AP.
2. Rubatex.

C. Acceptable Manufacturers for Adhesives, Mastics and Coatings:
1. Armstrong.
2. Benjamin Foster.
3. Childers.
4. Marathon.

D. Acceptable Manufacturers for Metal Jackets:
1. Childers.
2. Manville Metal-Loc.

2.04 SCHEDULES - PIPING

A. Plumbing Piping:
1. Domestic Cold Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipes located in walls: ½ inch thick.
   b. Foamed Plastic Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipes located in walls: ½ inch thick.
2. Domestic Hot and Recirculating Water Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1-1/2 inch thick.
      2) Pipe located in walls: 1 inch thick.
   b. Foamed Plastic Pipe Insulation
      1) All pipe sizes: 1 inch thick.
      2) Pipes located in walls: ½ inch thick.
3. Floor Drain Bodies, Traps and Waste Piping Between Floor Drain and Waste Stack for Floor Drains Serving Refrigeration Equipment, Ice Machine and AC Units; Interior, Above Grade:
   a. Glass Fiber Pipe Insulation
      1) All pipe sizes: 1 inch thick.

2.05 INSTALLATION – EQUIPMENT INSULATION GENERAL

A. Install in accordance with NAIMA Insulation Standards.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires or bands.

E. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature: Insulate entire system.

G. Finish insulation at supports, protrusions, and interruptions.

H. Equipment in Mechanical Rooms or Finished Spaces: Finish with canvas jacket or as scheduled.

I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

K. Install in accordance with NAIMA National Insulation Standards.

L. Exposed Piping: Locate insulation and cover seams in least visible locations.

M. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

N. Fit pipe hangers over insulation.

O. Inserts and Shields:
   1. Application: Protect insulated piping at hangers and supports with insulation shield. On pipe sizes over 2 inches, provide insert.
   2. Insulation Protection Shield: Galvanized steel formed in half circle to fit insulation. Length and gauge as follows:
      a. Up to NPS 4: 12 inches long and 22 gauge.
      b. NPS 6: 18 inches long and 22 gauge.
      c. NPS 8 through 12: 24 inches long and 18 gauge.
      d. NPS 14 and Large: 24 inches long and 16 gauge.
   3. Insulation-Insert Material: Water repellent treated, ASTM C533, Type I calcium silicate; or ASTM C552, Type II cellular glass of same thickness and vapor barrier jacket specified for surrounding insulation. Insert shall be a minimum of 2 inches longer than the shield.
   4. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
   5. For Clevis Hangers: Insert shall cover lower 180 degrees of pipe.
   6. Option: At Contractor's option, insert may be factory fabricated Thermal Hanger Shield (insulation insert encased in sheet metal shield) equal to Pipe Shield, Inc. "Insulated Pipe Supports."

P. Continue insulation through metal studs, walls, sleeves, pipe hangers, and other pipe penetrations. Finish firestopping at supports, protrusions, and interruptions. At fire separations, refer to Division 7 and Section 15410: Sleeves.

Q. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.00 EXECUTION:

3.01 PLUMBING PIPING INSULATION:

A. Bodies of floor drains serving refrigeration equipment, AC units and ice machines and traps and waste piping between such drains and waste stack: "Fiberglass Pipe Covering". 1" thick.

B. Cold water piping, interior, above grade: "Fiberglass Pipe Covering", 1" thick. Pipe insulation in partitions and chases may be 1/2" thick "Arma-cell" or approved equal.

C. Hot and Hot Water Return water piping, interior, above grade: "Fiberglass Pipe Covering", 1-1/2" thickness. Pipe insulation in partitions and chases may be 1" thick "Arma-cell" or approved equal.

D. Exposed P-Traps, stops and supplies on handicapped lavatories, and sinks. Equal to "PRO-WRAP" by McGuire.

E. Insulation with aluminum jacket: All exposed hot and cold water piping in Mechanical Rooms, Janitor's Closets and Water Heater Rooms.

1.00 PRODUCTS:

1.01 SCOPE:

A. Include Section 15410, "GENERAL PROVISIONS – PLUMBING AND FIRE PROTECTION", with this Section.

B. Pay particular attention to requirements in the General Provisions for substitution of products not named or listed as substitutions.

2.00 PRODUCTS:

2.01 CLEANOUTS:

A. Furnish and install cleanouts where indicated on drawings and at all 90-degree bends, angle, upper terminals and not over 50 feet apart on straight runs. All cleanouts to have bronze countersunk tapered slotted plugs, except acid waste piping cleanouts, which shall be standard of piping system used. Flush-with-floor cleanout access covers shall have non-skid covers. All wall cleanout access covers shall have polished satin finish. All cleanouts shall be full size of pipe, piping larger than 6" shall have minimum 6" cleanout covers.

B. Exposed Cleanouts: Cast brass plug type, J.R. Smith #4470.

C. Wall type cleanout plug and access covers, J.R. Smith #4472. Cleanout plug must be within 1" of finish wall and must be tapped for access cover.

D. Install wall cleanouts on stacks at flush valve fixtures 12" above top of flush value, 12" above finish floor on sinks, lavatories and water coolers and 12" above grab bars at fixtures with grab bars. Locate cleanouts to clear baseboard at floor.

E. Floor type cleanout access covers: J.R. Smith #4248-NB. Plug must be within 3" of finished floor. Grout cleanout below access cover to seal watertight.

F. Outside Cleanouts: J.R. Smith #4258 cleanout access encased in a 18" X 18" X 6" deep concrete pad. See Detail on Drawings.

2.02 REDUCED PRESSURE ZONE BACKFLOW PREVENTER AND DOUBLE CHECK VALVE ASSEMBLIES:

A. One (1) inch and larger: Equal to Watts #909 with gate valves and inlet strainer. Provide additional valve upstream of strainer. Clayton, Beeco, Febco, Conbraco, Wilkins or equal. Provide same size as piping.

B. One-half (1/2) inch and three-fourth (3/4) inch: Watts #9D, Wilkins #750, same size as pipe.

C. Pipe relief from backflow preventer full size to nearest floor drain. Provide factory made air gap for relief connection.

D. Double check valve assemblies: Watts, Clayton or Beeco.

2.03 PLUMBING FIXTURES AND EQUIPMENT:

A. All "wetted" domestic potable fixtures, piping materials, valves shall meet the Federal Lead Free Guidelines. All materials shall be clearly marked and submitted with complete data during submittal review.

B. Unless otherwise specified, all fixtures complete as catalogued, commercial grade, white color, exposed metal trim chromium plated.

C. Fixtures and brass shall be securely anchored. Carriers shall be securely anchored to floor with lug bolts in all holes as recommended by the manufacturer.

D. Flush valve "YJ" supports shall be installed 1" below vacuum breaker on all water closet flush valves
and around vacuum breaker on urinals.

E. Seal all fixtures at wall and floor with white silicone sealant. Seal countertop fixtures with clear silicone sealant.

F. Mount all fixtures at standard mounting height unless otherwise noted.

G. Furnish sinks and lavatories with correct number of drilling required by the faucet and accessories. Cock hole covers are not acceptable.

H. All items complete as catalogued as shown on drawings.

2.04 SUBSTITUTE MANUFACTURERS:

A. Where Kohler is listed above, American Standard or Zurn may be substituted.

B. Where J.R. Smith is listed above, Josam, Zurn, or Wade may be substituted.

C. Where Elkay water coolers are mentioned above, Halsey Taylor, or Oasis may be substituted, only if water ways are constructed of totally lead free materials.

D. Where McGuire is listed above for traps, outlets and stops, EBC, Kohler, Crane, Eljer or American Standard may be substituted.

E. Where Symmons is listed above, Chicago Faucet or Powers, Zurn may substituted.

F. Where Chicago Faucet is listed, T&S Brass may be substituted.

G. Where Elkay sink (s) are listed above, Just may be substituted.

H. Where Church is listed above, Bemis, Beneke or Centoco may be substituted.

I. Where Lochinvar tank type water heaters are listed, A.O. Smith or Rheem may be substituted.

J. Where Stern Williams is listed above, Fiat may be substituted.

K. Where Sloan is listed, Toto and Zurn may be substituted.

L. Where Symmons is listed above for shower control valves, Speakman, Leonard, Powers, T&S or Zurn may be substituted.

M. Where Armstrong is listed above, the equal of B & G, Taco, Grundfos or Thrush may be substituted.

3.00 EXECUTION:

3.01 INSTALLATION:

A. Equipment shall be installed in accordance with manufacturer's recommendation.

B. See details for mounting instruction and accessories.

C. Install electric water heaters so elements can be removed without disconnecting and/or removing heater.

D. Cleanouts on water closet stacks shall be installed minimum 12" above top of the flush valve on standard water closets, minimum 12" above top of grab bar on handicapped water closets and minimum 12" above tope of tanks on non-handicapped tank type water closets. On urinal locate cleanouts minimum 12" above top of flush valve on handicapped urinals and 12" above finish floor on standard units. On lavatories and sinks - 12" above finish floor and all other fixtures 12" above floor or above top of fixture.

E. Stops and supplies are to be installed with chrome plated brass nipples penetrating wall with deep escutcheon at wall. Compression type stops are not acceptable.

F. All floor mounted fixtures supports are to be securely attached to the floor using anchors in all mounting hole of size as recommended by manufacturer.

G. Provide wood backing in wall at all flush valve brackets and faucet supports and anchor brackets and supports to wood backing with anchors of sufficient length to penetrate backing.

H. Handicapped flush valve shall be installed with the pull handle on the open side or side opposite the adjacent wall.

END OF SECTION

SECTION 16010 - COMMON WORK RESULTS FOR ELECTRICAL

1.0 - GENERAL

1.01 RELATED DOCUMENTS

A. The "General Conditions" and "Special Conditions" of Contract as written and referred to hereinbefore are adopted and made part of Division 16.

1.02 DESCRIPTION OF WORK

A. Provide equipment, labor, etc., required to install complete working electrical system as shown and specified.

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings or in specifications, as though specified by both.

D. All equipment and wiring shall be new.

E. Electrical work includes, but is not limited to:
   1. Arrange with local utility companies for services as shown or specified.
   2. Removal or relocation of electrical services located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
   3. Complete 600-volt Distribution System. Provide meters, switchboards, panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
   4. Complete raceway systems for the following systems. Provide cabling and equipment as specified for each system as described in the applicable Section and/or on the Drawings.
      a. Voice and Data.
      b. Powered fiber cable system.
      c. Intercommunications and program systems.
      d. Clock systems.
   5. Complete raceway systems for the following systems. Provide cabling and equipment as specified for each system as described in the applicable Section and/or on the Drawings.
      a. Access control.
      b. Video surveillance.
   6. Connection of all appliances and equipment.
   7. Coordination with power utility and providing an aid to construction as noted in the drawings.
   8. Complete emergency lighting and power system, including individual battery units and/or inverters.
   9. Complete fire alarm system.
   10. Complete emergency responder radio system testing as described on the drawings. Provide allowance for system design, furnishing materials, and installing as described on the drawings.
   11. Complete lighting systems.
   12. Complete electrical generation system.
   13. Provide temporary facilities for construction power.
   14. Coordination with general contractor for access panels in hard ceilings or walls required for access to Division 16 components.

1.03 WORK NOT INCLUDED

A. Furring for conduit and equipment.

B. Finish painting of conduit and equipment.

C. Installation of motors except where specifically noted.

D. Installation of telephone instruments.

E. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

F. Active network devices including switches and transceivers, wireless activation point devices unless specifically noted in the Contract Documents.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Classification of excavation: Architectural Division.

B. Painting: Painting Division.

C. Concrete Work: Concrete Division.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain and pay for all permits required for the work. Comply with all ordinances pertaining to work described herein.

B. Install work under this Division per drawings, specifications, latest edition of the National Electrical Code, Local Building Codes, and any special codes having jurisdiction over specific portions within complete installation. In event of conflict, install work per most stringent code requirements determined by Architect.

C. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Architect Certificates of Inspection and approval issued by authorities.

1.06 QUALIFICATIONS OF CONTRACTOR

A. Has completed minimum two projects same size and scope in past five (5) years.

B. This qualification applies to Sub-Contractors.

C. Use workmen experienced in their respective trade. Submit qualifications of Superintendent for review.

D. Owner reserves right to reject bid of any Contractor failing to meet these qualifications.

E. Licensed and bonded in state where project is located.

1.07 GENERAL JOB REQUIREMENTS

A. Drawings and Specifications:
   1. Electrical work is shown on E series drawings inclusive. Follow any supplementary drawings as though listed above.
   2. Drawings show general run of circuits and approximate location of equipment. Right is reserved to change location of equipment and devices, and routing of conduits to a reasonable extent, without extra cost to Owner.
   3. Refer conflicts between drawings and specifications describing electrical work and work under other Divisions to Architect for remedial action.
   4. Use dimensions in figures in preference to scaled dimensions. Do not scale drawings for exact sizes or locations.
   5. Execution of Contract is evidence that Contractor has examined all drawings and specifications related to work and is informed to extent and character of work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.
   6. Charges for extra work not allowed unless work authorized by written order from Architect approving charge for work.

B. Specifications and Drawings:
   1. Specifications and Drawings shall be complementary and be used for the complete interpretation of the electrical work.

2. Unless noted or modified by specific notation to the contrary, the indication and/or description of any electrical item in the documents carries with it the instruction to furnish, install and connect same. It shall be understood that the intent governs the work, regardless of whether or not this instruction is explicitly stated. The use of the words "furnish" or "provide" with the absence of the word "install" shall be defined to include the installation and connection of the equipment and/or materials unless specific instructions are included for others to install and/or connect.
3. No exclusion from or limitation in drawings or specifications for the electrical work shall be reason for omitting the appurtenances, accessories, or devices necessary to complete any required system or item of equipment or compliance with codes.
4. The drawings are shown in part diagrammatic, intended to convey the scope of work, indicating the general arrangement of equipment, conduit and outlets. Follow the drawings in laying out the work and verify places for the installation of the materials and equipment. Wherever a question exists as to the exact intended location of outlets or equipment, obtain instructions from the Architect before proceeding with the work.

C. Visit to Site:
1. Visit site to survey existing conditions affecting work. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration given to future claims due to existing conditions.

D. Definitions:
1. Provide: Furnish, install and connect complete.
2. Wire: Furnish all necessary wiring and connect complete.
3. Install: Set in place and wire complete.
4. Work: Materials completely installed and connected.
5. AWG: American Wire Gage.
6. NEC: National Electrical Code (latest edition)
7. NFPA: National Fire Protection Association.
8. OSHA: Occupation Safety and Health Administration.
9. UL: Underwriters Laboratories, Inc.
10. NEMA: National Electrical Manufacturers Association.
11. IEEE: Institute of Electrical and Electronic Engineers.

E. Workmanship, Guarantee and Approval:
1. Work under this Division shall be first class with emphasis on neatness and workmanship.
2. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. Installation subject to Architect's constant observation, final approval, and acceptance. Architect may reject unsuitable work.
3. Furnish Architect written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance, such defects and other work damaged will be repaired and/or replaced.
4. In event that project is occupied, or systems placed in operation in several phases at Owner's request, guarantee will begin on date each system or item of equipment is accepted by Owner.

F. Observations of Work and Demonstration of Operation:
1. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for check. Provide sufficient personnel to expedite cover removal and replacement.
2. Contractor to assist Architect in demonstration of operation of new systems to satisfaction of Owner. Contractor to have manufacturer available for demonstration of systems where requested by Owner.

G. Testing of Electrical Systems:
1. Test Completed work as follows:

a. Perform tests required by Architect to indicate compliance with specifications, drawings and applicable codes. Provide instruments, labor and materials for tests.
b. Refer to other Division 16 specification sections for additional testing requirements.

H. Materials and Substitutions:
1. All material shall be new, with U.L. label where available. If U.L. label is not available, material shall be manufactured in accordance with applicable NEMA; IEEE and Federal Standards.
2. No material shall be substituted for specified, except by prior written approval of Architect. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material given consideration only if adequate comparison data including samples are provided. Approval required prior to bid date. Bid substituted material only if approved in writing by Architect.
3. Submit to Architect within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Approval of manufacturer on list does not constitute approval of specific material or equipment.

I. Shop and Erection Drawings:
1. Submit complete shop drawings for all material and equipment furnished under Division 16 specifications. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission, if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Architect/Contractor. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Architect. Shop drawings and submittals shall bear the stamp of approval of the Electrical and General Contractor as evidence drawings have been checked by them. Drawing submitted without this stamp of approval will not be considered and will be returned for proper resubmission.
2. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Architect in writing of equipment differing from that shown.
3. Prepare erection drawings when required by Architect. Investigate thoroughly all conditions affecting work and indicate on drawing. Architect will review erection drawings before work commences.
4. Coordination shop drawings will be required for the following areas, drawn to a scale of not smaller than 1/4" - 1'-0":
a. Electrical equipment rooms and areas.
b. Electrical and mechanical equipment areas.
c. Start drawings as HVAC shop drawings indicating all ductwork piping, equipment and locations of mechanical room floor drains, and electrical connections. Indicate elevations of all ductwork and piping. Draw sections as required to clarify congested situations.
d. Next, the Plumbing Section shall add all piping and plumbing equipment to the drawings.
e. Next, the Fire Protection Section shall add all sprinkler heads and fire protection piping.
f. Next, the Electrical Sections shall add all electrical fixtures, conduit and equipment.
g. Next, the drawings shall be submitted to the General Contractor for final coordination.
h. Finally, after the General Contractor has approved the drawings, they shall be submitted to the Architect for approval.
i. Finally, after the General Contractor has approved the drawings, they shall be submitted to the Engineer for approval.

J. Cooperation:
1. Carefully coordinate work with other contractors. Refer conflicts between trades to Architect.

2. Arrange and coordinate work to avoid conflict with trades to allow for accessibility, conserve space and to provide for maintenance.
3. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor and/or Architect.

K. Maintenance and Operating Instructions for Equipment:
1. Submit to Architect one (1) set of data prepared by manufacturer for each item of electrical equipment completely describing equipment. Data to include parts lists, description of operation, shop drawings, wiring diagrams, maintenance procedures and other literature required for maintenance of equipment. Bind in booklet form for presentation.

L. "Record" Drawings:
1. Provide "Record" prints at the completion of job. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Indicate actual location of conduit systems, outlets, and equipment. Turn over prints to Architect at final observation.
2. Provide as built drawings created from record drawings.

M. Items for Owner:
1. Provide following items for Owner at time of substantial completion:
   a. Certificates of inspection and approval from authorities having jurisdiction.
   b. Written guarantees.
   c. As built drawings.
   d. Final approved shop drawings (1 set).
   e. Spare fuses (furnish receipt).
   f. Maintenance data (1 set).
   g. Affidavit of Owner Instruction (1 copy).

N. Protection and Storage:
1. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury.
2. Do not leave exposed or unprotected, electrical items carrying current. Protect personnel from exposure to contact with electricity.
3. Protect work and materials from damage by weather, entrance of water or dirt. Cap conduit during installation.
4. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.
5. Exercise particular care when working around telephone (electronic) equipment to prevent entrance of dust, moisture and debris into the equipment. Provide dust barriers and partitions as required.
6. Deliver equipment and materials to job site in original, unopened, labeled container. Store to prevent damage and injury. Store ferrous materials to prevent rusting. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Storage space on site and in building designated by Owner/Architect.
7. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations, deferred to Architect.

O. Cutting and Repairing:
1. Cut and repair walls, floors, roof, etc., required to install work. Where work cut is finished, employ original installer of finish to repair finish. Do not cut structural members.

P. Anchors:
1. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable. Protect telephone equipment from drilling residue.

Q. Cleaning and Painting:
1. Clean equipment furnished in this Division after completion of work.

2. Touch-up or re-paint damaged painted finishes.
3. Remove debris, packing cartons, scrap, etc., from site.

R. Control Wiring:
1. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under another Division, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

S. Code Compliance:
1. Entire electrical installation shall comply with all aspects of code including local interpretations.

1.08 GENERAL JOB REQUIREMENTS

A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered unless explicitly stated otherwise by the Electrical Engineer. Where several manufacturers are named, only the named manufacturers' products will be considered, and the Contractor's bid shall be based on their product.

B. Where the phrase "OR APPROVED EQUIVALENT" or "OR EQUIVALENT" or "EQUIVALENT TO" or "ACCEPTED SUBSTITUTE" is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equivalent to that of materials named in the opinion of the Electrical Engineer; However, such unnamed manufacturers' products will be considered as substitutions and shall not be used as a basis for bidding.

C. Basis of quality shall include material, workmanship, weight, finishes and gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.

D. Furnish standard products and manufacturers regularly engaged in production of such equipment.

E. Furnish manufacturer's latest standard design.

F. All materials and equipment shall have manufacturer standard warranty unless indicated otherwise.

G. All equipment shall conform to applicable IEEE, UL, ANSI and/or NEMA Standards.

H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests and pre-service checks, and then ensure all have been performed prior to completion of work.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION 16010

PART 1 - GENERAL

1.1 DESCRIPTION OF SUBMITTAL CATEGORIES:

A. Submittals required are defined below and specified in each section. Refer to Section 01300.

B. Shop Drawings include fabrication, layout, wiring diagrams, erection, setting, coordination, similar drawings and diagrams and performance data.

C. Samples are units of work, materials or equipment items, showing the workmanship, pattern, trim and similar qualities proposed.

D. Manufacturer's Data is standard printed product information concerning the standard portions of the manufacturer's products.

E. Certifications are written statements, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer or other firm as designated, certifying to compliance with the specified requirements.

F. Test Reports are specific reports prepared by independent testing laboratories, showing the results of specified testing. Industry Standards are printed copies of the current standards in the industry.

G. Manufacturer's Product Warranties are manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed by the manufacturer if the product fails under certain conditions and times limits.

H. Operating Instructions are the written instructions by the manufacturer, fabricator or installer of equipment or systems, detailing the procedures to be followed by the Owner in operation, control and shut-down.

I. Maintenance Manuals are the compiled information provided for the Owner's maintenance of each system of operating equipment. Maintenance Materials are extra stock of parts or materials for the Owner's initial use in maintaining the equipment and systems in operation.

J. Guarantees are signed commitments to the Owner that certain acts of restitution will be performed if certain portions of work fail within certain conditions and time limits.

K. Product Data includes manufacturer's data pertaining to the products, materials and equipment of the work.

1.2 SUBMITTAL FORM AND PROCEDURES:

A. Submittals shall be made within 30 days of contract signing for projects of 12 months construction time or less. Make within 60 days for longer then 12 months construction time.

B. Submit shop drawings for all material and equipment furnished under Division 16 to Architect. Refer to Section 01300 get from Architect for submittal procedures.

C. Multiple System Items: Where a required submittal relates to an operational item of

equipment used in more than one system, increase the number of copies as necessary to complete maintenance manuals for each system.

D. Response to Submittals: Submittals will be returned with indication that documents comply with specifications or that documents do not comply and what action must be taken to comply.

E. Coordinate electrical submittals through Contractor to Architect and assist Contractor in preparation of submittal.

F. Submittals shall bear the stamp and signature of electrical and general contractor. Failure to place same on drawings require resubmittal before review.

1.3 SPECIFIC SUBMITTAL REQUIREMENTS:

A. Shop Drawings:

1. To accurate scale except where diagrammatic representations are specifically indicated.

2. To show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment.

3. To show conduit and conductor connections and other service connections.

4. To show interfaces with other work including structural support.

5. To include complete descriptive data, with dimensions, operating data and weight.

6. To indicate deviation from the contract documents.

7. To explain deviations.

8. To show how deviations coordinate with portions of the work, currently or previously submitted.

B. Review of shop drawings shall not relieve Contractor of responsibility for errors or omissions in shop drawings. Any equipment which will not fit into space shown on drawings shall be called to the attention of the Architect in writing.

C. Samples: Architect's review of sample submittals:

1. Limited to general type, pattern and finish.

2. Not to include testing and inspection of the submitted samples.

3. Compliance with specified requirements is exclusive responsibility of the Contractor.

D. Manufacturer's Data:

1. Where pre-printed data covers more than one distinct item, mark copy to indicate which item is to be provided.

2. Delete portions of data not applicable.

3. Mark data showing portion of operating range required for project application.

4. Elaboration of standard data describing a non-standard product processed as a shop drawing.

E. For each product include:

1. Manufacturer's production specifications.

2. Installation or fabrication instructions.

3. Source of supply.

4. Sizes, weights, speeds and operating capacities.

5. Conduit and wire connection sizes and locations.

6. Statements of compliance with required standard and governing regulations.

7. Performance data, where applicable.

8. Other information needed to confirm compliance. Manufacturer's recommended parts list.

F. Certifications: Submit with notarized execution.

G. Test Reports: Submit notarized test reports signed and dated by firm performing test.

H. Manufacturer's Product Warranties: Where published warranty includes deviation from required warranty, product is disqualified from use on project, unless manufacturer issues a specific project warranty.

I. Operating Instructions submittal required:

1. Manufacturer's operating instructions for each item of electrical equipment.

2. Supplement with additional project application instructions where necessary.

3. Specific operating instructions for each electrical system which involves multiple items of equipment. Instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operations.

4. Typewritten in completely explained and easily understood English language.

J. Maintenance Manual Requirements:

1. Emergency instructions including addresses and telephone numbers for service sources.

2. Regular system maintenance procedures.

3. Proper use of tools and accessories.

4. Wiring and control diagram for each system.

5. Manufacturer's data for each operational item in each system.

6. Manufacturer's product warranties and guarantees relating to the system and equipment items in the system.

7. Shop drawings relating to the system.

8. Bind each maintenance manual in one or more vinyl-covered, 2", 3-ring binders, plus pocket-folders for folded drawings. Index with thumb tab for sections. Mark the back spine and front cover of each binder with system identification and volume number.

K. Maintenance Materials: Deliver to Owner in fully identified containers or packages suitable for storage.

L. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal. Submit draft of each guarantee prior to execution.

END OF SECTION 16012

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Systems and equipment requiring identification are shown on the drawings, and extent of identification is specified herein and in individual sections of work.

B. Types of electrical identification include:

1. Exposed conduit color marking.
2. Buried cable and conduit warnings.
3. Cable/conductor identification.
4. Operational instructions and warnings.
5. Danger signs.
6. Equipment/system identification signs (nameplates).

1.2 SUBMITTALS:

A. Manufacturer's Data:

1. Product specifications and installation instructions for each material and device.

B. Samples:

1. Provide for each color, lettering style and other graphic representation.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIAL:

A. Color-Coded Conduit Markers:

1. Color code all conduit with 3/4 inch wide band of vinyl plastic electrical tape, 3M Company "Scotch 35", applied two (2) full turns around conduit, 6" from all conduit terminations into switchboards, panelboards, motor control centers, starters, cabinets, control panels, pullboxes, outlet boxes, etc., on each side of walls, floors or roof penetrated by conduit and where conduit enters wall to outlets below.

CONDUIT COLOR CODE

SYSTEM	COLOR
120/208 Volts - Normal	Black
277/480 Volts - Normal	Yellow
120/208 Volts - Emergency	Black and Red
277/480 Volts - Emergency	Yellow and Red
Intercom/Paging/Music/Telephone/Dictation	Brown
Computer/Word Processing/Monitoring/Security	Blue
Fire Alarm	Orange

B. Where authority does not allow tape use paint acceptable to authority.

C. Underground Line Marker/ Warning tape:

1. Permanent colored, detectable plastic tape with foil core (color per AWPA

Standard for utility being identified), with continuous-printed legend; for direct-burial service; minimum 6" wide x 4 mils thick. Legend to indicate type service of cable (e.g. "WARNING: Buried Electric Line").

D. Cable/Conductor Identification Bands:

1. Manufacturer's standard vinyl-cloth self-adhesive cable/conductor markers, wrap-around type; pre-numbered plastic coated, or write-on type with clear plastic self-adhesive cover flap, lettered to show circuit identification.

E. Self-Adhesive Plastic Signs:

1. Manufacturer's standard, self-adhesive, pre-printed, flexible vinyl signs for operational instructions or warnings. Sizes suitable for application and visibility, with proper wording for application.

2. Color: Orange with black lettering.

F. Danger Signs:

1. Manufacturer's standard "DANGER" signs, baked enamel finish on 20 gage steel; standard red, black and white graphics; 14" x 10" unless 10" x 7" is largest which can be applied, or where larger size is needed for visibility use recognized explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH).

G. Engraved Signs (Nameplates)

1. 1/8" thick melamine plastic laminate, complying with FS LP-387, sizes as indicated, engrave with standard letter style of sizes and wording indicated (1/4" letters minimum) white field, black letters for normal service; red field, white letters for essential service; yellow field, blue letters for D.C. service; orange field, white letters for UPS service. Punched for screws.

2. Fasteners: Self-tapping stainless steel screws, except contact epoxy adhesive where screws cannot or should not penetrate substrate.

H. Lettering and Graphics:

1. Coordinate names, abbreviations and other designations used with those shown or specified. Provide numbers, lettering, and wording as indicated or required for identification and operation/maintenance.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. General Installation Requirements:

1. After completion of painting.

2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification:

1. Where high voltage conduit is exposed, apply identification to conduit.

C. Underground Cable and Duct Identification:

1. During back-filling of underground cable or duct, install continuous marker warning tape, directly over buried line 6" to 12" below finished grade. Where multiple lines are buried in common trench not exceeding 24" width, install a single line marker.

2. Install line marker warning tape for every buried ductbank.

D. Operational Identification and Warnings:

1. Provide operational signs for main switch.

E. Danger Signs:

1. Provide for 5 KV to 35 KV medium voltage switchgear, sectionalizer loop switches, etc., as shown and described herein.

2. Provide as required by codes.

F. Engraved Plastic Laminated Signs: Install on each major unit of electrical equipment in the building. Provide single line of text, 1/4" high lettering on 1" high sign (1-1/2" high where 2 lines required). Matching terminology and numbering of contract documents. Provide signs for each unit of the following categories (signs shall identify item fed, voltage where fed from):

1. Electrical cabinets and enclosures. Indicate voltage.

2. Access panel/doors to electrical facilities.

3. Major electrical switchgear (indicate voltage).

4. Electrical substations.

5. Safety switches and circuit breakers.

6. Transformers.

7. Feeders in pull and junction boxes and in all switchgear. Fasten with nylon ties.

8. All equipment furnished in this Division of the specifications.

9. Install signs where indicated or most visible. Secure with screws or epoxy adhesive. Secure to feeder cables with nylon ties.

10. Nameplate sign shall include system voltage and source of feed (where applicable).

G. Outlet pull, and junction boxes shall be identified with circuit number(s), and source panel or switchgear/switchboard indicated with legible text written with permanent black marker. Write text and box cover.

H. Branch circuit and feeder conductors shall be identified where they enter pullboxes,

switchgear, switchboards, panelboards, transformers, and handholes. Feeder identification shall include source, conductor size, and phase identification.

I. Provide engraved device plates for wiring devices where indicated on drawings or related sections of the specifications.

1. Use black letters for devices on normal circuits; use red letters for essential circuits.

END OF SECTION 16014

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Installation of raceway systems for all work in Division 16 and required fittings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Metallic Raceways:

1. Republic
2. Wheatland
3. Allied
4. Clifton
5. Triangle
6. Walker
7. Western
8. AFC

B. Non-Metallic Raceways

1. Carlon
2. National Pipe & plastics
3. Can-Tex
4. Allied

C. Fittings

1. Thomas & Betts
2. Hubbell: RACO; Killark
3. Appleton
4. Midwest
5. EFCOR
6. OZ Gedney
7. Bridgeport
8. AFC

2.2 RACEWAYS

A. Rigid galvanized steel conduit to conform to ASA Standard C80.1 and U.L. Standard No. 6 for rigid metallic conduit, except hot dipped galvanized after threading.

1. Fittings, ells, couplings, etc., galvanized threaded type meeting above standards. Threadless fittings not allowed.
2. Terminate rigid conduit with two locknuts, one inside, one outside of the cabinet, junction or outlet and a bushing. Bushing - malleable iron with smooth bakelite ring molded into edge of bushing to prevent damage to cable, OZ Mfg. Co., type "B" or approved equal. Where grounding bushings are required, construction of bushing similar to above except a lug provided for grounding connection, OZ type "BLG" or approved equal.

B. Rigid intermediate grade conduit, IMC, to conform to UL Standard No.1242; hot dipped galvanized or approved equivalent.

1. All fittings, ells, couplings, etc., constructed to same standards as rigid steel conduit. Fittings - threaded type with all threads engaged. Use "Uni-swivel" couplings in dry locations only.

2. Conduit terminations same as rigid steel conduit.

C. Flexible steel conduit, "Greenfield", continuous spirally wound and inter-locked, threadless, galvanized conforming to U.L. and CSA Standards for flexible steel conduit.

1. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means.

D. Liquid tight flexible steel conduit constructed similar to flexible steel conduit above, except with polyvinyl chloride jacket.

1. Fitting Assembly - sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means.

E. Electrical metallic tubing, EMT, threadless, steel type conforming to ASA Standard C80.3 galvanized inside and out, and with additional corrosion resistant finish.

1. Fittings, connectors, couplings, etc., insulated throat galvanized steel screw indenter.

F. Plastic conduit, PVC, polyvinyl chloride compound, rated for direct burial, Schedule 40, except as noted otherwise.

1. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

G. Type EB - encased burial duct: Polyvinyl chloride compound conforming to NEMA Standard TC-6, UL listed and designed for encased burial use.
1. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install conduit as follows:

1. Use rigid steel or intermediate grade conduit for:

a. Transitions from circuits run underground to above ground.
b. Circuits run in concrete in contact with earth.
c. Circuits in hazardous and wet locations.
d. Circuits exposed to mechanical damage.
e. All feeders (1-1/4" diameter and larger).
f. All motor circuits.

2. Use electrical metallic tubing, EMT, for:

   a. Branch circuits (conduit 1" diameter and smaller) in dry locations.

   b. Telephone circuits.

   c. Auxiliary systems and controls (low voltage systems such as fire alarm nurse call sound systems, etc).

   d. Feeders run overhead in dry locations.

   e. Branch circuits in concrete slab (above slab on grade).

3. Use PVC conduit for:

   a. Circuits run underground.
   b. For branch circuits in concrete slab.
   c. Where specifically shown on drawings.
   d. No PVC shall be exposed.

   Note: Do note use PVC in Patient Care Areas.

4. Use type EB conduit for exterior concrete encased application where shown.

B. Size conduit per NEC. Minimum size 3/4" diameter, but no more than 3#12 installed in 3/4" conduit.

C. Run conduit concealed where possible. Run concealed conduit above furred ceiling in an orderly manner. Multiple conduits grouped and run parallel.

D. In concrete slab: Install conduits in center of concrete slabs and tie to reinforcing steel with tie wires. Do not install conduit larger than 1" in concrete slabs unless approved by Architect. Install with minimum of 2" between parallel runs. Do not cross conduits in slab unless necessary, then only one conduit crossover in 12" space.

E. Exposed Conduit: Use only where specifically shown or approved. Run perpendicular to building walls and partitions and tight against structure. Conceal vertical portion of conduits where possible.

F. Paint underground metal conduit with 2 coats of asphaltum or bituminous. Make underground conduit fittings watertight using Teflon tape. Do not use split couplings and similar fittings underground and exposed to moisture. Run underground conduits minimum 24" below grade. Do not run conduit in slag fill.

G. Paint conduit fittings and threads exposed to moisture with Rustoleum silver paint after installation.

H. Furnish offsets required to meet field conditions. Make bends in conduit in accordance with the National Electrical Code, except make minimum radius of 6 times conduit diameter or 6" whichever is greater. Bend IMC conduit without deforming.

I. Where conduit crosses expansion joints, install expansion type fittings OZ type EX with bonding jumper or approved equal.

J. Make connections to equipment away from wall with conduit extensions exposed from

ceiling to floor, anchored with floor flange and/or angle frame as required. Make connections to equipment with flexible conduit from tee condulet in conduit riser.

K. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with flexible conduit.

L. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of flexible conduit between roof penetration and equipment.

M. Use liquidtight flexible conduit where exposed to moisture, oil, etc.

N. Install conduit to avoid hot water pipes. Maintain 9" clearance of such pipes, unless closer crossings are unavoidable. Maintain minimum 1" clearance from covering of pipe crossed.

O. Support conduit per NEC. Support individual conduits with galvanized hangers and rods as follows:

1" diameter and smaller.....¼" dia. rod
1-¼" to 3" diameter.....3/8" dia. rod
Larger than 3" diameter.....½" dia. rod

P. Individual conduit hangers - Minnerallac, or approved equal. Support EMT near each joint. Support for multiple conduit runs consist of Uni-strut channel as required with 1/2" diameter galvanized bolts or rods anchored to structure. Provide "U" bolt clamps for each conduit on hangers. Support vertical riser conduits with galvanized bolted clamps at each floor. Do not support conduit to ceiling support system.

Q. Terminate conduits entering sheet metal boxes with double locknuts and bushings. Terminate conduit exposed to moisture with watertight hubs.

R. Install appropriate seal-off where conduits exit hazardous areas, areas of temperature differential etc.

S. Where ground conductor installed in conduits 1-1/4" and larger provide grounding bushings, and bond full size ground wire to bushings and from bushing to box or cabinet. Bond with self-tapping screw and appropriate lug. Where ground wires are run in smaller conduits, bond to outlet and junction boxes with self-tapping screw lug. Provide other conduits with non-grounding bushings as described under another article. Provide all service entrance metallic raceways with grounding bushing and bond to ground bus; bond sized per N.E.C..

T. Conduit work in hazardous areas, or areas with large temperature differential: Use rigid steel or IMC conduit with sealing fittings, poured with hardening compound after conductors are pulled-in. Seals installed per NEC. Conduit seals Crouse-Hinds type EYS or approved equal.

U. PVC Conduit Installation:

1. Above ground: Allow for expansion and contraction.

2. Below grade: Encase in 3" sand fill. Backfill free of large rocks and debris.

3. Make elbows, bends, etc., with heated bender when factory bends are not available.

a. When below slab, provide rigid elbows.

4. Make cuts with hacksaw and deburr ends.

5. Make joints as follows:

   a. Clean outside of conduit to depth of socket, and inside of socket with approved cleaner. Apply solvent cement to interior of socket and exterior of conduit, Insert conduit in socket and rotate 1/4 to 1/2 turn and allow to dry.

6. Where non-metallic conduit is used for power wiring install insulated ground wire, sized per NEC unless shown larger.

V. Sleeves:

1. Provide sleeves for raceways penetrating floor and structural members. Sleeves consist of Electrical Metallic Tubing set in forms. (Exception: Use Schedule 40 PVC for individual ground conductors).

2. Size sleeves to allow 1/2" clearance around raceway extending from bottom of floor construction to 2" above floor, minimum sleeve size 2-1/2" diameter. After raceways are installed, seal space between the raceway and sleeve with non-hardening, fireproof, compound, CTC PR-855 sealant, T&B "Flame Safe" for 2 hour fire rating or approved equal.

END OF SECTION 16110

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Furnishing, installing and testing 600 volt conductors for lighting, power, and auxiliary systems.

PART 2 - PRODUCTS

2.1 CONDUCTORS:

A. 98% conductivity copper; #12 AWG minimum; #10 AWG and smaller solid, #8 and larger stranded.

B. Conductors furnished with NEC, 600 volt, insulation as follows:

1. Dry locations:

a. # 6 AWG and smaller]: type THW, THWN or XHHW (do not intermix in circuits)

b. # 4 AWG and larger: type RHH-RHW-USE, (cross linked polyethylene)

2. Wet locations: type RHH-RHW-USE

C. Wiring for controls and auxiliary systems #14 AWG minimum with NEC type THWN insulation.

D. Luminaire Wire: Incandescent - Use type SF-2, #16 for luminaires up to 300 watts, and #14 over 300 watts, except for luminaires in concrete pour use #12 or larger or as shown. Conductors in channels of, and flex to fluorescent luminaires type THHN or XHHW.

E. Ungrounded System Wiring: All wiring connected to the secondary side of isolating transformers: Cross-linked polyethylene insulation with dielectric constant of less than 3.5; 30 mills minimum thickness, resistance constant greater than 20,000 at 60 degrees F, shall be suitable for wet and dry locations. Cable - G.E. No. SI-58053 or approved equivalent.

F. Color Code as follows and/or per local ordinances. Conductors #10 and smaller with colored insulation. Conductors #8 and larger not available in colors, color coded with colored pressure sensitive tape. Apply minimum 2" of tape to each individual phase or neutral conductor in half lapped pattern. The equipment ground conductor shall be taped green for its entire exposed length. Color-code as follows:

Phase	120/208 Volts	277/480 Volts
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Eq Grnd	Green	Green

G. Manufacturers of copper conductors: Phelps Dodge, Capital Cable, Southwire, Senator, United Copper, Cero Wire & Cable, American, or approved equal.

PART 3 - EXECUTION

A. Install wiring complete with connections to equipment.

B. No wiring installed until after plastering and similar work is complete and dry.

C. Install wiring so conductors are not in tension in completed system.

D. Form wiring neatly and group in circuits. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equal.

E. Use pulling compound of Ideal "Yellow 77", Minerallac No. 100, or approved equal. Do not use pulling compound for circuits on secondary side of ungrounded isolation transformers.

F. Join and terminate copper conductors individually.

1. Lugs in damp locations connected to copper bus: 98% conductivity copper or bronze Thomas & Betts "Locktite", Burndy "QA" or approved equivalent.

2. Lugs in dry locations and lugs connected to aluminum bus - heavy casting aluminum, CU/AL rated, listed under UL Standard 486B, rated 90 degrees C; plated to prevent electrolysis, Thomas & Betts, Blackburn, Ilsco or approved equivalent.

G. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.

H. Furnish lugs for conductors #2/0 and larger with two bolt tongue or approved equivalent.

I. Make conductor taps #8 and larger from a second conductor with 98% conductivity bolted insulated connector, T&B "IDT", Ilsco "KUP-L-TAP" or approved equivalent. Insulate splices with 600 volt "heat shrink" covers T&B or equal.

J. Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt "heat shrink" covers T&B or equal.

K. Joints #10 and smaller: T&B Sta-Kon wire joints EPT66M, with insulating caps, installed with WT161 Tool or C nest of WT11M Tool; Ideal Super/Nuts; Ideal Wing Nuts; 3M "Scotchlock" or Buchanan Electric Products B Cap or Series 2000 Pressure connectors complete with nylon snap on insulators installed with C24 pressure tool. Where conductors are connected to screw terminals, use nylon insulated, locking fork, T&B Sta-Kon or approved equal. Where joints are made in damp or wet locations insulate splices with 600 volt "heat shrink" covers T&B or equal.

L. Provide cable supports: As required by NEC. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the conductors; O.Z. Manufacturing Company or approved equal. Furnish pullbox, sized per NEC for each cable support.

M. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and screw type connection.

N. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power circuits in vaults, pull boxes, manholes, switchboard rooms, terminations of cables, etc.

O. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected.

P. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.

Q. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner.

R. DO NOT COMBINE CIRCUITS unless specifically approved by the Architect (or) Engineer. No more than 3 phase or current carrying conductors in a circuit.

END OF SECTION 16120

PART 1 - GENERAL

1.1 SCOPE OF WORK:

A. Grounding Details

PART 2 - PRODUCTS

2.1 SYSTEM GROUNDING:

A. Bond and ground main service neutral, cabinets, equipment, conduits, metallic piping systems, etc., per the latest edition of NEC.

B. Ground conductors - 98% conductivity copper, either bare or with green THW insulation. Other conductor requirements same as described for low voltage, 600 volts, conductors.

C. Ground Connections:

1. Make with mechanical connectors where accessible and with "Cadweld" or approved equivalent where inaccessible.

2. Use high alloy cast copper and/or silicon bronze mechanical connectors with Hex or Allen head bolts where permitted.

3. Use Burndy "GAR" or approved equivalent.

4. Size as required for piping connections.

5. Thoroughly clean prior to installation of clamps and/or lugs.

6. Use bolted or screwed on mechanical connectors. Do not use clip-on connections.

7. Bond ground conductor to metal raceway at each end of the run.

8. Seal connections between dissimilar metals (i.e.: bronze to steel), with approved epoxy resin.

9. Coat connections with "No-OXID-A" compound as manufactured by Dearborn Chemical Company.

D. Provide lighting and power circuits with green covered ground wire sized per NEC, or as shown, except not smaller than #12 AWG. Bond ground wire to all outlet boxes, junction and pull boxes, cabinets, equipment, etc., with self-tapping screw or bolt and appropriate lug. See Section covering "Raceways" for use of grounding bushing.

2.2 DRIVEN GROUND SYSTEM:

A. Provide driven ground rods and buried ground conductor interconnecting ground rods as required by code.

B. Ground rods 3/4"x10'-0" copper clad steel, Thompson #558 or approved equal. Ground rods installed with tops driven to 1'-6" minimum below grade. Connect ground wire to ground rod with Thompson #493 "U" bolt bronze clamp.

C. Exterior buried ground conductor #2/0, soft drawn, bare, tinned copper, installed 2'-0" minimum below grade.

D. Bond all masses of metal, i.e.: pipes, conduits, fence posts, etc., within 6'-0" of the buried ground conductor to ground conductor with #6 AWG bare, solid, tinned copper wire, attached to object with appropriate clamp, lug, etc.. Obtain complete set of drawings to determine quantity and location of required connections.

E. All connectors lugs, hardware, etc., for building ground system similar to that for other grounding as described above.

PART 3 - EXECUTION

3.1 EQUIPMENT GROUND 'GREEN WIRE CONCEPT':

A. Ground electrical equipment enclosures and conductor enclosures including metal raceways, outlet boxes, cabinets, switch boxes, motor frames, diesel engine frame, transformer cases, metallic piping systems such as water, gas, waste, air and metallic enclosures for all electrical equipment.

B. Provide separate grounding conductor for all circuits to insure adequate ground fault return path.

C. Install separate ground conductors in conduit.

D. Bond green wire to equipment enclosure at source and at apparatus served.

E. Insulate grounding conductor size to carry ground fault current safely. Minimum size for green wire grounding lead per N.E.C. or as indicated.

F. Do not use grounded current return conductors (neutrals) for equipment grounding. Connect common grounding lead to supply side of service disconnect unit only.

G. Do not ground neutral conductor after it has been grounded at service entrance, transformer or generator.

H. Maintain electrical continuity of conduit systems by threaded fittings with joints made-up wrench tight. Install insulated bushing and locknuts on terminating conduits. Provide conduits containing ground wires with grounding bushings bonded to ground wire with short full size jumper.

I. Provide receptacles with approved green covered bonding jumper from the grounding terminal screw connected to outlet box.

J. Install ground rods in quantity to provide a maximum of 5 ohms ground resistance. Where multiple rods required, separate a minimum of 6 feet and interconnect with wire of ground size shown.

K. Test ground systems as specified in Section 16010.

L. Install tags on ground connections to piping or electrode systems for all telephone equipment grounds.

END OF SECTION 16121

SECTION 16130 - OUTLET BOXES, JUNCTION BOXES AND GUTTERS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Outlet, junction boxes, conduit bodies, wiring gutters and their installation.

PART 2 - PRODUCTS

2.1 OUTLET AND JUNCTION BOXES:

A. Provide wiring devices, fixtures and special system outlets with outlet box. Use galvanized steel for concealed boxes and exposed boxes in dry locations. Use cast iron conduit fittings similar to "Condulets" or "Unilets" with threaded hubs for exposed boxes outside and exposed to moisture.

B. Concealed outlets and exposed outlets in unfinished spaces for lights, switches, wall receptacles, etc.; consist of standard galvanized steel outlet boxes and plaster rings.

1. Provide 1/16" thick boxes and covers of form and dimension adapted to its specific use and location, kind of fixture to be used and number, size and arrangement of connecting conduits.

2. Provide 3/8" fixture studs where required.

3. Ceiling Outlet Boxes: 4" octagonal or 4-11/16" square as required, due to number of wires, and 2" deep minimum. Ceiling boxes in slabs concrete type. Plaster rings not required for ceiling outlet unless needed for device.

4. Paint junction boxes provided with blank covers to match surroundings, except use blank device plates in finished areas.

5. Switch and receptacle outlet boxes: 4" square with plaster rings as necessary. Provide multigang boxes where shown or required. Provide metal barriers to separate emergency and normal service wiring per N.E.C.

6. Steel City, Appleton, Raco, Bowers or approved equivalent.

C. Use galvanized cast iron boxes, approved equivalent to Crouse-Hinds type "FS" or Appleton condulets, with appropriate covers for wall outlets in exposed conduit work and exposed to moisture.

D. Use galvanized cast iron boxes equivalent to Crouse-Hinds type GRF for ceiling outlets in exposed conduit work exposed to moisture.

E. Use square cut steel outlet boxes for outlets exposed in finished locations. Use round or square to adapt to device installed. Wiremold, Hoffman or approved equivalent.

2.2 LARGE JUNCTION BOXES:

A. Furnish pull, tap and cable support boxes required by NEC for excessive number of 90 degree conduit bends, conductor taps and cable supports.

1. Box construction per NEC and manufactured with galvanized sheet steel, 12 gage minimum, with angle iron frame where required for rigidity; welded or bolted construction. Install bolts to prevent damage to cables in box.

2. Boxes with removable screw type covers and plated screws. Provide split covers where necessary for access. Maximum single piece cover - 36" x 36".

3. Provide separate junction boxes for each feeder. If conduit is installed so separate junction boxes are not practical, one large pull-box may be used with each set of feeder conductors separated by 12 gage steel barriers. Furnish junction box or each compartment in junction box with ground lug for connection of ground wire.

2.3 CONDUIT BODIES:

A. Conduit bodies shall be installed to provide ease of pulling conductors and to provide neat appearance of conduit installation, and as shown on drawings. Conduit bodies constructed of malleable iron or copper free aluminum castings. Bodies shall be finished with standard durable exterior coatings of manufacturer specified. Provide rollers in type "C" and type "LB" bodies, 1-1/4" size and larger. Provide gasketed plated steel or malleable iron covers.

B. Conduit bodies shall be manufactured by Crouse-Hinds, Pyle National, Killark, Appleton or approved equivalent.

2.4 GUTTERS (Wireways):

A. 8" x 8" and smaller - use standard assembly manufactured by Square "D", Walker Electric, B&C Stamping Co., and General Electric. Make special and larger gutters of code grade galvanized sheet steel with hinged covers and approved fastening device.

2.5 SURFACE METAL RACEWAYS:

A. Where indicated on the drawings, wiring shall be run in exposed metal raceways, metal molding or wiremold complete with outlet boxes and fittings. All circuits run in surface metal raceways shall have a ground conductor with green insulation sized per the NEC, but not smaller than No. 12 AWG screw connected to each outlet box. All wiring in surface metal raceways shall be type "THWN" conductors.

PART 3 - EXECUTION

3.1 INSTALLATION OF OUTLET BOXES:

A. Fasten outlet boxes securely to structure.

B. Set all flush outlet boxes so edge of device flange is flush with finished surface.

C. Open no more knockouts in outlet box than required.

D. Seal boxes during construction.

E. Stagger back to back boxes 3" minimum. In rated walls use appropriate U.L. spacing.

F. Coordinate and verify rough-in location and mounting height of all boxes with drawings

and other trades prior to installation.

G. Support All Boxes:

1. Outlet boxes - with 1/4" diameter galvanized rods or bolts anchored to structure.

2. Outlet boxes for surface mounted luminaires on furred ceilings with 3/4" channel iron fastened to ceiling channels. See Section covering "Luminaires".

3. Pull, junction and cable boxes with 3/8" diameter galvanized rods or bolts (4 minimum).

4. Support outlet boxes in metal stud partitions with support that spans between two studs. Caddy "SGB", "TSGB", or "RBS" hangers or equal.

H. Install adjacent outlets at different levels in one vertical line where possible.

I. Provide green covered bonding jumper, screw connected to outlet box in all receptacle boxes.

J. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with "Scotchkote" and fill box with "Duxseal".

K. Mark outlet box covers with permanent ink markers to indicate circuit number(s) and panel of origination. Use black markers for normal service circuits and orange for emergency service.

L. Use 4" octagonal boxes with blank covers for master outlets, installed to permit installation of collars by others.

M. Where outlet boxes installed in unfinished concrete walls or columns, provide 1" deep plaster ring with box and ring set in position before the concrete is poured so concrete will fill around the ring and cover plate can be installed flush with the unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

N. Install all outlets located on columns on centerline of column and bend or shift reinforcing so that the outlet box will be flush with the finished concrete. Provide plaster rings as required so that the plate is flush with the finished plaster or exterior concrete surface.

O. Where outlets installed in waterproofed columns or walls, provide 6"x6"x3" deep wood box placed in the forms before concrete is poured. Box will be removed before waterproofing is applied. General Contractor will waterproof wall and opening, after which Electrical Contractor will install outlet box. General Contractor will grout around box. Set boxes carefully so that cover plates will be flush.

P. Install conduit bodies where shown or where required for sharp bends and/or aesthetics in raceway system. Do not use in lieu of pullboxes except in limited space or as directed by Architect.

3.2 INSTALLATION OF JUNCTION BOXES:

A. All junction boxes shall be accessible.

B. Securely fastened to structure.

C. Exterior below grade boxes shall be embedded 6" of concrete on sides and bottom. Top shall be level with finished grade unless shown otherwise.

D. There shall be no more knockouts opened in any box than are actually required.

E. Protection during construction.

F. Identify (See Section 16014).

3.3 INSTALLATION OF GUTTERS:

A. Mount gutters on 3/4" thick plywood backboard, sized for devices to be mounted, 2 coats of Albi No. 107A fire retardant paint (install label on board), mount all equipment thereon.

B. Run conductors in gutter without reduction in size, entire length of gutter.

C. Connect individual taps from conductor to tapped device with ILSCO insulated tap devices sized for conductors used.

D. Gutter Tops: for copper conductors shall be ILSCO type GTA or PTA with GTC or PTC insulating covers or by "TEE" compression lugs as manufactured by Anderson or Burndy, wrapped with Scotch #33 electrical tape to a thickness which equals insulation level of wire.

END OF SECTION 16130

SECTION 16136 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

B. Construction requirements for concrete bases.

1.02 RELATED REQUIREMENTS

A. 16110 - Raceways

B. 16130 - Outlet Boxes, Junction Boxes and Gutters

C. 16510 - Lighting

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

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

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

J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from the contract documents in writing. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured.

1.05 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field Welding.

D. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Manufacturer's Requirement.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported plus 25% growth with a minimum safety factor of (2). Where this determination results in a load of less than 200 lbs., increase the strength until there is a minimum of 200 lbs. safety. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap. or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
      e. nVent; Caddy: www.nvent.com/#sle.
   2. Conduit Straps: One-hole or two-hole type; steel.
   3. Conduit Clamps: Bolted type unless otherwise indicated.
   4. Products:
      a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
      b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
      c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
      d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
      e. nVent; Caddy: www.nvent.com/#sle.

D. Metal Channel/Strut Framing Systems:
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
      c. Custom Strut and Roll Forming, LLC: www.customstrut.com/#sle.
      d. Eaton Corporation: www.eaton.com/#sle.
      e. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   3. Comply with MFMA-4.
   4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
   5. Channel Material:
      a. Indoor Dry Locations: Use galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   6. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch (2.66mm).
   7. Minimum Channel Dimensions: 1-5/8 inch (41mm) wide by 13/16 inch (21mm) high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Electrical Equipment Supports: 1/2-inch (13mm) diameter.
      b. Busway Supports: 1/2-inch (13mm) diameter.
      c. Single Conduit up to 1-inch (27mm) Trade Size; 1/4-inch (6mm) diameter.
      d. Single Conduit Larger than 1-inch (27mm) Trade size: 3/8-inch (10mm) diameter.
      e. Trapeze Support for Multiple Conduits: 3/8-inch (10mm) diameter.
      f. Outlet Boxes: 1/4-inch (6mm) diameter.
      g. Luminaires: 1/4-inch (6mm) diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
   1. Manufacturers:
      a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. nVent; Caddy: www.nvent.com/#sle.
      d. PHP Systems/Design: www.phpsd.com/#sle.
   2. Description: Steel pedestals with thermoplastic bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
   3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
   5. Mounting Height: Provide minimum clearance of 6 inches (150mm) under supported component to top of roofing.

G. Anchors and Fasteners:
   1. Manufacturers - Mechanical Anchors:
      a. Dewalt: anchors.dewalt.com/#sle.
      b. Hilti, Inc: www.hilti.com/#sle.

c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Plastic and lead anchors are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
    d. Minimum Channel Thickness: Steel sheet, 12-gauge, 0.1046 inch (2.66) minimum base metal thickness.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Dewberry Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Dewberry Engineers, Inc., do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Dewberry Engineers, Inc.

H. Field Welding, Where Approved by Dewberry Engineers, Inc.

I. Equipment Support and Attachment:
    1. Use metal, fabricated supports, and/or supports assembled from metal channel/strut to support equipment as required.
    2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch (100mm) high concrete pad.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: See Section 16110 for additional requirements.

K. Interior Luminaire Support and Attachment: See Section 16510 for additional requirements.

L. Exterior Luminaire Support and Attachment: See Section 16510 for additional requirements.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 16136

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SECTION 16140 WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

D. Floor box service fittings.

1.02 RELATED REQUIREMENTS

A. Section 16120 – Conductors

B. Section 16121 - Grounding.

C. Section 16130-Boxes for Electrical Systems.

D. Section 16014 - Identification for Electrical Systems: Identification products and requirements.

E. Section 16155 - Wiring Connections: Cords and plugs for equipment.

F. Section 16145 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

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

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

6. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

B. Field Quality Control Test Reports.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Wall Plates: One of each style, size, and finish.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated

B. Leviton Manufacturing Company, Inc

C. Lutron Electronics Company, Inc

D. Pass & Seymour, a brand of Legrand North America, Inc

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed where children might be present.

E. Provide GFCI circuit breakers or remote GFCI modules for personnel protection for circuits feeding receptacles that are not readily accessible and require GFCI protection.

F. Provide GFCI protection for receptacles serving equipment and appliances in locations as required by the current edition of the National Electrical Code.

G. Devices indicated as GFCI receptacles on the Drawings shall be of the GFCI type. Do not rely on upstream protection or "feed-thru protection" by another device unless specifically indicated otherwise.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

I. For flush floor service fittings, use tile rings for installations in tile floors.

J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.03 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices Installed in Unfinished Spaces: Use galvanized steel wall plates.

C. Wiring Devices Installed in Wet or Damp Locations: Use with specified weatherproof cover.

D. Wiring Devices Connected to Emergency Power: Red with red nylon wall plate.

E. Flush Floor Box Service Fittings: Receptacle color specified above with brass cover and ring/flange.

2.04 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Hubbell Incorporated
   3. Leviton Manufacturing Company, Inc
   4. Pass & Seymour, a brand of Legrand North America, Inc:
   5. Wiremold
   6. Walker

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.05 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
   5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

3. Tamper Resistant Convenience Receptacles: Industrial specification grade Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, Class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
5. Tamper Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.
6. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, hospital grade, duplex duplex, 20A, 125V, NEMA 5-20R 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings , configuration as indicated on the drawings.

2.06 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wall plates by the same manufacturer in locations indicated.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.
4. Provide screwless wall plates with concealed mounting hardware where indicated.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: Service fittings compatible with floor boxes provided under Section 16138 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
   1. Single Service Flush Convenience Receptacles:
      a. Cover: Rectangular.
      b. Configuration: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
   2. Single Service Flush Communications Outlets:
      a. Cover: Rectangular.
   3. Single Service Flush Furniture Feed:
      a. Cover: Rectangular.
      b. Configuration: One 2-1/8 inch by 3/4-inch combination threaded opening(s).
   4. Dual Service Flush Combination Outlets:
      a. Cover: Rectangular.
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
   5. Dual Service Flush Furniture Feed:
      a. Cover: Rectangular.
      b. Configuration:
         1) Power: One 2-1/8 inch by 3/4-inch combination threaded opening(s).
         2) Communications: One One 2-1/8 inch by 1 inch combination threaded opening(s).
   6. Accessories:
      a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
      b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 16123 as required for installation of wiring devices provided under this section.
   1. Mounting Heights (to center of device) :Unless otherwise indicated, as follows:
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Dewberry Engineers, Inc. to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 16014.

P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 16140

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Outdoor and indoor photoelectric switches and daylight sensors.
3. Switch-box occupancy sensors.
4. Indoor occupancy sensors.
5. Outdoor motion sensors.
6. Multi-pole contactors.
7. Wallbox-style dimmers.

B. Related Sections include the following:

1. Division 16 Section "Switches and Receptacles" for manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

B. Manufacturers:
1. Wattstopper
2. Acuity Brands
3. Eaton
4. Cooper Lighting - Greengate
5. Substitutions: See Section 01600 - Product Requirements.

2.2 TIME SWITCHES

A. Digital Time Switches: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.

1. Contact Configuration: SPDT (Single-Pole Double-Throw)

2. Contact Rating: 20-A ballast load, 120/208/240/277 Vac. Contact output for both maintained and momentary (pulse) to allow control of latching contactors.

3. Programs: 4 channels.

a. For each channel, provide daily, weekly, or yearly schedules with a minimum of 1000 set points and an annual holiday schedule (up to 99 holidays) to override normal schedule.

4. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program on selected channels.

5. Astronomical Time: User scheduled for on or off function of a program on selected channels.

6. Battery Backup: 8 year lithium battery.

7. Memory: All programming and time functions shall be stored in EEPROM non-volatile memory.

8. Surge Protection: Circuitry shall utilize transient voltage surge protection for voltage surges up to 6000V.

9. Manual and Remote override.

B. Wallbox Time Switch: Digital programmable time switch, designed to replace a standard toggle switch, to turn lights OFF after a preset time period.

1. Completely self-contained control system, with standard single-gang switch device mounting and grounding strap with ground wire. Provide with compatible single-gang wallplate, color to match device (See section for "Switches and Receptacles" for device finish).

2. Switching mechanism shall be a latching air gap relay and utilize "zero crossing circuitry" to maximize relay life. Switch shall also be capable of operating as a manual ON-OFF switch.

3. Switch circuitry shall be compatible with all types of lighting loads, including tungsten, halogen, and fluorescent and HID ballasts (electro-magnetic and electronic).

4. Switch shall have no minimum load requirement and be capable of handling up to 800 watts (at 120 volt) or 1200 watts (at 277 volt) of lighting load.

5. Switch circuitry for time-off period shall be adjustable from 5 minutes to 12 hours (increments of 5 minutes up to one hour, and 15 minutes from 1 hour to 12 hours).

6. The time switch shall have optional warnings, including light flash and audible beep, for notifying occupant that the time-off period is expiring.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

A. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), 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: Instant ON;10-second delay OFF, to prevent false operation.

3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.

4. Mounting: Twist lock receptacle complying with ANSI/IEEE C136.10, with base mounting accessory as required to direct sensor to the North sky exposure.

2.4 INDOOR PHOTOELECTRIC SWITCHES

A. On/Off (closed loop) Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.

1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.

2. 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.

3. Light-Level Monitoring Range: 10 to 200 fc (108 to 2150 lx), with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.

5. Indicator: Two LEDs to indicate the beginning of on and off cycles.

B. Dimming Control (Open-Loop) for Daylight Compensation: Electronic solid-state controller with separate photo-sensor to measure incoming light and proportionally adjust the dimmer output.

1. Controller Output to Dimmer: 0-10Vdc, compatible with dimming ballasts by Advance, Osram-Sylvania and Lutron. (Ecoyo Series)

2. Control system shall use open-loop algorithms to determine signal output to dimming ballasts.

3. Photosensor: 30-3000 fc monitoring range, low-voltage.

C. Dimming Control (Closed-Loop) for Daylight Compensation: Self-contained, ceiling-mounted control device that detects changes in light levels and raises or lowers electrical fluorescent lighting in response.

1. Controller output to fluorescent dimming ballast is 0-10Vdc, compatible with dimming ballasts by Advance, Osram-Sylvania, and Lutron (ECO10 series).

2. The photosensor shall be low-voltage, powered by 24Vdc power pack.

3. The photosensor shall utilize a photocell that measures only in the visual spectrum and has a response curve that matches the photopic curve. It shall not measure in the ultra violet or infrared range (<5% for wavelengths < 400 nm or > 700 nm).

4. Sensor adjustments shall be made remotely with wireless remote control that shall be furnished with the product.

5. The photosensor shall have a control range of 20 –60 footcandles.

2.5 INDOOR OCCUPANCY SENSORS

A. Switch Box Sensors: PIR type with integral power-switching contacts rated for 800 W at 120-V ac, suitable for incandescent light fixtures, fluorescent light fixtures with magnetic or electronic ballasts, or 1/6-hp motors; (rated for 1000 W at 277-V ac).

B. Wall- or ceiling-mounting, sensor.

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 30 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit. Sensor shall include auxiliary single-pole, double-throw isolated relay.

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 though a 1/2-inch knockout in a standard electrical enclosure.

c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door or coverplate.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

6. Bypass Switch: Provide manual OFF/ON function facilitated by installation of a momentary contact switch.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 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.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch high ceiling.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8-foot high ceiling.

4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch high ceiling.

5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Wall or Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch high ceiling.

2.6 MULTIPOLE LIGHTING CONTACTORS

A. Approved Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Cutler-Hammer; Eaton Corporation.
4. GE Industrial Systems.
5. Square-D

B. Description: Electrically operated and electrically held, 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. Control-Coil Voltage: Match control power source.

2.7 WALLBOX-STYLE DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

2. Incandescent Lamp Dimmers: Modular, 120V, 60 Hz with continuously adjustable slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch (130-mm) wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 1% of full brightness (depending on ballast-type).

2.8 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 18 AWG.

C. Class 1 Control Cable: Multiconductor cable with stranded copper conductors not smaller than No. 14 AWG.

D. Provide unshielded, twisted-pair cable for control and signal transmission conductors.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install according to manufacturer's instructions. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Do not install ultrasonic or dual-technology occupancy sensors closer than 4 feet from air supply outlets / diffusers.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Division 16 Section "Conductors." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Provide field-mounting transient voltage suppressors for lighting control devices locations that do not have integral line-voltage surge protection.

D. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. 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.

3.3 IDENTIFICATION

A. Identify components and power and control wiring.

B. Label time switches and contactors with a unique designation. Provide a typewritten directory identifying circuits and spaces controlled by contactors.

3.4 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 in compliance with manufacturer recommendations.

2. Operational Test: Verify actuation of each sensor and adjust time delays per manufacturers instructions.

B. Remove and replace lighting control devices where test results indicate that they do not function properly.

C. Additional testing and inspecting, at Contractor's expense, may be performed to determine compliance of work with specified requirements.

3.5 ADJUSTING

A. Occupancy Sensor Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

B. Daylight Sensor Adjustments: Contractor shall provide on-site service to adjust sensors immediately after owner has occupied the space. An additional on-site visit shall be provided up to 12 months from date of substantial completion. At the end of the adjustment period, contractor shall turn-over accessories used for making adjustments, such as wireless remote controls, to the Owner.

END OF SECTION 16145

SECTION 16155 WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 16123- Conductors.

B. Section 16110-Conduit for Electrical Systems .

C. Section 16138-Boxes for Electrical Systems.

D. Section 16140-Wiring Devices.

E. Section 16170-Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

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

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches: As specified in Section 16170.

B. Wiring Devices: As specified in Section 16140.

C. Flexible Conduit: As specified in Section 16110.

D. Wire and Cable: As specified in Section 16123.

E. Boxes: As specified in Section 16138.

2.02 EQUIPMENT CONNECTIONS

A. Electrical Connection: Flexible conduit.

B. Provide field-installed disconnect switch.

C. Voltage: as indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

F. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

G. Install terminal block jumpers to complete equipment wiring requirements.

H. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 16155

SECTION 16171 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Documents: Drawings, General Conditions of the Contract and Division 01 Sections apply to this Section

B. Section 16180: Fuses

1.02 SUMMARY:

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
   1. Fusible switches.
   2. Non-fusible switches.
   3. Molded-case circuit breakers.
   4. Molded-case switches.
   5. Enclosures.

1.03 DEFINITIONS

1. GD: - General Duty
2. GFCI: - Ground-Fault Circuit Interrupter
3. HD: - Heavy Duty
4. RMS: - Root Mean Square
5. SPDT: - Single Pole, Double Throw
6. HID - High Intensity Discharge

1.04 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
   1. Enclosure types and details for types other than NEMA 250, Type 1.
   2. Current and voltage ratings.
   3. Short-circuit current rating.
   4. UL Listing for series rating of installed devices.
   5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field Quality-control test reports including the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition, include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current curves, including selectable ranges for each type of circuit breaker.

PART 2 PRODUCTS

2.01 FUSIBLE AND NON-FUSIBLE SWITCHES:

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Siemens Energy & Automation, Inc.
   4. Square D/Group Schneider.

B. Fusible switch, NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses,

lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non-fusible switch, NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. 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; and labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.02 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES:

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   3. Siemens Energy & Automation, Inc.
   4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, 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 150 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field adjustable trip setting.
   3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short –time pickup levels.
      c. Long- and short –time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.
   4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
   5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
   6. GFCI Circuit Breakers: Single- and two-pole configurations with 5 mA trip sensitivity.

C. Molded-Case Circuit Breaker Feature and Accessories:
   1. Standard Frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment, Type HID for High Intensity Discharge lighting loads.
   4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   5. Ground Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings push-to-test feature and ground fault indicator.
   6. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.Molded-Case Switch Accessories:
   1. Verify that accessories retained below are available and appropriate for molded-case switch types and ratings retained.
   2. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
   3. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.

2.03 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
   1. Outdoor Locations: NEMA 250, Type 3R.
   2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.02 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 16 Section "Electrical Supports and Seismic Restraints."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Electrical Identification."

3.04 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges in accordance with overcurrent device study (see Division 16 Section "Overcurrent Protective Device Study").

3.05 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches.
2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

2. Let-through current curves for fuses with current-limiting characteristics.

3. Time-current curves, coordination charts and tables, and related data.

4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

a. Let-through current curves for fuses with current-limiting characteristics.

b. Time-current curves, coordination charts and tables, and related data.

c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

B. Basis of design products:

1. Class L, current-limiting time delay – Bussman "Low Peak" KRP-C
2. Class RK1, time-delay, dual-element – Bussman "Low Peak", LPS-RK
3. Class RK5, time-delay, dual-element – Bussman "Fusetron" FRS-R
4. Class J, time-delay, dual-element – Bussman "Low Peak" LPJ
5. Class L, fast-acting, current-limiting, Bussman "Limitron" KTU

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

2. Finish: Gray, baked enamel.

3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

4. Fuse Pullers: For each size of fuse.

5. Place in the main electrical room.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Motor Branch Circuits:

1. Motors larger than 5 hp – RK1
2. Motors 5 hp and smaller – RK5

B. Other Branch Circuits: Class RK5, time delay.

C. Feeders:

1. 600 amp and smaller – RK1
2. Larger than 600 amp – Class L time-delay

D. Service Entrance:

1. Larger than 600 amp – Class L fast-acting
2. 600 amp and smaller – Class RK1

E. Low-Voltage Transformer: Class RK1

F. Elevator Machine Disconnect – Class J dual-element, time-delay

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16180

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.
   4. Generator set enclosure.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 15190 - Facility Natural-Gas Piping.

C. Section 15192 - Facility Liquefied-Petroleum Gas Piping.

D. Section 15810 - HVAC Ducts and Casings.

E. Section 16121-Grounding and Bonding for Electrical Systems.

F. Section 16136-Hangers and Supports for Electrical Systems.

G. Section 16014-Identification for Electrical Systems.

REFERENCE STANDARDS

H. ASTM D975 - Standard Specification for Diesel Fuel; 2023a.

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

J. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

K. NEMA MG 1 - Motors and Generators; 2021.

L. NFPA 30 - Flammable and Combustible Liquids Code; 2021, with Amendment (2020).

M. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2021.

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

O. NFPA 99 - Health Care Facilities Code; 2021, with Amendment.

P. NFPA 110 - Standard for Emergency and Standby Power Systems; 2022.

Q. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

R. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

S. UL 2085 - Protected Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

T. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
      a. Transfer Switches – Coordinate with fire pump controller design and equipment.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the spaces dedicated for engine generator system.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices upon request.
3. Include alternator thermal damage curve upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

F. Specimen Warranty: Submit sample of manufacturer's warranty.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

J. Manufacturer's factory emissions certification.

K. Manufacturer's certification that products meet or exceed specified requirements.

L. Source quality control test reports.

M. Provide NFPA 110 required documentation from manufacturer, including but not limited to:
1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

N. Manufacturer's detailed field-testing procedures.

O. Field quality control test reports.

P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

R. Maintenance contracts.

S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

T. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Fuses: Two of each type and size.
   3. Extra Filter Elements: Two of each type, including fuel, oil and air.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
   3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
   4. NFPA 30 (Flammable and Combustible Liquids Code).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years' experience.
   1. Authorized service facilities located within 200 Miles (320 km) of project site.

D. Installer Qualifications: Company with minimum three years' experience with engine generator systems of similar size, type, and complexity.

E. Maintenance Contractor Qualifications: .
   1. Contract maintenance office located within 200 miles (320 km) of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum five-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Packaged Engine Generator Set:
   1. Caterpillar Inc:
   2. Cummins Power Generation Inc:
   3. Generac Power Systems
   4. Kohler Co

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:
   1. Application: Emergency/standby.
   2. Configuration: Single packaged engine generator set operated independently (not in parallel).
   3. Total System Power Rating: As indicated on drawings, standby including applicable derating adjustments. Adjust kW as required for reconnectable leads of 3 phase alternator selection to single phase applications to meet overall kW and SkVA indicated on the Drawings.
   4. Where design is based on single generator set, use of multiple, smaller unit(s) operated in parallel to obtain equivalent total system power rating is not permitted.

D. Packaged Engine Generator Set:
   1. Voltage: As indicated on drawings.
   2. Frequency: 60 Hz.
   3. Main Line Circuit Breaker:
      a. Type: Electronic trip with long time, short time, and instantaneous pickup and delay.
      b. Trip Rating: As indicated on drawings.
      c. Features:
         1) Shunt trip where indicated on drawings.
         2) Auxiliary contacts where indicated on drawings.

E. Generator Set General Requirements:
   1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
   2. Factory-assembled, with components mounted on suitable base.
   3. List and label engine generator assembly as complying with UL 2200.
   4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
   5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
   6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Seismic Qualification: Provide engine generator assemblies and associated components suitable for application. Include certification of compliance with submittals.

G. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

H. Starting and Load Acceptance Requirements:
   1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
   2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate over crank alarm condition and lock-out generator set from further cranking until manually reset.
   3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
   4. Maximum Load Step: Supports 100 percent of rated load in one step.
      a. Maximum Voltage Deviation with Load Step: 3 percent.

b. Maximum Frequency Deviation with Load Step: 0.5 percent.

5. Motor Starting Capability: Supports starting of motor load indicated with a maximum voltage dip of 25 percent for general load steps and 15 percent for steps serving fire pumps.

I. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer. Where such modifications are made, provide field emissions testing as necessary for certification.

J. Sound Level Requirements:
1. Do not exceed 85 dBA when measured at 23 feet (7m) 10 from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Starting System:
1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
a. Battery Type: Nickel-cadmium.
b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed and battery starter disconnect.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
a. Provide dual rate battery charger with automatic float and equalize charging modes; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
c. Recognized as complying with UL 1236.
d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
f. Provide alarm output contacts as necessary for alarm indications.
5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

C. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Generator Sets Used with Closed Transition Transfer Switches: Provide electronic isochronous governor with frequency regulation suitable for transfer.
3. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

D. Engine Lubrication System:

1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dipstick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

E. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Ducted Radiators: Where ducted radiator air discharge is to be field installed, provide suitable radiator duct flange/adapter.
4. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

F. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.04 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class F with a maximum winding temperature rise of 105 degree C. above 40 degree C ambient.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:
a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g., automatic transfer switch).

b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
f. Time Delay: Programmable for shutdown (engine cooldown).
g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.

3. Generator Set Status Indications:
a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
b. Current (Amps): For each phase.
c. Frequency (Hz).
d. Real power (W/kW).
e. Reactive power (VAR/kVAR).
f. Apparent power (VA/kVA).
g. Power factor.
h. Duty Level: Actual load as percentage of rated power.
i. Engine speed (RPM).
j. Battery voltage (Volts DC).
k. Engine oil pressure.
l. Engine coolant temperature.
m. Engine run time.
n. Generator powering load (position signal from transfer switch).

4. Generator Set Protection and Warning/Shutdown Indications:
a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
1) Over crank (shutdown).
2) Low coolant temperature (warning).
3) High coolant temperature (warning).
4) High coolant temperature (shutdown).
5) Low oil pressure (warning).
6) Low oil pressure (shutdown).
7) Overspeed (shutdown).
8) Low fuel level (warning).
9) Low coolant level (warning/shutdown).
10) Generator control not in automatic mode (warning).
11) High battery voltage (warning).
12) Low cranking voltage (warning).
13) Low battery voltage (warning).
14) Battery charger failure (warning).
b. In addition to NFPA 110 requirements, provide the following protections/indications:
1) High AC voltage (shutdown).
2) Low AC voltage (shutdown).
3) High frequency (shutdown).
4) Low frequency (shutdown).
5) Overcurrent (shutdown).
6) Fuel tank leak (warning), where applicable.
c. Provide contacts for local and remote common alarm.
d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:
a. Event log.
b. Communications Capability: Utilize Modbus communications protocol. Provide all accessories necessary for proper interface.
c. Remote monitoring capability via PC.

C. Remote Annunciator:
   1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
   2. Generator Set Status Indications:
      a. Generator powering load (via position signal from transfer switch).
      b. Communication functional.
   3. Generator Set Warning/Shutdown Indications:
      a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
         1) Over crank (shutdown).
         2) Low coolant temperature (warning).
         3) High coolant temperature (warning).
         4) High coolant temperature (shutdown).
         5) Low oil pressure (warning).
         6) Low oil pressure (shutdown).
         7) Overspeed (shutdown).
         8) Low fuel level (warning).
         9) Low coolant level (warning/shutdown).
         10) Generator control not in automatic mode (warning).
         11) High battery voltage (warning).
         12) Low cranking voltage (warning).
         13) Low battery voltage (warning).
         14) Battery charger failure (warning).
      b. Provide audible alarm with silence function.
      c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.06 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Utilize an upward discharging radiator hood.

J. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

K. Enclosure Accessories: Provide battery powered emergency light(s), power service receptacle, and power load center.

L. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

2.07 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:
   1. Operation at rated load and rated power factor.
   2. Single step load pick-up.
   3. Transient and steady state voltage and frequency performance.
   4. Operation of safety shutdowns.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator sets, and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch (150 mm) high concrete pad constructed in accordance with Section 03300.

F. Provide required support and attachment in accordance with Section 16136.

G. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.

H. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

I. Provide duct for cooling air intake/exhaust in accordance with Section 15810.

J. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
   1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
   2. Do not exceed manufacturer's maximum back pressure requirements.

K. Install exhaust silencer in accordance with Section 235100, where not factory installed.

L. Provide grounding and bonding in accordance with Section 16121. Provide signage indicating neutral-ground bond under installed condition.

M. Identify system wiring and components in accordance with Section 16014.

N. Provide expanded galvanized steel platform around generator enclosure where generator base is greater than 24" above foundation or where height would exceed 6'7" to center line of circuit breaker and control panel.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Notify Owner and Dewberry Engineers, Inc. at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. Preliminary inspection and testing to include, at a minimum:
   1. Inspect each system component for damage and defects.
   2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
   3. Check for proper oil and coolant levels.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. Inspection and testing to include, at a minimum:
   1. Verify compliance with starting and load acceptance requirements.
   2. Verify voltage and frequency; make required adjustments as necessary.
   3. Verify phase sequence.
   4. Verify control system operation, including safety shutdowns.
   5. Verify operation of auxiliary equipment and accessories (e.g., battery charger, heaters, etc.).
   6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test). Provide load bank as required to achieve full load condition. Provide metering equipment to record loads as required.

J. Provide field emissions testing where necessary for certification.

K. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.

L. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

E. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.06 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.07 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION 16231

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SECTION 16271 LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 16120- Conductors

C. Section 16121-Grounding and Bonding for Electrical Systems.

D. Section 16136-Hangers and Supports for Electrical Systems.

E. Section 16110-Conduit for Electrical Systems.

F. Section 16014-Identification for Electrical Systems: Identification products and requirements.

G. Section 16442-Panelboards: Service entrance equipment.

H. Section 16171-Enclosed Switches: Service entrance equipment.

I. Section 16231-Generators: Emergency/standby power systems for interconnection with normal utility electrical supply.

J. Section 16289-Surge Protective Devices: Service entrance surge protective devices.

K. Section 312316 - Excavation.

L. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

M. Section 312323 - Fill: Bedding and backfilling.

N. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances:
   1. See Section 012100 - Allowances, for allowances affecting this section.
   2. Include cash allowance for Utility Company charges associated with providing service.

B. Unit Prices:
   1. See Section 012200 - Unit Prices, for additional unit price requirements.
   2. Primary:
      a. Basis of Measurement: By the lineal foot (meter), for each configuration.
      b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
   3. Secondary:
      a. Basis of Measurement: By the lineal foot (meter), for each configuration.
      b. Basis of Payment: Includes all work designated to be provided by Contractor in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
   4. Transformer Pad/Vault:
      a. Basis of Measurement: Per unit, for each type.
      b. Basis of Payment: Includes purchase, delivery, and installation.

1.04 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.05 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

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

1.06 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. The Contractor shall pay the power and communication utilities fees, assessments, charges, etc. required by that utility to provide service to the facility. If an allowance for these costs is indicated within Specifications or on the Drawings these costs shall be drawn from this allowance with all remaining monies returned to the Owner. Include all costs on the Schedule of Values. See Paragraph 1.03.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
   2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Utility Company letter of availability for providing electrical service to project. Letter to include transformer kVA rating, impedance and available short circuit current at the service point.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
   1. Obtain Utility company approval of shop drawings prior to submittal.

E. Drawings prepared by Utility Company.

F. Project Record Documents: Record actual locations of equipment and installed service routing.

1.08 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).

2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.
4. The requirements of the local authorities having jurisdiction.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new or modify the existing electrical service as indicated on the drawings consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults: Furnished and installed by Contractor per Utility Company requirements.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
      d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
      e. Primary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Utility Company.
      f. Secondary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Contractor.
   2. Pole-Mounted Utility Transformers:
      a. Utility Poles: Furnished and installed by Utility Company.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
      d. Primary: Furnished and installed by Utility Company.
      e. Secondary - Underground Service:
         1) Conduits and pull boxes furnished and installed by Contractor.
         2) Conductors: Furnished and installed by Contractor.
      f. Secondary - Overhead Service:

1) Conduits/Service Masts: Furnished and installed by Contractor.
2) Conductors: Furnished and installed by Contractor (Service Point at service mast).

3. Terminations at Service Point: Provided by Utility Company.
4. Metering Provisions:
   a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
   b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
   c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
   d. Metering Transformers: Furnished and installed by Utility Company.
   e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
   f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
   g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Section 312316.13 as described in Section 16010.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03300 or as described in Section 16010.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 16136.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 16121.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 16014.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 16271

SECTION 16289 SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.2 RELATED REQUIREMENTS

B. Section 16121 - Grounding and Bonding for Electrical Systems.

E. Section 16443 - Panelboards.

H. Section 16140 - Wiring Devices: Receptacles with integral surge protection.

I. Section 16710 - Structured Cabling: Protectors for communications service entrance.

J. Section 16703 - Fire Detection and Alarm.

1.3 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4 REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement 2009c (Validated 2019).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

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

F. UL 1283 - Standard for Electromagnetic Interference Filters Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Dewberry Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.

2. UL 1283 (for Type 2 SPDs).

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices:

ABB/GE: www.electrification.us.abb.com/#sle.

Current Technology; a brand of Thomas & Betts Power Solutions.

nVent ERICO: www.nvent.com/#sle.

Schneider Electric; Square D Brand Surgelogic Products.

Surge Suppression, LLC (SSI): www.surgesuppression.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

C. Substitutions: See Section 016000 - Product Requirements.

D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

Wye Systems: L-N, L-G, N-G, L-L.

Delta Systems: L-G, L-L.

Single Split Phase Systems: L-N, L-G, N-G, L-L.

High Leg Delta Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

Equivalent to basis of design.

208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

480V Delta System Voltage: Not more than 1,800 V for L-G mode and 3,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor clean, dry locations: Type 1.

b. Outdoor locations: Type 3R.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

Provide surface-mounted SPD where mounted adjacent to surface-mounted equipment.

Provide flush-mounted SPD where mounted adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

Switchgear: See Section 16430.

Switchboards: See Section 16442.

Panelboards: See Section 16443.

Motor Control Centers: See Section 16424.

Busway Plug-in Units: See Section 16451.

2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

Protection Circuits: Field-replaceable modular.

Surge Current Rating: Not less than 240 kA per mode/480 kA per phase.

Repetitive Surge Current Capacity: Not less than 5,000 impulses.

UL 1449 Nominal Discharge Current (I-n): 20 kA.

UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.

Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.

Diagnostics:

Protection Status Monitoring: Provide indicator lights to report the protection for each phase.

Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.

Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.4 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

B. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 160 kA per mode/320 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 3,500 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.
7. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
8. Diagnostics:
9. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
10. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
11. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
12. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

13. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.5 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular.
2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs.
7. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
8. Diagnostics:
9. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
10. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
11. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
12. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
13. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch.

2.6 Powerline cord/direct-wired (120 VAC) suppressors:

A. Suppressors shall consist of a three-stage hybrid design. First stage M.O.V., second stage air-core 300 uh inductor, and third stage silicon avalanche diode.

B. The suppressor shall provide certified test data confirming a fail short failure mode

C. Suppressor shall provide three suppression modes. Line to neutral, line to ground, and neutral to ground.

D. Suppressor shall provide a maximum single impulse current rating of 10,000 amperes (8 x 20 us - waveform) per mode.

E. Suppressor shall provide a pulse life rating of 3,000 amperes (8 x 20 us - waveform) every thirty (30) seconds for 2,000 occurrences.

F. Suppressors maximum clamping voltage when subjected to the ANSI/IEEE C62.41 - 1980, Cat. B (6kv-1.2 x 50 us, 3kA impulse) shall not exceed 450 Volts peak.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 16060, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as indicated on the drawings.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 16060 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3 Electronic Power Supply:

A. Install one each powerline cord or direct-wired branch circuit suppressor between each equipment item and its power supply conductors as follows:

1. Fire Alarm Master Panel
2. Building Management System headend
3. Security System headend
4. Telephone switch

B. Install suppressor according to manufacturer's recommendations.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Provide and install surge protection devices to meet the requirements of Section 16610 Lightning Protection for Structures.

3.5 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 16289

SECTION 16423 GENERATOR DOCKING STATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Generator Docking Stations for low-voltage (600 V and less) applications and associated accessories:
   1. Docking Station for portable generator and load bank.
   2. Docking Station for portable generator connection.
   3. Docking Station for load bank temporary connection
   4. Includes service entrance rated stations.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 16121 - Grounding and Bonding for Electrical Systems.

C. Section 16136 - Hangers and Supports for Electrical Systems.

D. Section 16014 - Identification for Electrical Systems: Identification products and requirements.

E. Section 16210 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

F. Section 16231 - Engine Generators: For interface with transfer switches.
   1. Includes code requirements applicable to work of this section.
   2. Includes additional testing requirements.
   3. Includes related demonstration and training requirements.

G. Section 263600 – Transfer Switches

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

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

E. NFPA 99 - Health Care Facilities Code 2021, with Amendment.

F. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.

G. UL 489 - Reference Standard for Molded Case Circuit Breakers.

H. UL 1008 - Transfer Switch Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of docking station to be installed with work provided under other sections or by others.
      a. Engine Generators: See Section 16231.
      b. Transfer Switches.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
   1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
   1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.
   2. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Specimen Warranty: Submit sample of manufacturer's warranty.

F. Evidence of qualifications for installer.

G. Evidence of qualifications for maintenance contractor (if different entity from installer).

H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

I. Manufacturer's certification that products meet or exceed specified requirements.

J. Source quality control test reports.

K. Manufacturer's detailed field-testing procedures.

L. Field quality control test reports.

M. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

N. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

O. Maintenance contracts.

P. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

Q. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years' experience.
   1. Authorized service facilities located within 200 miles (320 km) of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with generator docking station systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
   1. Contract maintenance office located within 200 miles (320 km) of project site.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store docking stations in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to docking station switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Docking Stations:
   1. ESL Power Systems
   2. Trystar
   3. ASCO Power Technologies.

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish generator docking stations and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 TEMPORARY LOAD BANK AND GENERATOR DOCKING STATION

A. Provide complete generator docking station suitable for permanent generator load bank testing and a backup portable generator.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
   1. Utilize mechanically interlocked mechanism to prevent cross-connecting power sources.
   2. Provide dry contact for annunciator circuit.
   3. Provide 3 pole circuit breakers for disconnecting means.
      a. Circuit breaker to be 100% rated.
      b. Circuit breaker to provide long time and instantaneous adjustable trip.
      c. Provide ground fault protection where indicated.
   4. Provide color-coded series 16 cam style connectors for generator (male) and load bank (female) connection.
   5. Provide acceptance of signal from facility automatic transfer switch. Signaling from the transfer switch of a transfer to emergency power to immediately disconnect any load bank connection.

6. Voltage: As indicated on the drawings.
7. Ampere Rating: As indicated on the drawings.
8. Neutral Configuration: Solid neutral (unswitched), except as indicated.
9. Provide phase rotation monitor.
10. Provide pilot lights to indicate the following:
    a. Primary Source Available
    b. Alternate Source Available
11. Provide Surge Protection Device.

2.03 TEMPORARY GENERATOR DOCKING STATION:

A. Provide complete generator docking station suitable for backup portable generator.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
1. Utilize mechanically interlocked mechanism to prevent cross-connecting power sources.
2. Provide dry contact for annunciator circuit.
3. Provide 3 pole circuit breakers for disconnecting means.
    a. Circuit breaker to be 100% rated.
    b. Circuit breaker to provide long time and instantaneous adjustable trip.
    c. Provide ground fault protection where indicated.
4. Provide color-coded series 16 cam style connectors for generator (male) connection.
5. Voltage: As indicated on the drawings.
6. Ampere Rating: As indicated on the drawings.
7. Neutral Configuration: Solid neutral (unswitched), except as indicated.
8. Provide phase rotation monitor.
9. Provide pilot lights to indicate the following:
    a. Primary Source Available
    b. Alternate Source Available
10. Provide Surge Protection Device.

2.04 TEMPORARY LOAD BANK DOCKING STATION:

A. Provide complete generator docking station suitable for connection of temporary load bank for permanent generator testing.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:
1. Utilize mechanically interlocked mechanism to prevent cross-connecting power sources.
2. Provide dry contact for annunciator circuit.
3. Provide 3 pole circuit breakers for disconnecting means.
    a. Circuit breaker to be 100% rated.
    b. Circuit breaker to provide long time and instantaneous adjustable trip.
    c. Provide ground fault protection where indicated.
4. Provide color-coded series 16 cam style connectors for generator (male) connection.
5. Voltage: As indicated on the drawings.
6. Ampere Rating: As indicated on the drawings.
7. Neutral Configuration: Solid neutral (unswitched), except as indicated.
8. Provide phase rotation monitor.
9. Provide pilot lights to indicate the following:
    a. Primary Source Available
    b. Alternate Source Available
10. Provide Surge Protection Device.

2.05 ALL DOCKING STATIONS

A. Seismic Qualification: Provide docking stations and associated components suitable for application .

B. Service Conditions: Provide generator docking stations suitable for continuous operation at indicated ratings under the service conditions at the installed location.

C. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Outdoor Locations: Type 3R or Type 4.
   2. Provide lockable door(s) for outdoor locations.
   3. Finish: Manufacturer's standard unless otherwise indicated.

D. Short Circuit Current Rating:
   1. Withstand and Closing Rating: Provide generator docking stations with listed withstand rating not less than the available fault current at the installed location as indicated on the drawings.

E. Provide service entrance rating where indicated on the drawings.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform production tests on docking station at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator docking stations are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive generator docking stations.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 16136.

E. Install docking stations plumb and level.

F. Unless otherwise indicated, mount floor-mounted docking stations on properly sized 4-inch- high concrete pad constructed in accordance with Section 03300.

G. Provide grounding and bonding in accordance with Section 16121.

H. Identify docking stations and associated system wiring in accordance with Section 16014.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Generator Docking Stations:
   1. Inspect and test in accordance with NETA ATS, except Section 4.
   2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

a. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of generator docking station to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of docking station.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Instructor: Manufacturer's authorized representative.
3. Location: At project site.

E. Coordinate with related generator demonstration and training as specified in Section 16231.

3.06 PROTECTION

A. Protect installed docking station from subsequent construction operations.

END OF SECTION 16423

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

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 NEMA PB 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. 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.

B. Phase and Ground Buses: Hard-drawn copper, 98 percent conductivity.

C. Conductor Connectors: Suitable for use with conductor material.

1. Ground Lugs and Bus Configured Terminators: Compression type.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Rating:
   1. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices:

   1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
   2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: 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. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.
   3. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

      a. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
      b. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
      c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

C. Fuses are specified in Division 16 Section "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

G. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

H. Ground equipment according to Division 16 Section "Grounding and Bonding."

I. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

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

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION 16442

SECTION 16460 – DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 SCOPE:

A. Dry type transformers.

B. Provide shop drawings.

PART 2 PRODUCTS

2.01 SERVICE AND RATINGS:

A. Transformers ventilated, for indoor service unless shown exterior, single or three phase as shown, with KVA rating shown.

B. Voltage for 3 phase units 480V to 120/208V, three phase, four wire. Voltage of single phase units 480V to 120/240V, single phase, three wire. All units equipped with 2-2-1/2% FCBN and 2-2-1/2% FCAN taps. Special voltage transformation as shown.

2.02 INSULATION:

A. Class-220 insulation, 115 degree C rise above 40 degree C ambient unless shown otherwise.

2.03 SOUND RATING:

A. Maximum design sound level:

K V A	DESIGN SOUND LEVEL
0-9.0	40 db
10-50	45 db
51 - 150	50 db
167 - 300	55 db
301 - 500	60 db

B. Sound levels determined per NEMA and ASA Standards. Mount core and coils on vibration isolator pads.

2.04 MANUFACTURERS:

A. G.E., Eaton, Square "D", Siemens.

PART 3 EXECUTION

3.01 MOUNTING:

A. Transformers must be floor mounted on a 4" housekeeping pad unless noted to be ceiling hung on the drawings. Ceiling hung transformers may be suspended from building structural members on 4 steel rods unless shown otherwise. Mount height as directed. Provide extra supports required due to size and weight. No units wall mounted except as shown.

B. Use extreme care to eliminate noise and vibration. Suspended units; install in each rod, Amber/Booth type PBSR or Consolidated Kinetics type SRH vibration isolator size as directed.

C. Floor mounted units shall be mounted on spring isolators. Use seal-tight flexible conduit for final connections to transformers.

D. Shop drawings for each transformer to show physical size, conduit and cable space, connection diagrams, specified requirements, impedance, and maximum current inrush at rated voltage.

E. Unless labeled otherwise, transformer ventilation openings should be located at least 0' - 6" away from walls or other obstructions to allow free circulation of air through and around each unit.

F. Shop drawings for each transformer to show physical size, conduit and cable space, connection diagrams, specified requirements, impedance, and maximum current inrush at rated voltage.

G. Provide with nameplate per 16014 - Electrical Identification.

END OF SECTION 16460

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Furnish and install all lighting luminaires, with all necessary accessories and lamps, as shown, specified, and/or scheduled.

1.2 RELATED SECTIONS:

A. See Section for Lighting Control Systems.

B. See Section 16010 or Section 16012 for requirement for submittals.

C. See Division 1 for allowances and Owner-furnished items to be installed under this Section.

1.3 ABBREVIATIONS:

A. H.I.D. - High Intensity Discharge (High Pressure Sodium, Mercury Vapor, Metal Halide)

1.4 SUBMITTALS:

A. Shop drawing submittals for luminaires shall include the following for each luminaire: complete construction details including all dimensions, complete description of materials used, complete electrical data (including operating voltage), photometric test report from an independent testing lab, complete description of finish, and manufacturer catalog cutsheet of lamp to be used.

PART 2 - PRODUCTS

2.1 LUMINAIRES:

A. Furnish and install luminaires as shown in luminaire schedule, or otherwise indicated on the drawings. Manufacturer catalog numbers shown are for general descriptive purposes only, and are intended only to establish the standard of quality.

B. Locations of luminaires on electrical drawings are diagrammatic. Verify location of luminaires with architectural drawings prior to installation. Conflicts between electrical and architectural drawings shall be referred to the Architect for resolution.

C. Provide luminaires complete with all options, accessories and other appurtenances required for a complete installation. Contractor shall verify type of ceiling and wall construction being installed, and provide luminaires properly configured for the type of construction.

D. All luminaires shall be UL listed for the application being installed.

E. Exit signs shall be furnished with 6" high letters with ¾" stroke. Verify color of signage required by local code authorities. Signs shall meet all NFPA, UL and local building code requirements.

F. Pendant stem mounted luminaires shall be furnished with ball aligner swivel, 30 degrees from vertical minimum, with swivel below canopy, with ½" diameter metal tube (stem).

G. Plastic lenses and shielding shall meet NFPA and local building code requirements for light transmitting plastics.

H. Metal luminaire housings shall be free of tool marks, dents, burrs and sharp edges. All metal parts shall be painted, galvanized, or otherwise corrosion-resistant.

I. Reflector surfaces shall be finished specular, semi-specular, diffuse or painted as indicated. Specular finish materials shall have a minimum reflectance value of 83%. Semi-specular or diffuse finish shall have reflectance of 75% and white painted finish materials shall have reflectance of 88%.

J. Luminaire support wires shall be zinc-coated, soft temper ASTM A641/A641M steel, 12 gage.

K. Luminaires with aircraft cable suspension system shall use 1/16" diameter (minimum) stainless steel aircraft cable and adjustable cable gripper with swaged cable stop at ceiling canopy. Cable size shall be selected by luminaire manufacturer to provide adequate support.

2.2 LEDS:

A. Components: UL 8750 recognized or listed as applicable.

B. Tested in accordance with IES LM-79 and IES LM-80

C. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance,

D. All LED's shall be sorted and provided to have ANSI McAdam Ellipse standard deviation color matching (SDCM) of 2 or better.

2.3 EMERGENCY LIGHTING:

A. Provide luminaires and exit signs with self-contained battery power supplies as indicated. All equipment shall conform to UL924-Emergency Lighting and Power Equipment.

B. Battery shall be sealed, maintenance-free lead-acid type (indoors) or nickel-cadmium (outdoors or unconditioned spaces) with 10-year nominal life. Unit shall incorporate a fully-automatic solid state charger and automatic transformer relay to transformer to backup battery power supply upon failure of normal power.

C. All emergency lighting equipment shall be equipped with means to test operation and an LED indicating battery status.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support luminaires from structure of the building, independent from the ceiling membrane or finish material. Luminaire shall be set level, plumb, and square with ceilings and walls.

B. Recessed lay-in luminaires in suspended grid ceilings shall be supported from the ceiling grid. Provide devices for securing the luminaire to the ceiling grid to comply with the National Electrical Code ("earthquake clips"). Luminaires heavier than 30 pounds shall have supplemental support wires anchored to the structure above the ceiling. Provide independent support wires, anchored to structure above and attached to fixture at each corner.

C. Recessed luminaires in fire-rated ceiling assemblies shall be installed in accordance with the UL listing of the assembly.

D. Recessed luminaires (non lay-in or hard ceiling types) shall be supported by ¾" steel ceiling channel, or factory-supplied hanger bars one on each side of the luminaire, anchored to ceiling structure. Recessed luminaires heavier than 20 pounds shall have supplemental support anchored to the structure above the ceiling. Do not use conduit to support luminaire.

E. Provide recessed luminaires with appropriate frames, hardware and trim for the ceiling installed.

F. Install luminaires free and clear of structural and mechanical interferences above the ceiling. If location indicated on the drawing conflicts with other elements, notify the Architect for directions for remedial action.

G. Attach surface and pendant mounted luminaires to 3/16" fixture stud in outlet box. Luminaires in excess of 20 pounds shall have supplemental support anchored to the structure above the ceiling.

H. Luminaires surface mounted to grid-type ceilings shall be mounted with Caddy IDS type clips anchored to structure above.

I. Wall mounted luminaires shall be anchored to wall structure. Luminaire shall fully conceal the outlet box.

J. Wiring to luminaires shall be with flexible metallic conduit to junction box. Do not wire luminaire to luminaire unless noted otherwise, or if using manufactured wiring systems.

K. Individual flexible connections under 6 feet in length shall consist of 2#14 and 1#14 (ground) in 3/8" flexible metallic conduit (for circuits 20A or less). Bond ground wire and conduit at each end.

L. Recessed luminaires in insulated ceilings shall be installed so that insulation is no less than 3 inches away from the fixture enclosure unless the luminaire is listed for direct contact with insulation (IC rated).

M. Provide equipment, labor and materials, as needed for final aiming of adjustable luminaires. Aiming shall take place immediately before final occupancy by the Owner.

N. Reflectors, trim cones, and other visible trim of luminaires shall not be installed until completion of ceiling work, and shall be clean and free of dust, fingerprints, scratches, dents etc. upon substantial completion.

END OF SECTION 16510

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

E. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Section 07840 - Firestopping: Materials and methods for work to be performed by this installer.

B. Designed using manufacturer's product-specific design software or based on manufacturer's pre-engineered design suitable for the application.

C. Section 08710 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

D. Section 15311 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

E. Section 15350 - Fire Pumps: Supervisory devices.

F. Section 15820 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

G. Section 16010- Common Work Results for Electrical Systems

H. Section 16120- Low-Voltage Electrical Power Conductors and Cables

I. Section 16121- Grounding and Bonding for Electrical Systems

J. Section 16110 Conduit for Electrical Systems

K. Section 16030 Boxes for Electrical Systems

L. Section 16014 – Identification for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).

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

E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities 2020.

G. NFPA 99: Health Care Facilities Code.

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

I. NFPA 601 - Standard for Security Services in Fire Loss Prevention 2020.

J. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.

K. UL 38 – Standard for Manual Signaling Boxes for Fire Alarm Systems

L. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

M. UL 1480 - Speakers for Fire Alarm and Signaling Systems

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with Contract Documents.
   4. Proposed maintenance contract.

C. Drawings must be prepared using AutoCAD Release 2010 or Newer.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

D. Evidence of designer qualifications.

E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix like that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Air-Sampling Smoke Detection Systems: Include air-sampling pipe network layout with sampling ports identified; include calculations demonstrating compliance with specified requirements.
   10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   11. Detailed drawing of graphic annunciator(s).
   12. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   13. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
   14. Certification by Contractor that the system design complies with Contract Documents.
   15. Do not show existing components to be removed.

F. Manufacturer's equipment seismic qualification certification.

G. Evidence of installer qualifications.

H. Evidence of instructor qualifications; training lesson plan outline.

I. Evidence of maintenance contractor qualifications, if different from installer.

J. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.

3. Submit NFPA 72 "Inspection and Test Form," filled out.

K. Operating and Maintenance Data: See Section 017800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
   2. Complete set of specified design documents, as approved by authority having jurisdiction.
   3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   5. List of recommended spare parts, tools, and instruments for testing.
   6. Replacement parts list with current prices, and source of supply.
   7. Detailed troubleshooting guide and large scale input/output matrix.
   8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

L. Project Record Documents: See Section 017800 for additional requirements; have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

M. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
   3. Certificate of Occupancy.
   4. Maintenance contract.
   5. Report on training results.

N. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
   3. In addition to the items in quantities indicated in PART 2, furnish the following:
      a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
      b. One copy, on CD-ROM, of all software not resident in read-only-memory.
      c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.05 QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

C. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
   4. Contract maintenance office located within 50 miles (80 km) of project site.
   5. Certified in the State in which the Project is located as fire alarm installer.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
   1. Edwards (to match existing school system fire alarm manufacturer)

B. Initiating Devices and Notification Appliances:
   1. Provide initiating devices and notification appliances made by the same manufacturer, as the control unit.

C. Substitutions: See Section 016000 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
   2. Protected Premises: Entire building shown on drawings.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards.

b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction.
d. Applicable local codes.
e. Contract Documents (drawings and specifications).
f. NFPA 101.
g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Evacuation Alarm and Zones: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises. New School Building and Gym Building shall be programmed as one notification zone and shall evacuate together. Existing building which the new system is networked to, shall be a separate evacuation zone. The new system shall monitor the existing system status and the existing system shall monitor the new system status.
5. Initiation: Manual and Automatic.
6. Notification: Provide one-way intelligible voice and visual alarm communications with multichannel capability; digital.
7. Program notification zones and voice messages as directed by Owner.
8. Hearing Impaired Occupants: Provide visible notification devices in all common public areas. Comply with the requirements of the ADA.
9. Fire Alarm Control Unit: Location indicated on the Drawings.
10. Reporting to Supervising Station: Dedicated leased telephone lines for connection to a monitoring company service via digital alarm communication transmitter (DACT)

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. Coordinate with AHJ and State Fire Marshal and provide as required:
a. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 dedicated leased telephone lines.
b. Means of Transmission to Remote Supervising Station: Via cellular dialer.
c. Means of Transmission to Remote Supervising Station: Primary: Over CAT 6e over to the via ethernet to the IP network. Secondary: Digital alarm communicator transmitter (DACT), with cellular telephone dialer. Provide auxiliary contacts for connection of the DACT and cellular dialer with connections to the battery backup system

C. Circuits:
1. Initiating Device Circuits (IDC): Class A.
2. Signaling Line Circuits (SLC)Within Single Building: Class A.
3. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
4. Notification Appliance Circuits (NAC): Class A.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72 for minimum 24 hours standby condition and 15 minutes of alarm condition.
4. Each Computer System: Provide uninterruptible power supply (UPS).

F. Seismic Qualification: Provide fire alarm system and associated components suitable for application.

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Sprinkler water storage tank low level.
   3. Sprinkler water storage tank low temperature.
   4. Fire pump(s).

B. Alarm: Provide alarm initiation in accordance with NFPA 72. See drawing for matrix.

C. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

D. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 087100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 087100.

2.04 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Fire Alarm Control Unit:
   1. System Capacity: 4,064 addresses; six notification appliance circuits (NACs), expandable to 192; four input/output (I/O) circuits; 1,500 software zones.
   2. Voice Integration:
      a. Support two hours of message storage; internal library of predefined messages and tones; 255 customizable audio patterns; text-to-speech custom text translation.
      b. Provide supervised low-level auxiliary input to interface with external audio sources and support background music applications.
      c. Provide eight programmable push buttons for speaker and emergency communication system (ECS) zone assignment, expandable to 104 pushbuttons.
      d. Support connection of up to 31 single-channel amplifiers (SCA) or dual-channel amplifiers (DCA), 30 Model LOC-1000 local operator consoles, and one Model FFT-1000 firefighter telephone system supporting 24 phone circuits, expandable to 96.
   3. Features: Strobe synchronization; dedicated alarm, supervisory and trouble relays; 4,000 event history buffer; built-in IP communicator; Ethernet port for programming and network connectivity; e-mail system status, reports and event information.
   4. Features: Strobe synchronization; dedicated alarm, supervisory and trouble relays; 4,000 event history buffer; built-in IP communicator; Ethernet port for programming and network connectivity; e-mail system status, reports and event information.

D. Addressable Modules:
   1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
   2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.

3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
5. Releasing Control Modules: Provide as indicated or as required for control of listed solenoids in releasing applications.
6. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
7. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.
8. Products:
   a. Ruskin Company; ADC105 Addressable Damper Controller for Simplex Panels: www.ruskin.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

E. Initiating Devices:
   1. Addressable Systems:
      a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
      b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

F. Manual Pull Stations: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   1. Single-action mechanism, pull lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   3. Station Reset: Key- or wrench-operated switch.
   4. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
   5. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

G. System Smoke Detectors
   1. General Requirements for System Smoke Detectors:
      a. Comply with UL 268, current accepted edition operating at 24-V dc, nominal.
      b. Detectors shall be two-wire type,
      c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
      d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
      e. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
      f. Integral Visual-Indicating Light: LED type, indicating detector has operated and communication status.

g. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
h. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
i. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
j. Multiple levels of detection sensitivity for each sensor.
k. Sensitivity levels based on time of day.
l. If any specialized equipment must be used to program any function of the smoke detector devices, then one must be furnished as part of the system.

H. Photoelectric Smoke Detectors
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present average value, present sensitivity selected, and sensor range (normal, dirty, etc).

I. Duct Smoke Detectors: Photoelectric type complying with UL 268A
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present average value, present sensitivity selected, and sensor range (normal, dirty, etc),
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Auxiliary function control is to be by discrete addressable control relay.

J. Carbon Monoxide Detectors
1. General: Carbon monoxide detector listed for connection to fire-alarm system.
2. Mounting: Adapter plate for outlet box mounting.
a. Testable by introducing test carbon monoxide into the sensing cell.
b. Detector shall provide alarm contacts and trouble contacts.
c. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
d. Comply with UL 2075.
e. Locate, mount, and wire according to manufacturer's written instructions.
f. Provide means for addressable connection to fire-alarm system.
g. Test button simulates an alarm condition.

K. Multi-Criteria Detectors
1. Mounting: Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
3. Automatically adjusts its sensitivity by means of drift compensation and smoothing algorithms. The detector shall send trouble alarm if it is incapable of compensating for existing conditions.
4. Test button tests all sensors in the detector.

5. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector including primary status, device type, present sensitivity selected, and sensor range (normal, dirty, etc.).
6. Sensors: The detectors shall comply with UL 268 7th edition.

L. Heat Detectors
1. General Requirements for Heat Detectors: Comply with UL 521.
   a. Temperature sensors shall test for and communicate the sensitivity range of the device.
   b. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
      1) Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
      2) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   c. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
      1) Mounting: Adapter plate for outlet box mounting or Twist-lock base interchangeable with smoke-detector bases.
      2) Integral addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   d. Continuous Linear Heat-Detector System:
      1) Detector Cable: Rated detection temperature 155 deg F (68 deg C). Listed for "regular" service and a standard environment. Cable includes two steel a actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit wires at the location of elevated temperature.
      2) Control Unit: Two-zone or multizone unit as indicated. Provide same system power supply, supervision, and alarm features as specified for fire-alarm control unit.
      3) Signals to Fire-Alrm Control Unit: Any type of local system trouble shall be reported to fire-alarm control unit as a composite "trouble" signal. Alarms on each detection zone shall be individually reported to central fire-alarm control unit as separately identified zones.
      4) Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

M. Notification Appliances
1. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
2. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
3. Visible Notification Appliances: visuals complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   a. Rated Light Output: 15/30/5/110/177 per drawings and field selectable.
   b. Mounting: Wall mounted unless otherwise indicated.
   c. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   d. Flashing shall be in a temporal pattern, synchronized with other units.
   e. Visuals Leads: Factory connected to screw terminals.
   f. Mounting Faceplate: Factory finished, [red] [white].

4. Voice/Tone Notification Appliances:
    a. Comply with UL 1480.
    b. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
    c. Speakers:
        1) The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
        2) A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
        3) Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
        4) The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
        5) All notification appliances shall be backward compatible.
5. Speaker Strobes:
    a. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
    b. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
    c. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
    d. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range

N. Remote Annunciator
1. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
    a. Mounting: Flush or Surface as indicated on the Drawings cabinet, NEMA 250, Type 1.

b. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

O. DIGITAL ALARM COMMUNICATOR TRANSMITTER
1. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
2. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically connect to a communications path and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on the path is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of path to the remote alarm receiving station over the remaining path. Transmitter shall automatically report service restoration to the central station. If service is lost on both communication paths, transmitter shall initiate the local trouble signal.
3. 3. Local functions and display at the digital alarm communicator transmitter shall include the following:
   a. Verification that all paths are available.
   b. b.Programming device.
   c. LED Display.
   d. Manual test report function and manual transmission clear indication.
4. Communications failure with the central station or fire-alarm control unit.
5. Digital data transmission shall include the following:
   a. Address of the alarm-initiating device.
   b. Address of the supervisory signal.
   c. Address of the trouble-initiating device.
   d. Loss of ac supply.
   e. Loss of power,
   f. Low battery.
   g. Abnormal test signal.
   h. Communication bus failure.
6. Secondary Power: Integral rechargeable battery and automatic charger.
7. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

P. Radio Alarm Transmitter
1. Transmitter shall comply with NFPA 1221 and 47 CFR 90.
2. Description: Manufacturer's standard commercial product; factory assembled, wired, and tested; ready for installation and operation.
   a. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
   b. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
   c. Normal Power Input: 120-V ac.
   d. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
   e. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph (160 km/h) with a gust factor of 1.3 without failure.
   f. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
   g. Antenna-Cable Connectors: Weatherproof.

h. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

3. Functional Performance: Unit shall receive alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions.
   a. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
   b. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
   c. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
   d. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
   e. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.
   f. Local Fire-Alarm-System, Supervisory-Alarm Message: Actuated when the building alarm system indicates a supervisory alarm.

Q. Network Communications
   1. Provide network communications between FACP / FACU for fire-alarm system according to fire-alarm manufacturer's written requirements.
   2. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
   3. Provide integration gateway using BACnet or Modbus for connection to building automation system as required.

R. MAGNETIC DOOR HOLDERS
   1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
   2. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
   3. Wall-Mounted Units: Flush mounted unless otherwise indicated.
   4. Rating: 24-V dc.
   5. The electromagnets shall be controlled by the FACU. Individual smoke detector auxiliary contacts shall not be used to release door holders.
   6. Material and Finish: Match door hardware

S. Device Guards
   1. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
   2. Factory fabricated and furnished by device manufacturer.
   3. b. Finish: Paint of color to match the protected device.

T. Circuit Conductors:
   1. Building wire - 14 AWG copper minimum. NAC circuits for speakers shall use conductors 14 AWG minimum, shielded and jacketed, plenum rated; provide 500 feet (60 m) extra; color code and label or each IDC and NAC conductor type.
   2. MC-FPLP Cable-Type THHN/THWN Insulated Copper #14 AWG minimum stranded and/or Type TFN Insulated 16/2 AWG minimum copper. Green insulated or tinned copper grounding conductor. UL Listed as Type MC and Type FPLP. 600 Volt Type MC and 300 Volt Type FPLP. Rated VW-1. Red Lightweight Aluminum Interlocked Armor.

U. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
   1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
   2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
   3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

V. Locks and Keys: Deliver keys to Owner.
   1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
   2. Provide a different standard lock and key for each key operated alarm initiating device; provide 25 keys of each type.

W. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

X. Storage Cabinet for Documentation: Steel with baked enamel finish, size appropriate to quantity of paper. Provide as required by NFPA 70.
   1. Locate and clearly label within room of FACP.
   2. Locate as directed by Edmonds Engineering, Inc.

Y. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
   1. Padlock eye and hasp for lock furnished by Owner.
   2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

B. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

C. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

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

3.02 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems".

B. Devices placed in service before all other trades have completed cleanup shall be replaced.

C. Devices placed in service before all other trades have completed cleanup shall be replaced.

D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
   1. Connect new equipment to existing control panel in existing part of the building.

2. Connect new equipment to existing control panel in existing part of the building
3. Expand, modify, and supplement existing control or monitoring equipment as necessary to extend existing control or monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

E. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor and in accordance to manufacturer installation instructions.

F. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

G. Smoke- or Heat-Detector Spacing
1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
7. When installed in a room, detectors shall be oriented, so their alarm light is visible from the nearest door to the corridor.

H. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

I. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends. All air duct/plenum detectors must have a RAIL located in the nearest corridor or public area and identified by an engraved label affixed to the wall or ceiling. The label shall have the device address, function, and room location. These detectors shall be installed in a manner that provides suitable access for required periodic cleaning and calibration.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

J. Duct detector sampling tubes shall extend the full width of the duct. Those over 36 inches long must be provided with rear support. The preferred method for doing this is to have the tube go through the far side of the duct, with the point of penetration tightly sealed to prevent air leakage around the tube. This facilitates smoke testing and tube cleaning. Duct smoke detector mounting position and air sampling tube orientation, are critical for proper operation. The Manufacturer's detailed installation instructions must be followed. The Contractor shall mark the direction of air flow on the duct at each duct detector location. Each duct detector installation shall have a hinged or latched access panel, 12"x12" minimum, for sampling tube inspection and cleaning. Coordinate with Mechanical Contractor.

K. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

L. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

M. Remote Alarm Indicating Light (RAIL): Visible Alarm-Indicating Devices: Install as indicated on drawings and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
   1. Remote Alarm Indicating Lights (RAIL): Locate in public space near the device they monitor. RAILS shall be labeled with device address, function and room location of device monitored.
   2. RAILs shall be provided with a key switch for testing of the duct detectors.

N. Antenna for Radio Alarm Transmitter: Mount to building structure where indicated. Use mounting arrangement and substrate connection that resists [100-mph (160-km/h)] wind load with a gust factor of 1.3 without damage.

O. Auxiliary Function defeat switches: Provide supervised "Auxiliary Function Defeat" toggle switches in the FACU for AHU, doors, elevators, notification, off premise reporting and others as owner requests. NOTE: Water flow bells are not to defeated. Provide an informative label at switch indicating "Normal" position. The switch must cause a system "trouble" indication when it is placed in the off ("Function Defeated") position. An Auxiliary Function defeat shall cause defeat, or when released allow restoral of the function at any point prior to or during the alarm event.

P. Surge Protection Device (SPD): The system shall be equipped with the following protective devices to prevent damage or nuisance alarms by nearby lightning strikes, stray currents, or voltage transients. The devices are to be provided by the fire alarm equipment supplier:
   1. On AC Input of all panels: A feed-through (not a shunt-type) branch circuit transient arrestor. The SPD shall meet current electrical code for use on fire alarm equipment and have NRTL listings. Install in a listed enclosure near the electrical panelboard and trim excess lead lengths. Wind small coil in the branch circuit conductor, within panelboard, downstream of the suppressor connection. Coil is to be about 1" diameter, 5 to 10 turns, and tie-wrapped.
   2. On DC Circuits Extending Outside Building: Adjacent to the FACU, and also near point of entry to outlying building, provide "pi"-type filter on each leg, consisting of a primary arrestor, series impedance, and a fast-acting secondary arrestor which clamps between 30 and 40 Volts. Use models recommended by the Original Equipment Manufacturer (OEM).

Q. FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION
   1. Installation of the FACU and connection of all circuits shall be performed by persons meeting requirements listed in the Quality Assurance paragraph. All connections at the FACU must be made by the Manufacturer's authorized, factory trained representative (rather than by the electrical contractor).
   2. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

R. The installing contractor will submit programmed point descriptors for owner preliminary approval. The approved descriptors will be programmed into the system before system testing to allow field verification. Final descriptor updates will be based on final testing review.

3.03 FIELD DEVICE LABELING

A. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

B. The location of all End of Line devices shall be labeled on the device, with NAC panel number and NAC circuit number. All notification devices shall be labeled.

C. The label will be permanently mount on each device so that it's readable standing on the floor below.

D. Devices above ceilings will have labels attached to the ceiling at location of access.

E. If the device is an isolator, then ISO will be a part of the label.

F. Pull stations will have the address on the top or front face.

G. Connections or cables in the FATC (FAJB) will be labeled with circuit numbers. Raceways feeding the FATC will be labeled with function / area served. 5th floor north, FATC 4th floor etc. Wires may be numbered with a printed schedule mounted in the FATC.

3.04 PATHWAYS

A. Pathways shall be installed concealed above accessible ceilings. Pathways in non-accessible locations may be routed exposed where noted or routed in Type MC-FPLP cable to assist in installation. Splices shall not be made between devices.

B. Circuit conductor pathways for building wire shall be installed in EMT.

C. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

D. New EMT shall be identified as described in Section 16014. Existing raceway that is reused shall be marked every 10 feet with a red band or label stating fire alarm.

E. Class A SLC riser shall be run in two (2) separate conduits. Each leg of the circuit of the circuit shall be separated by a minimum of two (2) hour fire resistance rated construction, as shown on the drawings, and arranged such that severing one of the conduits will not put any portion of the system out of service. Should a two hour (2) separation be determined impractical by the COR or appointed representative, a physical separation distance of not less than 1 foot on a vertical plane and not less than 4 feet on a horizontal plane shall be achieved.

3.05 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

B. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

C. Cable Splices: Any and all cable splices shall be in hinged terminal cabinets only. No splicing of conductors in outlet or junction boxes. There shall be NO splices in the system other than at terminal blocks. "Wire nuts," crimp splices, or insulation piercing type connectors are not acceptable. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type. Permanent wire markers shall be used to identify all splices and terminations for each circuit. For splices, use markers or other means to indicate which conductors leads to the FACU.

D. Detection or alarm circuits shall not be installed in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power must be properly separated from other circuits and the enclosure must have an appropriate warning label to alert service personnel to the potential hazard.

E. Provide an engraved label on FACP and all notification appliance circuit expansion panels identifying its 120 VAC power source. This label shall include panelboard identification and circuit number and panelboard location. This information shall also be provided inside panels.

F. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device and shown in system drawings.
   1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
   2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
   3. Smoke dampers in air ducts of designated HVAC duct systems.

4. Magnetically held-open doors.
5. Electronically locked doors and access gates.
6. Alarm-initiating connection to activate emergency lighting control.
7. Supervisory connections at valve supervisory switches.
8. Data communication circuits for connection to building management system.
9. Data communication circuits for connection to mass notification system.
10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
11. Supervisory connections at fire-pump engine control panel.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Install framed instructions in a location visible from fire-alarm control unit.

3.07 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.08 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by [Architect] [authorities having jurisdiction]

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections

C. Perform tests and inspections.

D. Perform the following tests and inspections:
1. Visual Inspection: Conduct visual inspection prior to testing.

E. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
1. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
6. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
7. Fire-alarm system will be considered defective if it does not pass tests and inspections.
8. Prepare test and inspection reports.
9. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
10. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.09 DEMONSTRATION

A. Train owner's maintenance personnel to adjust, operate, and maintain fire-alarm system. Multiple training sessions will be provided to meet owner's needs for multiple shift training. Training sessions will include testing for retention of training.

3.10 TESTING

A. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

B. Minimum System Tests: Minimum test shall be a 100% operation test including, but not limited to the following:

C. Verify the absence of unwanted voltages between circuit conductors and ground.

D. Test all conductors for short circuits using an insulation-testing device.

E. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.

F. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.

G. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.

H. Test all initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

I. All circuits shall be tested for supervision. "Class A" Signal Line Circuits shall be tested for "Class A" operation.

J. All sprinkler devices shall be tested for alarm, supervisory and trouble situations.

K. All control circuits (AHU shutdown, door holders, dampers) shall be tested for proper operation on an alarm condition and for wire supervision.

L. Check zone map for proper location of all devices. Verify that devices and wire are properly labeled. Verify that program descriptors match device location. Verify EOL locations with as built drawings.

M. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

N. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.

O. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests. Provide documentation of specific examples of the various tests via FACU event logs or other data capture means.

P. Engineer's Test: After the pretest has been completed and the system is clear of trouble all test documentation including a printout of all custom labels and a NFPA 72 "Record of Completion" form shall be submitted to Engineer for approval. At that time Engineer may, at his discretion, perform a 100% functional test of the fire alarm system. The Contractor and the Manufacturer's authorized representative that installed the system must be present. Should the results of this test not be satisfactory, then corrections will be made, and a re-test will be required at the Contractor's expense.

Q. Authority Having Jurisdiction Inspection/Test: Only after Engineer has approved the system the design professional will schedule the inspection. The Contractor and the Manufacturer's authorized representative must be present for test. Provide a minimum of 10 days' notice in writing to the Engineer for the Authority Having Jurisdiction Inspection/Test.

R. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.

S. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.

T. Closeout: After successful completion of inspections and tests, the warranty period begins. In the event of malfunctions or excessive nuisance alarms, the Contractor must take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections. Continued improper performance during the warranty period shall be cause to require the Contractor to remove and replace the system.

U. All System documentation shall be provided and housed in a Documentation Cabinet at the control panel or other approved location.

3.11 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
   3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.
   2. Refresher Training: 1 session post-occupancy.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.
   2. Refresher Training: One 1-day session post-occupancy.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.12 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
6. Occupancy permit has been granted.
7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.13 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within [two] years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
1. 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.14 MAINTENANCE

A. See Section 017000-=Execution and Closeout Requirement, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by trained employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

D. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.

E. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
4. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
5. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
6. Record keeping required by NFPA 72 and authorities having jurisdiction.

F. Provide trouble call-back service upon notification by Owner:
1. Provide on-site response within 2 hours of notification.
2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

G. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

H. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

I. Comply with Owner's requirements for access to facility and security.

END OF SECTION 16703

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Fiber optic cable and interconnecting devices.

E. Communications equipment room fittings.

F. Communications outlets.

G. Communications grounding and bonding.

H. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 16121 - Grounding and Bonding for Electrical Systems.
   1. Includes intersystem bonding termination.
   2. Includes bonding jumpers for bonding of communications systems and electrical system grounding.

B. Section 16736 - Cable Trays for Electrical Systems.

C. Section 16130 - Boxes for Electrical Systems.

D. Section 16014 - Identification for Electrical Systems: Identification products.

E. Section 16140 - Wiring Devices.

F. Section 16110 - Conduit for Communications Systems.

1.03 REFERENCE STANDARDS

A. BICSI - Information Technology Systems Installation Methods Manual (ITSMM) 8th edition.

B. BICSI - Telecommunications Distribution Methods Manual (TDMM) 14th edition.

C. TIA-492AAAE - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers with Laser-Optimized Bandwidth Characteristics Specified for Wavelength Division Multiplexing 2016.

D. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

E. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

F. FM (AG) - FM Approval Guide; current edition.

G. ICEA S-83-596 - Indoor Optical Fiber Cable; 2016.

H. ICEA S-90-661 - Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communication Wiring Systems; 2021.

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

J. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

K. TIA-492AAAA - Detail Specification for 62.5-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

L. TIA-492AAAB - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009a.

M. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

N. TIA-492AAAA-B - Detail Specification for 62.5-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

O. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009a.

P. TIA-492AAAC-B - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

Q. TIA-492AAAD - Detail Specification for 850-nm Laser- Optimized, 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers Suitable for Manufacturing OM4 Cabled Optical Fiber; 2009.

R. TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers; 1998 (Reaffirmed 2002).

S. TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak; 2000 (Reaffirmed 2005).

T. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).

U. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Modification of IEC 61280-4-1 Edition 2, Fiber-Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant-Multimode Attenuation Measurement; 2015c.

V. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2020.

W. TIA-569 - Telecommunications Pathways and Spaces; 2019e.

X. TIA-570 - Residential Telecommunications Infrastructure Standard; 2012c.

Y. TIA-598 - Optical Fiber Cable Color Coding; 2014d, with Addendum (2018).

Z. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009, with Addendum (2016).

AA. TIA-568-C.3 - Optical Fiber Cabling Components Standard; 2016.

BB. TIA-569-D - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).

CC. TIA-570-C - Residential Telecommunications Infrastructure Standard; 2012c.

DD. TIA-598-D - Optical Fiber Cable Color Coding; 2014d.

EE. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

FF. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d.

GG. TIA-606-B - Administration Standard for Telecommunications Infrastructure; Rev B, 2012 (with Addenda; 2015).

HH. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).

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

JJ. UL 444 - Communications Cables; Current Edition, Including All Revisions.

KK. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

LL. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

MM. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Dewberry Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Arrange for Communications Service Provider to provide service.

C. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

B. Sustainable Design Documentation: Submit manufacturer's product data on cable and cable insulation showing compliance with specified lead content requirements.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Evidence of qualifications for installer.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

F. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

G. Field Test Reports.

H. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on drawings.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents and shop drawings.

1.06 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B. Manufacturer Qualifications: At least 5 years' experience manufacturing products of the type specified.

C. Installer Qualifications: A company having at least 3 years' experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
   2. Supervisors and installers factory certified by manufacturers of products to be installed.
   3. Employing BICSI Registered Technicians (TECH) for supervision of all work.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Keep stored products clean and dry.

1.08 WARRANTY

A. Correct defective work within a 1-year period after date of substantial completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures, cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
   2. Comply with Communications Service Provider requirements.
   3. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third-party independent testing laboratory certified.
   4. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F (0 to 60 degrees C) at relative humidity of 0 to 95 percent, noncondensing.
   5. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:
   1. Building Entrance (Service Provider) Cable: By others or as noted on drawings.
   2. Backbones - Intra-Building: Copper (25, 50 or 100)-pair; Fiber optic, 6, 12, 24, 48, 96 or 144 SM OS2 or MM OM3/OM4 fiber or as noted on drawings.
   3. Backbones - Inter-Building: Copper (25, 50 or 100)-pair; Fiber optic, 6, 12, 24, 48, 96 or 144 SM OS2 or MM OM3/OM4 - fiber or as noted on drawings.
   4. Offices and Work Areas: Provide minimum of one voice outlet and one data outlet in each work area or as noted on drawings.

C. Equipment Room (ER); Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets; backbone cables that extend to Intermediate Distribution Frames (IDFs); Telecommunication Rooms (TR) and Entrance Facility (EF)/Minimum Point of Entry (MPOE); functioning as point of presence to external service provider.
   1. Locate Equipment Room (ER)/Main Distribution Frame as indicated on the drawings.
   2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.

D. Telecommunications Room (TR); Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
   1. Locate Telecommunication Rooms (TR)/Intermediate Distribution Frames as indicated on the drawings.

E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting Telecommunication Rooms (TRs)/ Intermediate Distribution Frames (IDF's) with the Equipment Room (ER)/Main Distribution Frame (MDF), installed in a continuous, home run manner between connecting location

F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to Equipment Room (ER)/Main Distribution Frame (MDF) and to Telecommunication Rooms (TRs)/Intermediate Distribution Frames (IDFs) as indicated on drawings.

2.02 PATHWAYS

A. Conduit: See section 16110.

B. Cable Trays: As indicated on drawings.

C. Hangars and Supports: See Section 16136.

D. Overhead Service Entrance: Weatherhead or service entrance fitting located on outside of building with galvanized rigid steel or intermediate metallic conduit running to entrance facility.

E. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40; Galvanized rigid steel conduit or Intermediate metallic conduit (IMC).

F. Firestop Sleeves: UL listed; provide as required to preserve fire resistance rating of building elements. Sleeves shall be re-enterable unless otherwise noted on drawings.
   1. Products:
      a. 3M: www.3m.com
      b. Hilti: www.hilti.com
      c. Specified Technologies Inc. (STI): www.stifirestop.com.
      d. Unique Fire Stop Product: www.uniquefirestop.com.

2.03 COPPER CABLE AND TERMINATIONS

A. Manufacturers:
   1. Belden: www.belden.com.
   2. Berk-Tek: www.leviton.com/ns/berktek.
   3. Commscope: www.commscope.com.
   4. General Cable Corp.: www.prysmiangroup.com.
   5. Hubbell: www.hubbell-premise.com.
   6. Mohawk: www.belden.com/products/mohawk.
   7. Panduit: www.panduit.com.
   8. Superior Essex: www.superioressexcommunication.com.

B. Provide cables with lead content less than 300 parts per million.

C. Copper Backbone Cable:
   1. Description: Voice grade, 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
   2. Cable Type: TIA-568 Category 5e UTP (unshielded twisted pair); 24 AWG or TIA-568Category 3 UTP (unshielded twisted pair); 24 AWG.
   3. Cable Capacity: Quantity of pairs as indicated on drawings.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
   5. Product(s):
      a. Belden: www.belden.com.
      b. Berk-Tek: www.leviton.com/ns/berktek.
      c. Commscope: www.commscope.com.
      d. General Cable Corp.: www.prysmiangroup.com.
      e. Mohawk: www.belden.com/products/mohawk.
      f. Superior Essex: www.superioressexcommunication.com.

D. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568.2 Category 6A ScTP (screened twisted pair) or F/UTP (foiled unshielded twisted pair); 23 AWG; TIA-568.2 Category 6A UTP (unshielded twisted pair); 23 AWG or TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.

b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.
c. Outdoor and Under Slab Applications: Use non-rated outdoor, gel-filled cable with PE jacketing or a Plenum rated indoor/outdoor cable with PVDE jacketing. Follow standards for transitioning from a non-rated outdoor cable to a rated (CMR, CMP) cable.
d. If not otherwise indicated on drawings, use listed NFPA 70, type CMP Plenum cable.

5. Cable Jacket Color - Data Cable: Blue, unless otherwise noted.
6. Cable Jacket Color - Voice Cable: White, unless otherwise noted.
7. Product(s):
   a. Basis of Design: Commscope; Uniprise Twisted Pair Cables: CS34 Series Category 6 U/UTP Cable; CS44 Series Category 6A U/UTP Cable: www.commscope.com.
   b. Belden: www.belden.com
   c. Berk-Tek: www.leviton.com/ns/berktek.
   d. General Cable Corp.: www.prysmiangroup.com
   e. Hubbell: www.hubbell-premise.com.
   f. Leviton: www.leviton.com
   g. Mohawk: www.belden.com/products/mohawk.
   h. Panduit: www.panduit.com.
   i. Superior Essex: www.superioressexcommunication.com.

E. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool.

F. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
3. Product(s):
   a. Basis of Design: Commscope; Uniprise RJ45 Jacks; UNJ600 Series Category 6 U/UTP Modular Jacks; Ultra 10 UNJ10G Series Category 6A U/UTP Modular Jacks: www.commscope.com
   b. Belden: www.belden.com
   c. Hubbell: www.hubbell-premise.com
   d. Leviton: www.leviton.com.
   e. Ortronics: www.legrand.com
   f. Panduit: www.panduit.com
4. Colors: Match cable jacket colors unless otherwise noted.

G. Copper Patch Cords:
1. Description: Factory-fabricated and tested 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panel Cross-Connections:
   a. Quantity: One for each pair of patch panel ports or 50 percent of the total terminated cable count
   b. Length: 1 foot (304.8mm) up to a maximum of 5-feet (1524mm).
3. Product(s):
   a. Basis of Design: Commscope; Uniprise Category 6 U/UTP Patch Cords; Uniprise Category 6A U/UTP Patch Cords; UC series, RJ-45 to RJ-45, 4-pair, non-Plenum. www.commscope.com/#sle.
   b. Belden: www.belden.com.
   c. Hubbell: www.hubbell-premise.com.
   d. Leviton: www.leviton
   e. Ortronics: www.legrand.com.

f. Panduit: www.panduit.com.

2.04 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Manufacturers:
1. Belden: www.belden.com.
2. Berk-Tek: www.leviton.com/ns/berktek.
3. Commscope: www.commscope.com
4. Corning: www.corning.com
5. General Cable Corp.: www.prysmiangroup.com.
6. Hubbell: www.hubbell-premise.com.
7. Mohawk: www.belden.com/products/mohawk
8. Panduit: www.panduit.com.
9. Superior Essex: www.superioressexcommunications.com.

B. Provide cables with lead content less than 300 parts per million.

C. Fiber Optic Hybrid Composite (Powered) Cable
1. Description: Composite cable that supports low voltage (Class 2, 57 VDC/100V) and bulk power transmission containing fiber and 20-12 AWG copper power conductors. Available as tight-buffer and loose-tube, indoor Plenum, indoor/outdoor non-Plenum (riser), indoor Plenum armored and indoor armored non-Plenum (riser) with gel-fee (dry water blocking technology).
a. Complies with NEC Article 800, UL 13, UL 444, UL 1424, UL 1666, NFPA 262, ICEA S-83-596, Telcocrdia GR-409-CORE (issue 2) and RoHS/RoHS-2.
2. Fiber Grade: Single mode, OS2.
3. Cable construction: armored and non-armored.
4. Cable application:
a. Plenum applications: Use CL3P Plenum rated.
b. Non-Plenum applications: Use CL3R non-Plenum rated.
5. Products:
a. Basis of Design: Corning ActiFi composite cable.
b. Belden: www.belden.com.
c. Commscope: www.commscope.com.
d. Panduit: www.panduit.com.
e. Superior-Essex: www.superioressexcommunications.com.

D. Fiber Optic Backbone Cable: Intra-Building
1. Description: Tight buffered, Intra-Building conductive fiber optic cable with an overall aluminum armoring complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
2. Cable Type: Multimode, laser-optimized 50/125 um (OM4) complying with TIA-492AAAD; Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC; Single-mode, 8.3/125 um (OS2) complying with TIA-492CAAB.
3. Cable Capacity: Minimum 12 fiber strands or as otherwise indicated on drawings.
4. Cable Applications:
a. Plenum Applications: Use listed NFPA 70 Type OFCP plenum cable.
b. Riser Applications: Use listed NFPA 70 Type OFCR riser cable or Type OFCP plenum cable.
5. Cable Jacket Color:
a. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua.
b. Single-Mode Fiber (OS1/OS2): Yellow.
6. Product(s):
a. Basis of Design: Commscope; TeraSpeed Zero Water Peak Single-Mode Fiber; LazrSpeed 300 OM3 and LazrSpeed 550 OM4. www.commscope.com/#sle.
b. Belden: www.belden.com.
c. Berk-Tek: www.leviton.com/ns/berktek.

d. Corning: www.corning.com.
e. General Cable Corporation: www.prysmiangroup.com.
f. Hubbell: www.hubbell-premise.com.
g. Mohawk: www.belden.com/products/mohawk.
h. Panduit: www.panduit.com.
i. Superior Essex: www.superioressexcommunications.com.

E. Fiber Optic Backbone Cable: Inter-Building OSP
1. Description: Available as loose-tube and tight-buffer, conductive and non-conductive, indoor/outdoor Plenum, indoor/outdoor non-Plenum, indoor/outdoor LSZH (low smoke, zero halogen), outdoor messenger self-supporting (figure 8) and direct-burial rated fiber optic cable, gel-filled or gel-free (dry water blocking technology), complying with TIA-568.3, TIA-598, ICEA S-87-640, ICEA S-104-696, ICEA S-110-717 and ICEA S-120-742, listed as complying with UL 444 and UL 1651.
2. Fiber Grade: Multimode, laser-optimized 50/125 um (OM4) complying with TIA-492AAAD; Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC; Single-mode, 8.3/125 um (OS2) complying with TIA-492CAAB.
3. Cable Construction: All dielectric, Armored and All dielectric, self-supporting (ADSS) constructions.
4. Cable Capacity: 6 and 12 strand central (single) tube; 24, 48, 96 and 144 strand distribution (sub-unit) tube constructions.
5. Cable Applications:
a. Plenum applications: Use listed NFPA 70 type OFNP AND OFCP
b. Riser applications: Use listed NFPA 70 type OFNR and OFCR
6. Products:
a. Basis of Design: Commscope L-LN, N-DS, N-DZ, P-DS, P-DZ, P-MZ, R-DS and R-DZ series.
b. Belden: www.belden.com.
c. Berk-Tek: www.leviton.com/ns/berktek.
d. Corning: www.corning.com.
e. General Cable Corporation: www.prysmiangroup.com.
f. Hubbell: www.hubbell-premise.com.
g. Mohawk: www.belden.com/products/mohawk.
h. Panduit: www.panduit.com.
i. Superior Essex: www.superioressexcommunications.com.

F. Fiber Optic Horizontal Cable:
1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
2. Cable Type: Multimode, laser-optimized 50/125 um (OM4) complying with TIA-492AAAD; Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC or Single-mode, 8.3/125 um (OS2) complying with TIA-492CAAB.
3. Cable Capacity: Minimum 2 fiber strands per workstation or as otherwise indicated on drawings. Available as Zipcord Duplex and Round Constructions.
4. Cable Applications: Use listed NFPA 70 Type OFNP plenum cable unless otherwise indicated.
5. Cable Applications:
a. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
b. Riser Applications: Use listed NFPA 70 Type OFNR riser cable or Type OFNP plenum cable.
6. Cable Jacket Color:
a. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua.
b. Single-Mode Fiber (OS2): Yellow.
7. Product(s):

a. Basis of Design: Commscope; TeraFlex Bend-resistant Single-Mode Fiber and TeraFlex Bend-resistant, Laser-optimized 50/125 um Multimode: www.commscope.com/#sle.
b. Belden. www.belden.com
c. Berk-Tek: www.leviton.com/berktek
d. Hubbell: www.hubbell-premise.com
e. Mohawk: www.belden.com/products/mohawk
f. Panduit: www.panduit.com
g. Superior-Essex: www.superioressexcommunications.com

G. Fiber Optic Interconnecting Devices:
1. Connector Type: Type LC, SC or ST.
2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
3. Maximum Attenuation/Insertion Loss: 0.3 dB.
4. Product(s):
a. Commscope Fiber Optic Connectors; QWIK-FUSE LC and SC connectors, QWIK-II LC, SC and ST connectors: www.commscope.com/#sle.
b. Corning: www.corning.com.
c. Hubbell: www.hubbell-premise.com.
d. Panduit: www.panduit.com.

H. Fiber Optic Patch Cords:
1. Description: Factory-fabricated and pre-tested 2-fiber (duplex) cable assemblies with LC, SC or ST connectors at each end.
2. Patch Cords for Patch Panels:
a. Quantity: One for each pair of terminated fiber strands.
b. Length: 1M, 2M or 3M.
c. Match the fiber patch cord performance to installed fiber backbone performance.
d. Colors: Yellow for OS2 single mode and Aqua for OM3/4 multi-mode.

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
1. Manufacturers:
a. Commscope: www.commscope.com/#sle.
b. Belden: www.belden.com.
c. Hubbell: www.hubbell-premise.com.
d. Leviton: www.leviton.com.
e. Ortronics: www.legrand.com.
f. Panduit: www.panduit.com.
2. Connector Blocks for Category 3 Cabling: Type 66 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
3. Connector Blocks for Category 5e: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
4. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6mm) wide equipment racks; 0.09 inch (2.2mm) thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface and modular patch panels designed to accept Cat6 and Cat6A, RJ-45 modular jack inserts.
a. Jacks: Cat6 and Cat6A, Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
d. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
e. Provide incoming cable strain relief and routing guides on back of panel.

5. Product(s):
    a. Basis of Design: Commscope Uniprise CPP-DM and DDM-SL series patch panels.
    b. Belden: www.belden.com.
    c. Hubbell: www.hubbell-premise.com.
    d. Leviton: www.leviton.com.
    e. Ortronics: www.legrand.com.
    f. Panduit: www.panduit.com.

B. Fiber Optic Cross-Connection Equipment:
    1. Manufacturers:
        a. Belden: www.belden.com
        b. Commscope: www.commscope.com/#sle.
        c. Corning: www.corning.com.
        d. Hubbell: www.hubbell-premise.com.
        e. Ortronics: www.legrand.com.
        f. Panduit: www.panduit.com.
    2. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch (482.6 mm) wide equipment racks; 0.09 inch (2.2 mm) thick aluminum. Available in 1U, 2U, 3U and 4U capacities.
        a. Adapters: Maximum of 12 duplex couplers per modular fiber adapter panel insert.
        b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
        c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606-B.
        d. Provide incoming cable strain relief and routing guides on back of panel.
        e. Provide rear cable management tray at least 8 inches (203 mm) deep with removable cover.
        f. Provide dust covers for unused adapter openings.
    3. Product(s):
        a. Basis of Design: Commscope EPX series fiber optic panels.
        b. Belden: www.belden.com.
        c. Corning: www.corning.com
        d. Hubbell: www.hubbell-premise.com.
        e. Leviton: www.leviton.com.
        f. Ortronics: www.legrand.com.
        g. Panduit: www.panduit.com.

C. Backboards: Interior grade plywood without voids, 3/4 inch (19 mm) thick; UL-labeled fire-retardant.
    1. Size: As indicated on drawings.
    2. Do not paint over UL label.

D. Equipment Frames, Racks and Cabinets:
    1. Manufacturers:
        a. Basis of Design: Chatsworth: www.chatsworth.com.
        b. APC: www.apc.com.
        c. Commscope: www.commscope.com.
        d. Hoffman: www.hoffmanonline.com.
        e. Hubbell: www.hubbell-premise.com.
        f. Ortronics: www.legrand.com.
        g. Middle Atlantic: www.legrand.com.
        h. Panduit: www.panduit.com.
    2. Component Racks: EIA/ECA-310 standard 19 inch (482.6 mm) wide.
    3. Wall Mounted Aluminum Racks: Steel construction, hinged to allow access to back of installed components. Minimum 18-inch depth.

a. Load Rating: 250 pounds.

4. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; 2 post or 4 post or as shown on drawings. Minimum 42U (7-ft high) or as shown on drawings.
   a. Load Rating: 1000 pounds (453.6 kg).
5. Freestanding Cabinets: Front and rear doors with locks; removable side panels with locks; vented top and rear door; adjustable leveling feet; cable access in roof and base; grounding bar.
   a. Load Rating: 1500 pounds (680 kg).
   b. Roof mounted fan, capacity 400 cfm.
6. Wall Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.
   a. Load Rating: 300 pounds (136 kg).
   b. Roof mounted fan, capacity 250 cfm.
7. Cabinets: Steel construction with corrosion resistant finish.
8. Locks: Keyed alike.
9. Product(s):
   a. Basis of Design: Chatsworth: www.chatsworth.com.
   b. APC: www.apc.com.
   c. Commscope: www.commscope.com.
   d. Great Lakes: www.greatcabinets.com
   e. Hoffman: www.hoffmanonline.com.
   f. Middle Atlantic/Ortronics: www.legrand.com.
   g. Panduit: www.panduit.com.

E. Cable Management:
   1. Manufacturers:
      a. Basis of Design: Chatsworth. www.chatsworth.com.
      b. APC: www.apc.com.
      c. Commscope: www.commscope.com.
      d. Great Lakes: www.greatcabinets.com
      e. Hoffman: www.hoffmanonline.com.
      f. Middle Atlantic/Ortronics: www.legrand.com.
      g. Panduit: www.panduit.com.
   2. Horizontal Management Panels: 2U with front and rear cable management and covers. Provide horizontal managers to match quantity of copper/fiber patch panels or as shown on drawings.
   3. Vertical Management Channels: Minimum 42U high, 6-inch wide, dual channel with front and rear hinged covers. Provide as shown on drawings.
   4. Product(s):
      a. Basis of Design: Chatsworth Products, Inc.: www.chatsworth.com.
      b. APC: www.apc.com.
      c. Commscope: www.commscope.com.
      d. Hoffman: www.hoffmanonline.com.
      e. Middle Atlantic/Ortronics: www.legrand.com.
      f. Panduit: www.panduit.com.

2.06 COMMUNICATIONS OUTLETS

A. Manufacturers:
   1. Commscope: www.commscope.com/#sle.
   2. Belden: www.belden.com.
   3. Hubbell: www.hubbell-premise.com
   4. Leviton: www.leviton.com
   5. Ortronics: www.legrand.com.

6. Panduit: www.panduit.com

B. Outlet Boxes:
   1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
   2. Minimum Size, Unless Otherwise Indicated:
      a. Voice Only Outlets: 4-inch by 2-inch by 3-1/4 inch deep (100 by 50 by 54 mm) trade size or 4-11/16-inch square.
      b. Data or Combination Voice/Data Outlets: 4-inch square by 3-1/4 inch deep (100 by 54 mm) trade size or 4-11/16-inch square.

C. Wall Plates:
   1. Comply with system design standards and UL 514C.
   2. Accepts modular jacks/inserts.
   3. Capacity:
      a. Wall Phone Outlet: 1-port.
      b. Data or Combination Voice/Data Outlets: 4 ports or as otherwise noted on drawings.
   4. Wall Plate Material/Finish - Flush-Mounted Outlets: High impact thermoplastic, color to match electrical devices or Type 302 stainless.
   5. Product(s):
      a. Basis of Design: Commscope Faceplates; M Series; www.commscope.com/#sle.
      b. Belden: www.belden.com.
      c. Hubbell: www.hubbell-premise.com.
      d. Leviton: www.leviton.com.
      e. Ortronics: www.legrand.com.
      f. Panduit: www.panduit.com.

2.07 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

B. Comply with Division 16 and NFPA 70.

2.08 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with TIA-606-B.

2.09 SOURCE QUALITY CONTROL

A. Factory test cables according to TIA-568 (SET).

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install UL listed firestopping products and systems to preserve fire resistance rating of partitions and other elements.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches (1220 mm) from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches (300 mm) from power conduits and cables and panelboards.
   3. 5 inches (125 mm) from fluorescent and high frequency lighting fixtures.
   4. 6 inches (150 mm) from flues, hot water pipes, and steam pipes.

B. Minimum Cover - Underground Service Entrance: Comply with NFPA 70 and Communications Service Provider requirements.

C. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Division 16 or as required for installation of telecommunications outlets provided under this section.
      a. Mounting Heights: Unless otherwise indicated as follows as indicated on the drawings.
         1) Telephone and Data Outlets: 18 inches (450 mm) above finished floor.
         2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 54 inches (1.4 m) above finished floor to top of telephone.
         3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches (1.2 m) above finished floor to top of telephone.
      b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated on drawings.
      c. Provide minimum of 24 inches (600 mm) horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
      d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
      e. Locate outlet boxes so that wall plate does not span different building finishes.
      f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches (3000 mm) unless otherwise indicated on drawings.
   2. At Outlets - Copper: 12 inches (305 mm).
   3. At Outlets - Optical Fiber: 39 inches (1000 mm).
   4. At Junction Boxes - Backbone Copper: 39 inches (1000m).
   5. At Junction Boxes - Backbone Optical Fiber: 120 inches (3000 mm).

C. Copper Cabling:
   1. Category 5e and Above: Maintain cable geometry up to the point of termination. However, do not untwist more than 1/2 inch (12 mm) from point of termination.
   2. For 4-pair cables, do not exceed 25 pounds (110 N) pull tension.
   3. Use T568B wiring configuration.

D. Fiber Optic Cabling:
   1. Prepare for pulling by cutting outer jacket for 10 inches (250 mm) from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
   2. Support vertical cable at intervals as recommended by manufacturer.

E. Wall-Mounted Racks and Enclosures:
   1. Install to plywood backboards only, unless otherwise indicated.
   2. Mount so height of topmost panel does not exceed 78 inches (1980 mm) above floor.

F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

G. Floor-Mounted Enclosures: Connect adjacent cabinets together and remove interior side panels unless otherwise indicated on drawings.

H. Identification:
   1. Use machine-generated, self-laminating, adhesive cable wrap labels to identify cables at each end.
   2. Use manufacturer-furnished label inserts or identification labels to identify each jack at communications outlets with unique identifier.
   3. Use identification nameplate or machine-generated, adhesive, tape style labels to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

A. Comply with inspection and testing requirements of specified installation standards.

B. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.
   4. Inspect patch cords for complete labels.

C. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 3 Backbone: Perform attenuation test.
   5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational ring-back, and dial tone.
   6. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   7. Category 5e and Above Links: Perform permanent link tests for wire map, length, attenuation, NEXT, and propagation delay.
   8. Provide one test certification report per Cat5e/6/6A cable. Provide in PDF format utilizing the tester's native software format.

D. Testing - Fiber Optic Cabling:
   1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests where fusion or mechanical splicing has been performed on the fiber.
   2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
   3. Single Mode Backbone: Perform tests in accordance with TIA-526-7.
   4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.
   5. Provide one test certification report per terminated fiber strand. Provide report in PDF format utilizing the tester's native software format.

END OF SECTION 16710

SECTION 16711 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backboards.
2. Boxes and Enclosures.

B. Related Requirements:

1. 16736 - Cable Trays For Telecommunications.
2. Section 16710 -Structured Cabling for Voice and Data.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. RCDD: Registered Communications Distribution Designer.

D. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

E. TTB: Telephone Termination Board (aka, Backboard)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of Contractor's RCDD.
2. Installation Supervision: Installation shall be under direct supervision of a BICSI Technician or Installer 2, who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as an RCDD to perform the on-site inspection.

1.7 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, Telcordia GR-63-CORE requirements for Zone 4 Seismic Earthquake Environments.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.8 BACKBOARDS

A. Backboards:
1. Fire-retardant/treated Plywood.
2. Factory stamped/marked with an indelible ink indicating fire rating.

3. Nominal dimensions: ¾ inch by 48-inches by-96 inches (19 by 1220 by 2440 mm).
4. Type/grade AC, installed with smooth side to interior of ER/MDF and TRs/IDFs.

1.9 BOXES AND ENCLOSURES

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed and labeled for intended location and use.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, ferrous alloy or aluminum, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4-11/16 inches square by 2-1/8 inches deep (119 mm square by 60 mm deep) 4-11/16 inches by 2-1/8 inches by 2-1/8 inches deep (119 mm by 60 mm by 60 mm deep).

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, Type 3R or Type 4. 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 PVC or Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

1.10 POWER STRIPS AND UPS BATTERY BACKUPS

A. Power strips and UPS battery back-up appliances will be Owner-Furnished, Owner-Installed (OFOI).

PART 2 - EXECUTION

2.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Comply with requirements in Section 16110 - Raceways for materials and installation requirements for underground/buried and aerial pathways.

2.2 INSTALLATION

A. Comply with NECA 1, "Standard for Good Workmanship".

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of all communications equipment in racks, cabinets and enclosures with the Owner and/or the Owner's IT services provider. This shall include:
   1. Contractor-furnished, Contractor-installed equipment.
   2. Owner-furnished, Owner-installed (OFOI) equipment.
   3. Owner-furnished, Contractor-installed (OFCI) equipment.

F. Coordinate service entrance configuration with the respective service provider.

   1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
   2. Record agreements reached in meetings and distribute them to other participants.
   3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
   4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

H. Backboards:

   1. Install from 6-inches (150 mm) to 8-feet, 6-inches (2588 mm) above finished floor. If plywood is fire rated, ensure that a minimum of one fire-rating stamp is visible after installation.
   2. Paint all sides of backboard with two coats of a latex-based white or very light-colored paint.
   3. Install plywood with smooth side to interior of ER/TR space.
   4. Secure plywood backboards to the substrate using manufacturer's approved hardware in a quantity to ensure installed backboard can fully support a minimum load of 50 pounds per square foot.
   5. Unless otherwise noted, install plywood backboards with longest dimension vertical.
   6. Mask-off or otherwise leave an unpainted section of the backboard showing fire-retardancy stamp/marking. This unpainted stamp/marking shall be left in a conspicuous location on the lower half of each sheet of installed plywood.
   7. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

2.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

2.4 FIRESTOPPING

A. Comply with TIA-569-D, Annex A, "Firestopping."

B. Comply with BICSI's "Information Technology Systems Installation Methods Manual," "Firestopping Practices" Chapter 7.

END OF SECTION

SECTION 16716 - COMMUNICATIONS RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. 19-inch equipment racks, two and four post.
2. 19-inch freestanding and wall-mounted equipment cabinets (enclosures)
3. Grounding.
4. Labeling.

B. Related Requirements:

1. Section 16716 "Communications Equipment Room Fittings" for backboards and accessories.
2. Section 16726 "Grounding and Bonding for Telecommunications Equipment" for TMGBs and PBBs.
3. Section 16736 "Cable Trays for Communications Systems" for cable trays and cable tray accessories.
4. Section 16710 "Structured Cabling for Voice and Data" for copper data cabling associated with system panels and devices.

1.3 DEFINITIONS

A. Access Provider: An operator that provides a circuit path or facility between the service provider and user. An access provider can also be a service provider.

B. BICSI: Building Industry Consulting Service International.

C. LAN: Local area network.

D. RCDD: Registered communications distribution designer.

E. Service Provider: The operator of a telecommunications transmission service delivered through access provider facilities.

F. PBB: Primary Bonding Busbar (formerly TMGB: Telecommunications main grounding bus bar)

G. SBB: Secondary Bonding Busbar (formerly TGB: Telecommunications grounding bus bar)

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, certifications, standards compliance, and furnished specialties and accessories.

B. Shop Drawings: For communications racks, frames, and enclosures. 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. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of PBB and its mounting detail showing standoff insulators and wall-mounting brackets.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, installation supervisor, and field inspector.

B. Seismic Qualification Data: Certificates, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under direct supervision of Contractor's RCDD.
2. Installation Supervision: Installation shall be under direct supervision of Contractor's BICSI Certified Technician or Installer 2 who shall be present at all times when Work of this Section is performed at Project site.
3. Field Inspector: Currently registered by BICSI as an RCDD to perform on-site inspection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and Telcordia GR-63-CORE requirements for Zone 4 Seismic Earthquake Environments.

1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. UL listed.

C. RoHS compliant.

2.2 19-INCH EQUIPMENT RACKS

A. Description: Two and four post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72-inches (450-mm) between rails.

B. General Requirements:

1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded steel and extruded aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

C. Floor-Mounted Racks:

1. Overall height: 84-inches (2133.6 mm).
2. Overall depth: 23-inches (584.2 mm) for two-post rack. Four-post rack shall have adjustable depth up to a maximum of 42-inches (1067 mm).
3. Upright rail "C-Channel" depth: 6-inches (152.4 mm)
4. Two-Post Load Rating: 400 lb (181 kg)
5. Four-Post Load Rating: 2000 lb (907 kg)
6. Number of Rack Units per Rack: 45 or as otherwise indicated on drawings.
   a. Numbering: Every rack unit, on interior of rack, from bottom to top.
7. Threads: 10-32 or 12-24 tapped at EIA/TIA spacing or universal square to accept captive (cage) nut hardware.

8. Provide floor-mounted racks from one of the following manufacturers:
    a. Belden
    b. B-Line
    c. Commscope
    d. Chatsworth
    e. Great Lakes
    f. Hoffman
    g. Middle Atlantic/Legrand
    h. Panduit
    i. Tripp Lite
9. Base shall have a minimum of four mounting holes for permanent attachment to floor.
10. Top shall have provisions for attaching to cable ladder tray.

D. Wall-Mounted Racks:

1. Height: As indicated on drawings.
2. Minimum Depth: 23 inches (584.2 mm)
3. Load Rating: 200 lb (91 kg).
4. Number of Rack Units per Rack: As indicated on drawings.
5. Threads: 10-32 or 12-24 tapped at EIA/TIA spacing or Universal Square designed to accept captive (cage) nut hardware.
6. Wall Attachment: Minimum of eight attachment points spaced at 16-inches and 24-inches
7. Equipment Access: Integral swing to provide access to rear of rack and mounted equipment.
8. Provide wall-mounted racks from one of the following manufacturers:
    a. Belden
    b. B-Line
    c. Commscope
    d. Chatsworth
    e. Great Lakes
    f. Hoffman
    g. Middle Atlantic/Legrand
    h. Panduit
    i. Tripp Lite

2.3 19-INCH EQUIPMENT CABINETS

A. Description: Manufacturer-assembled four-post frame enclosed by side and top panels, front and rear doors, designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72 inches (450 mm) between rails.

B. General Cabinet Requirements:

1. Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Material: Extruded steel, extruded aluminum, sheet steel and sheet aluminum.
3. Finish: Manufacturer's standard, baked-polyester powder coat.
4. Color: Black.

C. Modular Freestanding Cabinets:

1. Overall height: 84 inches (2133.6 mm) or as indicated on drawings.
2. Overall minimum Depth: 36 inches (914.4mm)

3. Load Rating: 3000 lb (1362 kg)
4. Number of Rack Units: 42, 45 or as indicated on drawings.
   a. Numbering: Every rack unit, on interior of rack, from bottom to top.
5. Threads: 10-32, 12-24 or Universal square to accept captive (cage) nut hardware.
6. Removable and lockable side panels.
7. Vented/perforated modular roof panel equipped with cable access knockouts and fan mount openings.
8. Hinged, lockable and vented/perforated front doors.
9. Hinged, lockable and split (aka barn door) vented/perforated rear doors.
10. Adjustable feet for leveling.
11. Cable access provisions in roof and base.
12. SBB that is rack mounted.
13. Roof-mounted, 550-cfm (260-L/s) fan with filter.
14. All cabinets keyed alike.
15. Provide modular, freestanding cabinets from one of the following manufacturers:
    a. APC
    b. Belden
    c. B-Line
    d. Commscope
    e. Chatsworth
    f. Great Lakes
    g. Hoffman
    h. Middle Atlantic/Legrand
    i. Panduit
    j. Tripp Lite

D. Modular Wall Cabinets:

1. Height: As indicated on Drawings.
2. Minimum Depth: 23 inches (584.2 mm)
3. Load Rating: 200 lb (91 kg)
4. Number of Rack Units: As indicated on Drawings.
5. Adjustable "C-channel" rails at front of enclosure.
6. Threads: 10-32 or 12-24 and universal square to accept captive (cage) nut hardware.
7. Wall Attachment: Minimum of eight attachment points spaced at 16-inches and 24-inches
8. Dual-swing style enclosure with separate, hinged access to cabinet body and front door.
9. Vented/perforated roof section equipped with cable access knockouts and fan mount openings.
10. Hinged, lockable and vented/perforated front door.
11. Louvered side panels.
12. Cable access provisions top and bottom.
13. Grounding lug.
14. Roof-mounted, 250-cfm (118-L/s) fan.
15. All cabinets keyed alike.
16. Color: Black.
17. Provide modular, wall-mounted cabinets from one of the following manufacturers:
    a. APC
    b. Belden
    c. B-Line
    d. Commscope
    e. Chatsworth
    f. Great Lakes
    g. Hoffman
    h. Middle Atlantic/Legrand

i. Panduit
j. Tripp Lite

2.4 CABLE/WIRE MANAGEMENT

A. Description: Horizontal and vertical wire management hardware designed for proper and aesthetic routing, managing and maintaining of patch and equipment cross connect cords. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72 inches (450 mm) between rails.

B. Horizontal managers
1. 2U high x 19 inch with integrated front and rear cable management rings/fingers.
2. Metal construction with integrated, hinged and removable front and rear covers
3. Color: Black
4. Provide quantities as shown on drawings.

C. Vertical managers
1. 6 inch wide by 10-inch-deep x 7 feet.
2. Integrated divider with pass through opening to separate front/rear section.
3. Metal construction with integrated, hinged and removable front and rear doors sections.
4. Color: Black
5. Provide quantities as shown on drawings. Otherwise, a single rack shall be equipped with two vertical managers, two racks shall be equipped with three vertical managers, etc.

D. Provide wire management from one of the following manufacturers:
a. Belden
b. B-Line
c. Commscope
d. Chatsworth
e. Great Lakes
f. Hoffman
g. Hubbell Premise Wiring
h. Leviton
i. Middle Atlantic/Legrand
j. Ortronics/Legrand
k. Panduit
l. Tripp Lite

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1 "Standard for Good Workmanship".

B. Comply with BICSI TDMM for layout of communications equipment spaces.

C. Comply with BICSI ITSIMM for installation of communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in racks.

F. Reference drawing sheets for the layout of the ER and TRs, including rack and cabinet mounting locations.

1. Meet jointly with system providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment spaces to accommodate and optimize configuration and space requirements of telecommunications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

G. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.2 GROUNDING

A. Comply with NECA/BICSI 607.

B. Comply with Section 16726 "Grounding and Bonding (Earthing) for Communications Systems."

C. Install grounding according to BICSI ITSIMM, "Bonding, Grounding (Earthing) and Electrical Protection"

3.3 IDENTIFICATION

A. Coordinate system components, wiring, and cabling complying with TIA-606-B. Comply with requirements in Section 16753 "Identification for Communication Systems."

B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 2, Class 3, and Class 4 level of administration, including optional identification requirements of this standard.

END OF SECTION

SECTION 16726 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Selection and installation of communications busbars.
2. Selection and installation of communications bonding conductors.
3. Selection of signal reference grids.
4. Installation of grounding and bonding for towers and antennas.

B. Related Requirements:

1. Section 16750 "Common Work Results for Communications" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 16121 - Grounding

1.2 DEFINITIONS

A. BBC: Backbone bonding conductor, for connecting multiple TBBs serving the same floor.

B. PBB: Primary bonding busbar, located in the MDF/ER (main distribution frame/equipment room) and ideally near electrical service entrance.

C. RBB: Rack bonding busbar, located in equipment cabinets and racks.

D. SBB: Secondary bonding busbar, located in IDF/TR (intermediate distribution frame/telecommunication) rooms.

E. TBB: Telecommunications bonding backbone, for connecting SBBs to PBB.

F. TBC: Telecommunications bonding conductor, for connecting PBB to intersystem bonding termination device or busbar at electrical service entrance.

G. TEBC: Telecommunications equipment bonding conductor, for connecting RBBs to SBBs or PBB.

H. UBC: Unit bonding conductor, for connecting individual communications equipment to RBBs or SBBs.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. For communications equipment room signal reference grid.
2. Include plans, elevations, sections, details, and attachments to other work.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:

1. Installing wire connector on conductor.
2. Recommended torque values.

1.5 CLOSEOUT SUBMITTALS

A. Record Documentation: Project record documents in accordance with Section 017839 "Project Record Documents" must include locations of PBB and SBBs, and routing of TBC, TBBs, and BBCs.

PART 2 - PRODUCTS

2.1 See 16121 - Grounding

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of TBC connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of TBC only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF COMMUNICATIONS BUSBARS

A. PBB:

1. Dimensions: ¼ inch thick by 4-inch-high x 12 inch long (6.3 mm thick by 100 mm high by 300 mm).
2. Stand-Off Distance: minimum 2 inch (50 mm).
3. Hole patterns to accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

B. SBB:

1. Dimensions: ¼ inch thick by 2-inch-high x 12 inch long (6.3 mm thick by 50 mm high by 300 mm).
2. Stand-Off Distance: minimum 2 inch (50 mm).
3. Hole patterns to accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

3.3 SELECTION OF COMMUNICATIONS BONDING CONDUCTORS

A. Communications Busbar Connections:

1. TBC: Not smaller than 1/0 AWG for lengths up to 52 ft (16 m) and 3/0 AWG for lengths greater than 52 ft (16 m) and no smaller than largest TBB.
2. TBB: Not smaller than 2 kcmil per linear ft of conductor length, but not larger than 750 kcmil, unless otherwise indicated on Drawings.
3. BBC: Not smaller than largest TBB to which it is connected unless otherwise indicated on Drawings.
4. TEBC: Not smaller than 2 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
5. UBC: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted connectors.
6. Bonding Conductors to Structural Steel: Not smaller than 6 AWG unless otherwise indicated on Drawings. Provide bolted clamp connectors.

B. Cable Tray Connections:

1. Cable Tray Equipment Grounding Conductor: 6 AWG.
2. Cable Tray Bonding Jumper: If not supplied by cable manufacturer, provide bonding jumper no smaller than 6 AWG and not longer than 12 inch (300 mm). If jumper is wire, it must be terminated with lug having two holes and long barrel for two crimps. If jumper is flexible braid, it must be terminated with one- or two-hole ferrule. Attach with bonding screw or connector provided by cable tray manufacturer.

C. Underground Connections: Not smaller than 2 AWG. Provide welded connectors, except bolted connectors may be used in handholes or manholes or as otherwise indicated on Drawings.

3.4 INSTALLATION OF BONDING FOR COMMUNICATIONS

A. Comply with manufacturer's published instructions.

B. Reference Standards:

1. Bonding of Communications: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with BICSI N3.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Busbars:

a. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 12 inch (300 mm) above finished floor unless otherwise indicated.

b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

2. Conductors:

   a. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
   b. Assemble wire connector to conductor, complying with manufacturer's published instructions and as follows:

      1) Use crimping tool and die that is specific to connector.
      2) Pre-twist conductor.
      3) Apply antioxidant compound to bolted and compression connections.

   c. Install in straightest and shortest route between origination and termination point, and no longer than required. Bend radius must not be smaller than 10 times diameter of conductor. No single bend may exceed 90 degrees.
   d. Install conductors continuous and without splices.
   e. Support conductors at not more than 36-inch (900 mm) intervals.
   f. Outside telecommunications rooms, install conductors in metric designator 21 (trade size 3/4) PVC-80 conduit until conduit enters telecommunications room. Install bonding conductors in EMT-A or EMT-SS when routed through plenum. Do not install bonding conductors in EMT-S unless otherwise indicated on Drawings.

      1) If bonding conductor must be installed in EMT-S or other ferrous metallic raceway, bond conductor to raceway using grounding bushing that complies with Section 270528 "Pathways for Communications Systems," and bond both ends of raceway to SBB.

3. Provide TBC and terminate ends to PBB and intersystem bonding termination device or busbar at electrical service entrance in accordance with Section 250.94, "Bonding for Communication Systems," of NFPA 70.
4. Busbar Interconnections: Bond SBBs to PBB with TBBs. If more than one TBB is installed, bond TBBs together BBCs where required by TIA-607.
5. Structural Steel: Where structural steel of steel frame building is readily accessible within room or space, bond each SBB and PBB to vertical steel of building frame.
6. Communications Enclosures: Bond metallic enclosures of telecommunications equipment with UBCs to nearest SBB or PBB.
7. Equipment Racks: Bond metallic components of enclosures to RBB using UBCs. Provide RBB if not provided by enclosure or rack manufacturer. Bond RBB to SBB with TEBC. Power connection must comply with NFPA 70; equipment grounding conductor in power cord of cord- and plug-connected equipment must be considered supplemental to bonding requirements in this Section.
8. Shielded Cable: Bond shield of shielded cable to SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568.2 when grounding shielded balanced twisted-pair cables.
9. Primary Protector: Bond to PBB with insulated bonding conductor.
10. Electrical Power Panelboards: Where electrical panelboards for communications equipment are located within the same room or space, bond each ground bar of panelboard to SBB.
11. Cable Trays: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
12. Ladder Racks: Provide continuous electrical path by installing bonding clips and jumpers. Bond each end to nearest SBB.
13. Access Floors: Bond metal parts of access floors to SBB.

3.5 INSTALLATION OF GROUNDING AND BONDING FOR TOWERS AND ANTENNAS

A. Special Techniques:

1. Ring Electrode: Buried at least 30 inch (760 mm) below grade and at least 24 inch (610 mm) from base of tower or mounting.
2. Bond each tower base and metallic frame of dish to ring electrode, buried at least 18 inch (460 mm) below grade.
3. Bond ring electrode and antenna bonding conductors to equipment room PBB or SBB, buried at least 30 inch (760 mm) below grade.
4. Bond metal fences located within 6 ft (1.8 m) of towers and antennas to ring electrode, buried at least 18 inch (460 mm) below grade.
5. Special Requirements for Roof-Mounted Towers:

    a. Roof Ring: Meet requirements for ring electrode except conductors must comply with NFPA 780.
    b. Bond tower base footings steel, SBB in equipment room, and antenna support guys to roof ring.
    c. Connect roof ring to perimeter conductors of lightning protection system.
    d. Coordinate with building lightning protection system.

6. Special Requirements for Waveguides and Coaxial Cable:

    a. Bond cable shields at point of entry into building to nearest SBB and to cable entrance plate, using 2 AWG bonding conductors.
    b. Bond coaxial cable surge arrester to ring electrode or roof ring using bonding conductor size recommended by surge-arrester manufacturer.

3.6 IDENTIFICATION

A. Comply with Section 16753 "Identification for Communications Systems."

B. Labels must be preprinted or computer-printed type.

1. Label PBB(s) with "TS-PBB," where "TS" is telecommunications space identifier for location of PBB.
2. Label SBB(s) with "TS-SBB," where "TS" is telecommunications space identifier for location of SBB.
3. Label TBC, TBBs, and BBCs at attachment points with legend: "WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench according to manufacturer's published instructions.
2. Test bonding connections of system using AC earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing PBB or SBB, using process recommended by BICSI N1. Conduct tests with facility in operation.

a. Measure resistance between PBB and electrical service intersystem termination point. Maximum acceptable value is 100 mΩ.

1) If measured resistance from electrical service equipment to ground exceeds 5 Ω, notify Architect and include recommendations to reduce resistance to ground.

b. Measure resistance between SBBs and PBB. Maximum acceptable value is 100 mΩ.

3. Test for ground loop currents using digital clamp-on ammeter, with full scale not more than 10 A, displaying current in increments of 0.01 A at accuracy of plus or minus 2.0 percent.

a. With grounding infrastructure completed and communications system electronics operating, measure current in bonding conductors connected to PBB and to SBBs. Maximum acceptable AC current level is 1 A.

B. Nonconforming Work:

1. Communications bonding will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

C. Collect, assemble, and submit test and inspection reports.

3.8 PROTECTION

A. After installation, protect busbars and conductors from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 16736 - CABLE TRAYS FOR TELECOMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Provide a complete cable support system comprised of cable tray and cable ladder and as indicated in Project Documents.

C. Provide all necessary materials and labor for the cable support system including supporting/suspension hardware, and miscellaneous accessories resulting in a complete system.

1.2 SUMMARY

A. Section Includes:

1. Ladder cable tray.
2. Wire-mesh cable tray.
3. Cable tray accessories.
4. Warning signs.

PART 2 - PRODUCTS

2.1 GENERAL

A. Equipment specified is intended as a reference standard for level of quality.

B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the scheduled bid time. Refer to Division 01.

C. Provide materials listed by UL or ETL.

2.2 LADDER CABLE TRAY

A. Specifications

1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Chromium-zinc-plated steel, ASTM F 1136.
3. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.
4. Width: 6 inches (150 mm) 9 inches (225 mm) 12 inches (300 mm) 18 inches (450 mm) 24 inches (600 mm) 30 inches (750 mm) 36 inches (900 mm). Refer to plans for dimensions.
5. Minimum Usable Load Depth: 4 inches (100 mm).
6. Straight Section Lengths: 10 feet (3.0 m) 12 feet (3.7 m) 20 feet (6.0 m) 24 feet (7.4 m), except where shorter lengths are required to facilitate tray assembly.
7. Rung Spacing: 6 inches (150 mm) o.c.

8. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
9. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
10. No portion of the rungs shall protrude below the bottom plane of side rails.
11. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
12. Fitting Minimum Radius: 12 inches (300 mm).
13. Class Designation: Comply with NEMA VE 1.
14. Splicing Assemblies: Bolted type using serrated flange locknuts.
15. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

B. Acceptable Manufacturers

1. Chatsworth
2. Eaton (B-Line)
3. Hoffman (nVent)
4. Middle-Atlantic (Legrand)
5. MonoSystems, Inc.
6. Approved equivalent

2.3 WIRE-MESH CABLE TRAY

A. Specifications

1. Materials: Low carbon, passivated, stainless steel, Type 304L or Type 316L, ASTM F 593 and ASTM F 594.
2. Hardware for Stainless-Steel Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
3. Configuration: Galvanized- steel wire mesh, complying with NEMA VE 1.
4. Width: 6 inches (150 mm) 8 inches (200 mm) 12 inches (300 mm) 16 inches (400 mm) 18 inches (450 mm) 20 inches (500 mm) 24 inches (600 mm) unless otherwise indicated on Drawings.
5. Minimum Usable Load Depth: 4 inches (100 mm).
6. Straight Section Lengths: 10 feet (3.0 m) 12 feet (3.7 m), except where shorter lengths are required to facilitate tray assembly.
7. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
8. Class Designation: Comply with NEMA VE 1.
9. Splicing Assemblies: Bolted type using serrated flange locknuts.
10. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

B. Acceptable Manufacturers

1. Chatsworth
2. Eaton (B-Line)
3. Hoffman (nVent)
4. Middle-Atlantic (Legrand)
5. MonoSystems, Inc.
6. Approved equivalent

2.4 CABLE TRAY ACCESSORIES

A. Specifications

1. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
2. Barrier Strips: Same Materials and finishes as for cable tray.
3. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

B. Acceptable Manufacturers

1. Chatsworth
2. Eaton (B-Line)
3. Hoffman (nVent)
4. Middle-Atlantic (Legrand)
5. MonoSystems, Inc.
6. Approved equivalent

2.5 WARNING SIGNS

A. Specifications

1. Comply with requirements for identification in Section 270553 "Identification for Communications Systems."
2. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel

B. Acceptable Manufacturers

1. Chatsworth
2. Eaton (B-Line)
3. Hoffman (nVent)
4. Middle-Atlantic (Legrand)
5. MonoSystems, Inc.
6. Approved equivalent

2.6 PULL STRING

A. Specifications

1. Application: Light duty cable pulling
2. Special Features: Rot and mildew resistant
3. Tensile Strength: 210 lb.
4. Material: Polypropylene
5. Color: White/Contrasting color

B. Acceptable Manufacturers

1. Ideal Powr-Fish Pull Line. Typical of all interior conduit pathways.
2. Klein Tools 56110 poly pull line
3. Greenlee

2.7 PULL ROPE

A. Specifications

1. Applications: Below grade duct bank
2. Construction: ¼" minimum diameter braided
3. Special Features: Rot and mildew resistant

4. Tensile Strength: 1,125 lb.
5. Material: Polypropylene

B. Acceptable Manufacturer

1. Ideal Pro-Pull Polypropylene Pull Rope. Typical of communications duct banks.
2. Klein Tools
3. Greenlee

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the plans for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

3.2 SOURCE QUALITY CONTROL

A. Testing: Test and inspect cable trays according to NEMA VE 1.

3.3 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.

G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg).

H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

J. Support bus assembly to prevent twisting from eccentric loading.

K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.

L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

M. Support wire-basket cable trays with trapeze hangers.

N. Support trapeze hangers for wire-basket trays with 3/8-inch diameter rods.

O. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

P. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

Q. Make changes in direction and elevation using manufacturer's recommended fittings.

R. Make cable tray connections using manufacturer's recommended fittings.

S. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Through-Penetration Firestop Systems."

T. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

U. Install cable trays with enough workspace to permit access for installing cables.

V. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

W. Install permanent covers, if used, after installing cable. Install cover clamps according to NEMA VE 2.

X. Clamp covers on cable trays installed outdoors with heavy-duty clamps.

Y. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.4 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect pathways to cable trays according to requirements in NEMA VE 2.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
2. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
3. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
4. Check for improperly sized or installed bonding jumpers.
5. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
6. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. The conditions of the General Contract (General, Supplementary, and Other Conditions) and the General Requirements are hereby made a part of this Section.

B. All bids shall be based on the equipment as specified herein. The catalog numbers and model designations are those of the CH2000IP Life Safety Communication Platform. This system and its components or an equal system shall be provided.

C. Contractors who want to submit alternate equipment shall provide the architect with the appropriate documentation at least 10 business days before bid opening. The submitted documentation must provide a feature-by-feature comparison identifying how the proposed equipment meets the operation and functionality of the system described in this specification. The contractor shall provide adequate and complete submittal information before the bid date. Submittal documentation shall include but is not limited to, specification sheets, working drawings, shop drawings, and system demonstrations. The alternate supplier-contractor must also provide a list of six installations identical to the system proposed.

D. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system at the contractor's expense.

E. The contractor for this work shall be held to have read all bidding requirements, the general requirements of Division 1 and contract proposal forms and complete the execution of this work. The contractor shall be bound by all conditions and requirements therein.

F. The contractor shall be responsible for providing a complete functional system including all necessary components whether included in this specification or not.

G. In preparing the bid, the contractor should consider that no claim will be made against the owner for any costs incurred by the contractor for any equipment demonstrations that the owner requests.

1.02 SCOPE OF WORK

A. Furnish and install all equipment, accessories, and materials per these specifications and drawings to provide a complete and operating school communications system including, but not limited to:

1. An Administrative Display able to receive call-ins and establish two-way audio communication between call-signaling audio endpoints. Capable of calling and receiving calls from other network-connected administrative consoles, consisting of a map-based GUI (Graphical User Interface) and capable of running on a 22" (or larger) LCD touchscreen computer.

2. Administrative Console with a color touchscreen display and intuitive GUI.

3. Call initiation switches capable of placing normal and emergency calls.

4. Built-in calendar with configurable time zone (including Daylight Savings Time), unlimited events and supporting a minimum of 80 schedules.

5. IP-based system software with LAN/WAN access for Voice over IP (VoIP) communications and remote management.

B. Public Switched Telephone Network (PSTN) or VOIP switch can be connected to the system via an inbound SIP Trunk.

1.03 SUBMITTALS

A. Specification sheets on all items including cable types.

B. Shop drawings that detail the integrated electronic communications network system including, but not limited to, the following:

1. Port wiring arrangement
2. Floor plans showing all device quantity and locations.
3. Floor plans and elevation plans showing all head end equipment and its connections.

C. Wiring diagrams showing typical connections for all equipment.

D. Numbered Certificate of Completion for installation, programming, and service training, which identifies the installing technician(s) as having successfully completed the technical training course(s) provided by the system manufacturer.

1.04 QUALITY ASSURANCE

A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

B. The contractor shall be an established communications and electronics contractor who currently maintains and for at least five years has had a locally run and operated business. The contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

C. The contractor shall show satisfactory evidence, upon request, that he or she maintains a fully equipped service organization that can furnish adequate inspection and service to the system. The contractor shall maintain at his or her facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied. Upon request, the contractor shall show satisfactory evidence that he or she maintains a fully equipped service organization.

1.05 SINGLE SOURCE RESPONSIBILITY

A. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and with a minimum of 10 years' experience in the industry. The supplying contractor shall have attended the manufacturer's installation and service school. A certificate of this training shall be provided with the contractor's submittal.

1.06 SAFETY/COMPLIANCE TESTING

A. The mains-powered communications system shall bear the label of a Nationally Recognized Testing Laboratory (NRTL), such as UL, and shall be listed by their re-examination service. All work must be completed in accordance with all applicable electrical codes under the direction of a qualified and factory-approved distributor with the owner's approval.

B. The system is to be designed and configured for ease of service and repair.

1.07 IN-SERVICE TRAINING

A. The contractor shall provide at least eight hours of in-service training with this system. These sessions shall be broken into segments that facilitate the training of individuals in the operation of this system. Operator manuals and user guides shall be provided at the time of this training.

1.08 WIRING

A. System wiring and equipment installation shall be in accordance with good engineering practices as

established by the EIA and the NEC/CSA. Wiring shall meet all local electrical codes. All wiring shall be tested and verified to meet the requirements.

B. All communication system wiring shall be labelled at both ends of the cable. All labelling shall be based on the designators indicated in the architectural graphics package.

1.09 PROTECTION

A. The contractor shall provide all necessary transient protection on the AC power feed and all port lines leaving or entering the building.

B. The contractor shall note in the system drawings the type and location of these protection devices and all wiring information. Such devices are not to be installed above the ceiling.

1.10 SERVICE AND MAINTENANCE

A. The contractor shall provide a five-year equipment hardware warranty for the installed system against defects in material and workmanship. All materials subject to warranty repair/replacement shall be provided at no expense to the owner during normal working hours. The warranty period shall begin on the date of acceptance by the owner/engineer.

B. The contractor shall, at the owner's request, make available a maintenance contract offering continuing factory-authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments that are capable of rendering advice regarding the installation and final adjustment of the system.

1.11 USER ROLES AND ACCESS

A. The system shall include the ability to configure user roles and access for permission-based functionality.

1.12 DATA AND COMMUNICATION ENCRYPTION

A. The system shall include a minimum of AES-128 encryption for communications and data transfers.

1.13 SUPERVISION

A. The system shall include supervision of IP endpoints with the ability to alert end users via software and/or automated emails.

PART 2 - EQUIPMENT SPECIFICATION

2.01 MANUFACTURERS

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

1. CH2000IP manufactured by CareHawk Inc.

B. The architect must approve any alternate system.

C. This specification is intended to establish a standard of quality, function, and features. It is the bidder's responsibility to ensure that the proposed product meets or exceeds every standard outlined in these specifications.

D. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with this specification's requirements.

2.02 EQUIPMENT

A. SYSTEM EQUIPMENT

1. CH2000IP Life Safety Communication Platform Server

    a. Intel I5 or higher processor
    b. 99 simultaneous tasks capable of 200 call-ins in the queue
    c. Linux OS
    d. CH2000IP software

2. GW2WIP1/GW2WIP2 SIP Enabled POE Gateway

3. GWMIC Omnidirectional Microphone

4. Program Sources

    a. External audio source interfaced through a 3.5mm connection to a GW2WIP1/GW2WIP2

5. Administrative Equipment

    a. Spotlight Administrative Display Application with map-based user interface
    b. ADMIN7 Administrative Console

6. Other Equipment:

    a. CLKMSL10(D) Messaging display POE – Clock and digital display – Where shown on the drawings
    b. CLKMSL10(D)-SPK Messaging display with SIP speaker POE+ – - Clock, digital display, speaker, and microphone - Where shown on the drawings
    c. DAF100-25/70 100-Watt remote Class D amplifier 25V or 70V (For use with GW2WIP1/GW2WIP2) – Provide as required for a part of a complete system.
    d. DAF300-25/70 300-Watt remote Class D amplifier 25V or 70V (For use with GW2WIP1/GW2WIP2) – Provide as required for a part of a complete system.
    e. VCall+ Mobile application – Provide as required for a part of a complete system.
    f. AS-3B-LWE Alert Station – Provide at each intercom master station shown on the drawings.
    g. CS2-CE – Call in switch – Provide where shown on the drawings.
    h. GPIO-8I-8O Integration Hub (General Purpose Inputs and Outputs) – Provide as required for a part of a complete system.
    i. SS32IP SIP Audio Bridge – Provide as required for a part of a complete system.

2.03 COMPONENTS AND DESCRIPTIONS

A. CH2000IP

1. The system shall have a maximum of 256 SIP audio endpoints and 16 administrative devices.
2. The system shall be capable of expanding capacity using additional systems.
3. The software shall be upgraded via a web interface. After rebooting the system, the software upgrade is complete. The system shall allow for a manual revert to the previous working software.
4. The system shall facilitate the playing of pre-recorded audio files.
5. The system shall facilitate the live recording, naming, and storage of user-generated audio files.
6. The built-in calendar shall facilitate automatic control of class changes and other events.
7. The system shall be capable of retrieving ("pulling") calendars from other connected systems as well as sending ("pushing") a calendar or day schedule from one or more designated systems to a single or multiple connected systems (Mass Calendar Update).

8. The system shall be capable of displaying active calendars from connected systems.
9. Network Time Synchronization. The system shall be capable of synchronizing the time with a Network Time Server running NTP via the school's LAN network. Systems that cannot provide Network Time Synchronization will not be deemed equivalent.
10. The system shall have user management with configurable permission-based roles and access to system functionality.
11. The system shall be capable of integrating with a minimum of 20 existing analog systems from the same manufacturer.
12. The system shall support up to 8 SS32IP devices.

B. Spotlight Administrative Display Application

1. The system shall show the time of day and date.
2. The system shall provide an option to select the language (English).
3. The system shall display a facility map(s)/floorplan(s).
4. The system shall include a tool to create and update facility maps.
5. The system shall highlight, with distinct colors, system communications on the map including intercom, paging, tones, and music distribution.
6. The system shall have the ability to provide Lockdown Acknowledgement per endpoint. This is to be highlighted on the map as the endpoints report back to the system as secure.
7. The system will use a GUI to activate intercoms, security alerts, zone pages, external functions, select program sources, and distribute or cancel the source to any or all endpoints or zones.
8. The system shall allow for the generation of user-created zones and dynamic zone creation.
9. The system shall display call-in extensions/room numbers and the call-in priority of calls placed.
10. The system shall allow for the management of users, roles, and permissions.
11. The system shall allow for the management of user-defined tones and preannounce tones.
12. The system shall facilitate the distribution of configurable email alerts based on triggered tones/events.
13. The system shall be accessible on supported browser-based devices connected to the local network.
14. The system shall enable bi-directional communication with system audio endpoints, Spotlight, and Administrative Consoles.

C. ADMIN7 Administrative Console (Admin Phone)

1. The console shall clearly distinguish between normal and emergency call-ins.
2. The console shall use a priority-based call-in display queue, where critical call-ins are placed at the top of the call queue.
3. The console shall allow the user to select call-ins out of queue order.
4. The console shall display active critical alert badges such as Lockdown.
5. The console shall facilitate quick access to color-coded emergency tones and alerts, including Lockdown and All Clear.
6. The console shall facilitate two-way intercom calls, phone-to-phone calls, paging to zones, tones to zones, and music distribution to zones.
7. The console shall display its IP address and other system information and connectivity status.
8. The console shall include a minimum display size of 7" with a color touch-screen display.
9. The console shall not require the use of phone codes for the operation of daily or emergency communications.

D. Spotlight Calendar

1. The system shall include a browser-based Calendar interface.
2. The calendar shall have unlimited events that may be programmed into any of the unlimited day schedules.
3. The schedules shall be calendar-based and allow for programming years in advance.
4. The calendar shall facilitate on-the-fly day schedule changes in a calendar-based interface.
5. The calendar shall facilitate the use of exclusion dates for holidays and other special circumstances.

6. The calendar interface shall have options for import, export, and schedule editing.
7. Users shall have configurable role-based access to Calendar with all scheduling functions.

E. External Phones

1. External phones shall access the system through an inbound SIP trunk.

F. Call Stations

1. Call Stations shall be CareHawk Model:
    a. CS2-CE Push button Call-in/Emergency switch
2. Shall be capable of Normal and Emergency Calls.
3. Normal Calls are initiated by pressing the Call button once.
4. Emergency Calls are initiated by pressing the Emergency Call button once.
5. The system must have Emergency Call escalation.
    a. If the emergency call is unanswered by the designated extension and the emergency call escalation is programmed, the emergency call shall be forwarded to all the other administrative extensions. Systems that do not provide Emergency call escalation will not be considered equal.
6. The stations shall be able to provide Lockdown Acknowledgement
    a. This shall be provided through the pressing of any button on the station following the initiation of a Lockdown.
    b. After acknowledgement, the buttons revert to the default functionality.

G. Alert Stations

1. Alert stations shall be CareHawk Model:
    a. AS-3B-LWE
2. Alert stations shall be capable of triggering a Lockdown, Weather/Tornado or Evacuate critical tones.
3. Alert stations shall include a minimum of two software-programmable buttons.

H. VCall+

1. The mobile application will initiate normal and emergency call-ins to Spotlight and ADMIN7 consoles from the selectable classroom endpoints.
2. Call-ins initiated by the mobile application will be displayed on the Spotlight and ADMIN7 consoles as VCall+ triggered (with mobile device callback number if configured).
3. This system shall not provide direct audio communication to the mobile application.
4. The system shall initiate Lockdown and up to 10 custom tones from the mobile application.
5. The mobile application will initiate Lockdown Acknowledgement from the selectable classroom endpoints.
6. The system shall allow for the configuration of users, roles and permissions based on login credentials.
7. The mobile application will indicate any active alerts through a graphical display and vibration.

I. GPIO-8I-8O Integration Hub

1. The system shall include 8 contact closure inputs and 8 relay outputs.
2. The system shall allow for a combined 16 contact closure inputs and 16 relay outputs (2 xGPIO-8I-8).
3. The GPIO-8I-8O Hub shall be powered by POE or an optional external 12V power supply.
4. The GPIO-8I-8O Hub shall support LLMNR addressing.
5. The GPIO-8I-8O Hub shall include runtime communication with AES-128 encryption.
6. The GPIO-8I-8O Hub shall allow for remote browser-based firmware updates.
7. The GPIO-8I-8O Hub shall allow for supervision and firmware fatal error reporting and logging.
8. The GPIO-8I-8O Hub shall allow additional criteria configuration for event processing.

J. SS32IP SIP Audio Bridge

1. The device shall provide 32 analog 25V speaker connections with a maximum power of 50W per port.
2. The device shall provide a THD+N of <1% @ 1kHz, and a typical value of 0.1%.
3. The device shall have a max power of 90W, 6.94 Ohm total load
4. The device shall be able to provide two audio activities per device including normal and emergency call-ins.
5. The device shall support integration into a district wide distributed system.
6. The device shall be compatible with decision codes, event rules, call-in groups and zones.
7. The devices shall communicate utilizing AES-128 encryption at minimum

2.04 SYSTEM PARAMETERS

A. The communication system shall be a CareHawk CH2000IP Life Safety Communication platform and provide an IP-based communication network between administrative areas and indoor and outdoor locations throughout the facility over VLANs.

B. The system shall provide integrated criteria-based contact closure inputs and relay outputs for communication with third-party systems. Systems that do not contain event-processing communication ports shall not be considered.

C. The system shall provide no less than the following features and functions:

1. IP-based SIP communications between GW2WIP1/GW2WIP2 gateways, Spotlight, and ADMIN7 consoles. Each gateway shall support a 10-watt speaker output, a normal/emergency call-in station, and external relay support. A single gang plate-mounted microphone shall be installed for two-way audio communication.

2. Paging only speaker locations shall use a GW2WIP1/GW2WIP2 SIP gateway connected to either a DAF100 or DAF300 25V or 70V amplifier and shall use twisted pair cable. A system that uses shielded wire shall not be acceptable.

3. System amplifiers shall be Class D only.

4. Classroom and hallway locations needing visual displays shall use CLKMSL10(D)-(SPK) messaging displays. The SPK version shall support a 4" 4-watt speaker and microphone with echo suppression. Use of a remote call switch shall be supported (applicable to -SPK versions only). 10-inch LCDs shall show visual graphics for emergency and non-emergency events. Four integrated RGB multicolor strobe LEDs per display shall be available to enhance any visual alert.

5. Communal areas (Cafeterias/Gymnasiums) needing visual displays shall use CLKMSL22A messaging displays. The display shall support 15W(@4ohms) or 9W (@8ohms) external speakers with the internal amplifier. This unit shall provide AGC based on ambient audio levels. The unit shall provide a line out for use with external amplifiers and a configurable dry contact closure.

D. The system shall consist of any combination of the following:

1. Classrooms shall consist of wall or ceiling-mounted 8ohm loudspeakers, a call-in station, a microphone, a GW2WIP1/GW2WIP2 gateway, and a CLKMSL10-SPK with integrated speaker and microphone with connected call-in station.
2. Spotlight Administrative Display and ADMIN7 Administrative Console.

E. The Emergency Page All-Call function shall have the highest system priority that will suspend security alert audio for additional announcements.

1. Systems that do not treat Emergency Page All-Call page with the highest priority shall not be

deemed as equal.

F. There shall be at least 100 user tone slots available for pre-recorded tones/announcements. Any of these can be dedicated Emergency Alarm Tones. Each shall be accessed from the Spotlight Administrative Display, ADMIN7 console, or any authorized PBX. Systems using external alarm generators or having less than 100 pre-recorded tones/announcements shall not be acceptable.

G. The system shall provide for three-, four-, five-, or six-digit architectural room numbers with description.

H. There shall be an automatic level control for return speech during amplified voice communications.

I. Each room's loudspeaker shall be assigned to any single, any combination, or all of 64 multi-purpose zones per facility. Systems with less than 64 multi-purpose zones shall not be acceptable.

J. There shall be unlimited Time-Signaling Schedules with unlimited user-programmed events per facility. Each event shall trigger one of the user-selected tones or program sources. It shall be possible to assign each schedule to a day in an unlimited calendar or to manually change schedules from the Spotlight Administrative Display. Systems that do not provide unlimited time-signaling schedules or a choice of 100-time tones and external audio shall not be acceptable.

K. There shall be a zone-page/all-page feature that is accessible by Spotlight Administrative Display, ADMIN7 console, and authorized PBX

    1. There shall be a preannounce tone signal at any loudspeaker selected for voice paging.

L. There shall be a voice intercom feature that is accessible by Spotlight Administrative Display, ADMIN7 console and authorized PBX

    1. There shall be a privacy tone every 15 seconds to signal that any loudspeaker selected for amplified-voice intercom is active.
    2. There shall be a preannounce tone signal at any loudspeaker selected for voice intercom communication.
    3. Privacy and pre-announce tone signals shall be capable of being disabled during system initialization.

M. Each Classroom call station shall support two call-in types, as follows:

    1. Normal
    2. Emergency
    3. Emergency Call-ins from Classroom Call Switch Stations shall jump to the top of the call-in queue and alert the Spotlight Administrative Display via a distinctive ring and the map location flashing red. If the Spotlight Administrative Display is busy, the user shall be alerted via a tone. Systems which interrupt calls shall not be acceptable.
    4. Normal calls shall be logged into a queue for the designated Spotlight Administrative Display.
    5. Each queue shall first be sorted by call priority (emergency calls, and then normal calls). Calls are sorted within each priority level on a first-in, first-out basis. When a call is answered, it shall automatically be removed from the queue. Systems that do not sort calls according to priority and order received shall not be acceptable.
    6. It shall be possible to answer any incoming call simply by clicking the map location while it is ringing. It shall not be necessary to hit any buttons to answer a call unless the call has dropped into the queue.

N. Spotlight Administrative Display

    1. Incoming calls can be directed to the desired administrative console via call groups.
    2. The display shall, by default, show the time of day, day of the week, the current time, and the

locations of all stations calling with the call-in status of each station (normal or emergency).
3. When dialing from Spotlight, the console shall indicate the room number being dialed.
4. The display shall provide user-friendly menu selections to assist the operator when paging and distributing program material. Systems that require the operator to memorize long lists of operating symbols or control codes shall not be acceptable.
5. Program selection and its distribution or cancellation shall be accomplished from a designated Spotlight Administrative Display with the assistance of the menu display system. Distribution and cancellation shall be to any one or combination of speakers, any zone(s), or all zones. It shall be possible to provide multiple program channels at the same time.
6. It shall be possible, via a Spotlight Administrative Display, to manually initiate any of 100 tones. The tones shall be separate and distinct.
7. Each Spotlight Administrative Display shall maintain a unique queue of all stations calling that phone.
8. Provide the ability to mass update calendars across multiple servers including IP and Analog based systems.
9. Provide the system status of the various IP and analog-based systems.
10. Provide custom configurable instant access buttons to initiate alerts.

O. System programming shall be from the CH2000IP browser-based interface. All system programming data shall be stored in nonvolatile memory.

1. Diagnostics shall be built into the system and be accessible via a web browser and only by authorized personnel. Diagnostics shall show all activity with a 30-day log of all events. Logs shall be exportable for in-depth system analysis. Systems that do not provide a summary of the activity shall not be deemed equal.
   All programming and data access shall be through an Ethernet connection. Systems that do not have a built-in Ethernet port shall not be deemed equal.

P. IP Endpoint Supervision
1. The system shall include supervision of IP endpoints including:
   (i) GW2WIP1/GW2WIP2 Gateways
   (ii) CLKMSL Messaging Displays
   (iii) GPIO-8I-8O Integration Hubs
   (iv) ADMIN7 Administrative Consoles
   (v) Spotlight Administrative Display
   (vi) SS32IP SIP Audio Bridge
2. The system shall attempt automatic active recovery of IP endpoints should a malfunction or error occur.
3. The system shall include the ability to alert end users via software and/or automated emails if an IP endpoint is offline.

2.05 SPEAKERS

A. Standard constant voltage speakers for paging in hallways, communal areas, and outside paging. Groups of speakers are connected via external amplifiers (DAF100/300 25/70) and fed by the GW2WIP1/GW2WIP2. These speakers do not support intercom/talkback communication through the IP system, only one-way paging.

1. The CH-SYSTEM 12 is a complete, UL Listed, shallow depth, lightweight, 2' x 2' ceiling tile replacement loudspeaker system consisting of an 8" O.D. loudspeaker with a 5 oz. magnet and a 5W-25/70V transformer. The molded fiber enclosure is 1,283 CID. Powder-coated steel baffle with standard perforation and four (4) seismic tie-off points. The cable clamp is included.

   i. Average Sensitivity - 92 dB SPL, 1W/1M
   ii. Loudspeaker Power Rating - 12W RMS EIA 426A Standard
   iii. Maximum Power Rating - 15W @ 8 Ohms

iv. Calculated Output - 99 dB-SPL 5W/1M
v. Magnet Type & Weight - BeFe Ceramic, 5 oz. Nominal
vi. Frequency Response - 65 Hz - 17 kHz EIA 426A Standard
vii. Nominal Coverage Angle - 100° Included Angle -6 dB / 2 kHz, Half space.
viii. Audio Connection - 4" Color-Coded Leads, (5W, 2.5W, 1.25W, 0.63W, 0.31W)
ix. Unit Weight - 6.05 Lbs.

2. The CH-QH16T is a compression type, double re-entrant horn loudspeaker with an integrated 16W-25/70V rotary select transformer and an adjustable mounting base. Tan, enamel finish.

i. Average Sensitivity - 110 dB SPL, 1W/1M
ii. Loudspeaker Power Rating - 16W RMS EIA 426A Standard
iii. Calculated Output - 121 dB-SPL 16W/1M
iv. Frequency Response - 450 Hz - 15 kHz EIA 426A Standard
v. Nominal Coverage Angle - 110° Included Angle -6 dB / 2 kHz, Half space.
vi. Audio Connection – Screw Terminals
vii. Transformer – 25/70V 16W-5 Tap Rotary Select (16W, 8W, 4W, 2W, 1W)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions with the installer present for compliance with requirements and other conditions affecting the performance of the Integrated Telecommunications/Time/Audio/Media System.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation shall conform to local electrical requirements and be sized and installed in accordance with the manufacturer's approved shop drawings.

B. Low-voltage wiring may be run exposed above ceiling areas where easily accessible but must be installed and supported in compliance with current codes and standards.

C. All Administrative Consoles shall be desk- or counter-mounted.
1. Verify the exact location with the Architect.

D. System Configuration
1. All configuration parameters need to be gathered from the facility administration for the system configuration.

3.03 GROUNDING

A. Provide equipment grounding connections for IntegratedTelecommunications/Time/Audio/Media System as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to ensure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazards and to minimize tothe greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.

C. Provide all necessary transient protection on the AC power feed and all audio lines leaving or entering the building.

D. Note in the drawing the type and locations of these protection devices as well as all wiring information.

E. Furnish and install a dedicated, isolated earth ground from the central equipment rack and bond to the incoming electrical service ground bus bar.

PART 4 - EXECUTION

4.01 DIVISION OF WORK

A. While all work included under this specification is the complete responsibility of the contractor, the following division of actual work listed shall occur.

1. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by the electrical contractor. The balance of the system, including installation of speakers and equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative. The entire responsibility of the system, its operation, function, testing, and complete maintenance for one year after final acceptance of the project by the owner shall also be the responsibility of the manufacturer's authorized representative.

4.02 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory-authorized representative of the basic line of equipment to be used.

B. As further qualification for bidding and participating in the work under this specification, the manufacturer's representative shall hold a valid C-10 Contractor's License issued by the Contractor's State License Board of [your state]. The manufacturer's representative shall have completed at least 10 projects of equal scope, giving satisfactory performance, and shall have been in the business of furnishing and installing sound systems of this type for at least 5 years. The manufacturer's representative shall be capable of being bonded to ensure the owner of performance and satisfactory service during the guarantee period.

C. The manufacturer's representative shall provide a letter with submittals from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state that the manufacturer guarantees service performance for the life of the equipment and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

D. The contractor shall furnish a letter from the manufacturer of the equipment that certifies that the equipment has been installed according to factory-intended practices, that all the components used in the system are compatible, and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written guarantee, guaranteeing all parts for five years after the final acceptance of the project by the owner.

4.03 INSTALLATION

A. Plug disconnect: All major equipment components shall be fully pluggable using multi-pin receptacles and matching plugs to provide ease of maintenance and service.

B. Protection of cables: Cables within terminal cabinets, equipment racks, etc.

C. Cable identification: Cable conductors shall be color-coded, and each cable shall be individually identified. Each cable identification shall have a unique number located about 1 1/2" from the cable connections at both ends. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings.

D. Instructions: Provide complete "in service" instructions of system operation to school personnel.

4.04 DOCUMENTATION

Provide the following directly to the Supervisor of Technology Service:

A. A printed copy of all field programming for all system components

B. One copy of all diagnostic software with a copy of field program for each unit

C. One copy of all service manuals, parts list, and internal wiring diagrams of each system component

D. One copy of all field wiring runs, location, and end designation of the system

END OF SECTION

SECTION 16744 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Round sleeves.
2. Rectangular sleeves.
3. Sleeve seal systems.
4. Grout.
5. Pourable sealants.
6. Foam sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 ROUND SLEEVES

A. Wall Sleeves, Steel:

1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral water stop.

B. Sheet Metal Sleeves, Galvanized Steel, Round:

1. Provide communication sleeves by Hilti, STI, Unique Firestop Products or equivalent.
2. Description: Galvanized-steel sheet; thickness not less than 0.0239-inch (0.6-mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

1. Provide communication sleeves by Hilti, STI, Unique Firestop Products or equivalent.
2. Description:

a. Material: Galvanized sheet steel.
b. Minimum Metal Thickness:

1) For sleeve cross-section rectangle perimeter less than 50-inches (1270 mm) and with no side larger than 16-inches (400 mm), thickness must be 0.052 inch (1.3 mm).
2) For sleeve cross-section rectangle perimeter not less than 50-inches (1270 mm) or with one or more sides larger than 16-inches (400 mm), thickness must be 0.138 inch (3.5 mm).

2.3 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable or between pathway and cable.

1. Sealing Elements: EPDM and Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel, Fiber-reinforced plastic or Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating and Stainless steel of length required to secure pressure plates to sealing elements.

2.4 GROUT

A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.5 POURABLE SEALANTS

A. Description: Single-component, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2.6 FOAM SEALANTS

A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

   a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   b. Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless sleeve seal system is to be installed or seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 6-inches (150 mm) above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for wall assemblies.

D. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

F. Underground, Exterior-Wall and Floor Penetrations:

1. Install steel or cast-iron pipe sleeves with integral water stops. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Install sleeve during construction of floor or wall.
2. Install steel pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing sleeve seal system. Grout sleeve into wall or floor opening.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.

B. Install conduits and cable with no crossings within the sleeve.

C. Fill opening around conduits and cables with expanding foam without leaving voids.

D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at pathway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

SECTION 16750 – COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide infrastructure for support of owner furnished and installed Information Communications Technology systems. Owner furnished and installed Information Communication Technology systems may include but are not limited to:
   1. Phone System
   2. Building and Campus Local Area Network(s)

B. The work includes the following as well as work not listed below but described elsewhere, as it applies to all Information Communication Technology systems:

   1. Communications Ducts and Duct Banks
   2. Raceways and Cable Trays
   3. Power Distribution and Control
   4. Telecommunications Grounding and Bonding System
   5. Horizontal Structured Cabling System
   6. Fiber Optic Riser/Backbone System
   7. Communication Room Equipment and Fittings
   8. Communication System Pathways Hangars and Supports
   9. Mass Communication and Clock Systems
   10. Audiovisual System
   11. Permits and inspections per local Authority Having Jurisdiction

C. Interpretation of Contract Documents

   1. This section of the specifications describes infrastructure requirements applicable to Information Communications Technology systems.
   2. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
   3. Mention in these specifications or indications and/or reasonable implications whereby articles, materials, operation or methods related to execution of the work are noted, specified, drawn or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and accessories required for execution thereof.
   4. No exclusions from, or limitations in, the language used in the specifications shall be interpreted as meaning that the accessories necessary to complete any required system or item of equipment are to be omitted.
   5. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
   6. Drawings are diagrammatic and indicate general arrangement of system and equipment, except when specifically dimensioned or detailed. They are to show size, capacity, approximate location, direction, and general relationship of one work phase to another, but not exact detail or arrangement.
   7. Refer to dimensioned architectural/structural drawings for exact locations of building elements.
   8. Field verification of measurements takes priority over dimensioned drawings.
   9. Dimensions indicated anywhere, are limiting dimensions.
   10. The Owner/User reserves the right to make any reasonable change in location of devices and equipment prior to rough installation without involving additional expense. All such reasonable location changes from the drawings as are necessary to make the work of the Contractor conform to the building as constructed, shall be included and installed without extra cost.

1.2 SCOPE AND RESPONSIBILITY

A. Provide full-time, on-site field representation for Division 27 Information Communication Technology Systems scope of work for duration of installation and prior to turnover.

B. Include detailed scheduling information for Information Communication Technology Cabling Systems installation and testing in the construction schedule. Provide detailed GANTT chart construction schedule showing all tasks referenced in the project phasing plans. Include:

1. Engineering
2. Shop drawing preparation
3. Electrical Work
4. Testing, commissioning, and training.

C. This schedule must be submitted fourteen (14) calendar days after receipt of contract. The duration of this schedule must also comply with the completion dates of the construction schedule contained in the contract documents.

D. Provide coordination to ensure Telecommunication spaces are completed, cleaned and have conditioned air as early as possible to facilitate completion of Information Communication Technology Systems wiring and terminations. Space shall be free of air-borne particles prior to installation of any Information Communication Technology Systems Equipment. The Architect shall inspect and approve the condition of these rooms prior to the installation of any active or passive equipment.

E. Conduct periodic coordination meetings between Contractors to make everyone aware of critical areas of construction. Distribute the meeting minutes and attendance to the Owner/User's Representative, the Architect and the Owner/User in a timely fashion.

F. Contractor shall provide coordination of mechanical and electrical installation requirements with the General Contractor and the Electrical Contractor.

G. Provide coordination of the Owner Furnished and Owner Installed Information Communication Technology Cabling Systems installation.

H. Provide coordination as required to complete the inspection described in paragraph 3.1 INSPECTION.

I. Furnish and install a complete raceway system including conduit, surface raceways, back boxes, junction boxes, mortar boxes, and cable tray for all Information Communication Technology Systems. The conduit size shall allow for a maximum conductor fill of 40% in accordance with NEC guidelines, unless noted otherwise on the drawings.

J. Inspect conduit raceway system including back boxes, junction boxes, and mortar boxes for all Information Communication Technology Cabling Systems furnished by others. Notify the Architect of any discrepancies immediately.

K. Conduit and surface raceways from telecommunications outlets shall continue from box to location above the nearest, accessible ceiling space.

L. Furnish and install all nonstandard back boxes.

M. Furnish all 120-volt AC wiring and connections for power panels and/or terminal strips in electrical panels, cabinets, enclosures, and or consoles, as indicated in the contract documents and approved shop drawings.

N. Furnish and install all devices, equipment, and appurtenances resulting in complete, functional, and fully operational systems as specified herein and indicated on the drawings.

O. Prior to fabrication, coordinate exact location and installation of devices with other trades.

P. Provide coordination to complete the inspection described in Paragraph 3.1 INSPECTION.

Q. Coordinate the work of this Section with that of other Sections to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.3 RELATED DOCUMENTS

A. General

1. Drawings, specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. The Contractor and all subcontractors are responsible for locating information pertaining to required items of work specified or indicated elsewhere in the Contract Documents.

B. Related Work Specified Elsewhere

1. Division 01 - GENERAL REQUIREMENTS
2. Division 16 – ELECTRICAL

C. Reference Specifications, Materials, and/or Codes

1. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies obtain all required permits and pay all required fees.
2. All work shall conform to the National Electrical Code (NEC) and to applicable National Fire Protection Association (NFPA) codes.
3. All work shall conform to all Federal, State and local ordinances.
4. Where applicable, all fixtures, equipment and materials shall be as approved or listed by the following:

    a. Factory Mutual Laboratories (FM).
    b. Underwriters Laboratories, Inc. (UL).
    c. National Electrical Manufacturers Association (NEMA).

5. References to the National Electrical Code and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and specification sections shall govern in those instances where requirements are greater than those specified in the NEC and NFPA.
6. All material and equipment shall be listed, labeled or certified by Underwriters' Laboratories, Inc. where such standards have been established. Equipment and material which are not covered by the UL Standard, will be accepted provided equipment and material are listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class, which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings. NOTE: It is not required that the final installed system be UL listed as a single product.

D. All work shall meet or exceed the standards and procedures of the following:

1. National Fire Protection Association (NFPA): NFPA 70, NFPA 72, NFPA 90A
2. National Electrical Code (NEC)
3. National Electrical Contractors Association (NECA)
4. National Electric Manufacturers Association (NEMA)
5. American National Standards Institute (ANSI)
6. Telecommunications Industry Association (TIA):

    a. 568 Commercial Building Telecommunications Cabling Standard (latest revision).

    b. 569 Commercial Building Standard for Telecommunications Pathways and Spaces (latest revision).

    c. 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (latest revision).

    d. 607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

7. National Electrical Manufacturers Association (NEMA)
8. American Society of Testing Materials (ASTM)
9. Institute of Electronic & Electrical Engineers (IEEE)
10. Underwriters Laboratory (UL)
11. Americans With Disabilities Act (ADA)
12. Building Industry Consulting Service International (BICSI)

E. Include all items of labor and material required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

F. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of the current local codes and any additional authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. General

1. Furnish and install only new equipment and materials required (less than 1 year from manufacture), unused without blemish or defect.
2. Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data, which is die-stamped into the surface of the equipment, shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases, equipment is oversized to allow for pickup loads which cannot be delineated under the minimum performance.
3. All equipment of the same type shall be the product of one manufacturer.
4. The original factory condition of manufactured equipment shall not be modified without the written approval of the Architect.

1.5 SUBMITTALS

A. Duplicate copies of the bidding documents are not acceptable and will be rejected.

B. The formal submittal shall be transmitted 30 days after award of contract.

C. Submit electronic submittals via email as PDF electronic files.

D. Product Submittal

1. Submittal must consist of a complete package including Bill of Material, Product Data for each Section of the Division 27 Cable Tray Systems, and Shop Drawings as applicable. PARTIAL OR INCOMPLETE SUBMITTALS ARE NOT ACCEPTABLE. The Submittal shall include the following:

   a. A Title Page complete with the following required information:

      1) Project name.
      2) Date.
      3) Name and address of the Architect.
      4) Name of Construction Manager
      5) Name and address of the Electrical Contractor
      6) Name and address of the General Contractor
      7) Name and address of any Subcontractors.

   b. An Index Page complete with the following required information:

      1) Name of the Supplier.
      2) Name of the Manufacturer.
      3) Title, section and paragraph of the Specification Sections. (Example section 271500, paragraph 2.4)
      4) Products in order as specified in PART II of the related specification.

   c. Bill of Materials

      1) Provide complete bill of materials for all major components, accessories, and hardware to be provided in order to assemble a complete functioning system.
      2) Bill of materials shall include-

         i) Manufacturer Name
         ii) Model
         iii) Version
         iv) Quantity

   d. Each Specification section shall be separated, collated in order, and complete with the following information:

      1) Title sheet.
      2) Descriptive purpose of the system, stating how each product is to function.

   e. Each Data Sheet shall have the specific reference to the Specification it is to be used for, noting the section and paragraph.

   f. Product Data showing multiple products, models or options shall be clearly marked identifying the specific product, model and options, which are submitted for review. Unmarked submittals or facsimile copies shall not be acceptable.

   g. Submit product data for all equipment showing:

      1) Original Data Sheets Only.
      2) Product performance, mechanical and electrical specifications.

3) Manufacturer's installation instructions.
4) Certification from the submitted manufacturers that the Contractor's designated personnel are trained on the installation of the system. Include Contractor installer's name, experience and responsibility.
5) Product test compliance certificates if required.

E. Shop Drawings

1. Contract documents are diagrammatic in nature and intended to define the general scope and complexity of the systems. They do not reflect the detail necessary to construct the specified system. Assembly and submission of detailed shop drawings are required.
2. Submittals consisting of reproduced copies of the original bidding documents will be rejected. The contractor is required to develop a complete set of drawings specific to the final configuration of the system based on the manufacture and models of all components included. Shop drawings are to include all changes noted in addenda, as well as any changes included in architect's special instructions or change orders issued prior to the submittal of the shop drawings.
3. Shop drawings shall be submitted with product data.
4. All drawings shall be created using an industry recognized computer aided design program. Recognized programs include AutoDesk Revit, AutoCAD, and Microstation. All drawings are to be made using the latest software release available.
5. Submit shop drawings for all equipment showing:

a. Location and type of all field equipment on floor plans. Include all device revisions from addenda.

1) Conduit Routing
2) Cable Tray Routing
3) Wall Penetrations for Conduit, Tray, and Sleeves

b. Size and spacing of all anchors, wall penetrations, joinery construction, etc., required for complete system installation.
c. Electrical riser diagrams which identify all signal, power, and ground circuitry. Identify circuit numbers corresponding with electrical drawings.
d. Telecommunication Backboard layouts including wall mounted equipment, equipment ladders, ground bus bar mounting, wall penetrations, cable routing, and cable support methods.

F. Record Documents

1. Provide Record Documents for each Division 27 section.
2. Records shall be submitted in both paper and electronic format.
3. Provide one (1) set of black line prints.
4. Record documents shall detail "As-built" condition of all systems including:

a. A set of updated shop drawings showing all Contract changes.
b. A set of updated product data showing all Contract changes.
c. Cable tray routing and installation.
d. Electronic copy shall use the most recent version of the software platform used for creating shop drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Products that have been in manufacture for at least one year, unless otherwise specified by performance requirements.

2.2 SUBSTITUTIONS

A. Deviations from specifications

1. Any deviations from the specifications must be approved 10 calendar days prior to the bid date. This includes changes to the scope of work, equipment substitutions, and changes to the general provision.
2. Changes to the scope of work in the bid proposal are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved scope changes will be listed by addendum prior to the bid opening.
3. Any proposed equipment substitution must be submitted 10 calendar days prior to the bid date. Accompanying the request, the Contractor must provide manufacturer's product specifications for the exact model be substituted. This literature must clearly state all specifications called for in the bidding documents, as well as performance characteristics not specified but inherent to the product listed in the specifications. Any items approved as a substitute will be listed by addendum prior to the bid opening. Substitutions after the award of bid will only be allowed in case of discontinued equipment, or if an item of equal or better quality is available and will not affect the contract cost of the system.
4. Changes to the general provisions are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved changes will be listed by addendum prior to the bid opening.
5. When a specified item is found to be discontinued or obsolete by the manufacturer, the contractor is required to substitute the manufacturer recommended equivalent for that product. If an equivalent is not available, the contractor is instructed to notify the Architect in writing prior to bid time.

B. Where specific products may be sole source specified, no substitutions will be allowed.

2.3 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are readily available.

2.4 EQUIPMENT IDENTIFICATION

A. All back boxes shall be labeled according to their intended use.

B. Pull strings shall be labeled on both ends with a unique identifier.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that all equipment is installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

B. In the event of discrepancy, immediately notify the Architect.

C. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

D. Return to original (preconstruction) condition any work disturbed during system installation.

3.2 INSTALLATION

A. Install all equipment in strict accordance with the manufacturer's recommendations, reviewed shop drawings, BICSI TDMM, latest/most current edition and TIA Standards for UTP and fiber optic cable.

B. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

C. Secure equipment with fasteners suitable for the use, materials, and loads encountered. If requested, submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

D. National Electrical Code requirements are applicable to all work.

E. Working spaces (clearances) shall be not less than specified in the National Electrical Code for all voltages specified.

F. Where the Architect determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner/User. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.

G. All new cable pathways using cable ladders, trays raceways or conduits must be designed and installed to be at 40% or less of maximum fill capacity.

H. During construction, temporarily support all communications cable bundles in ceiling spaces of the MDF/ER and IDFs/TRs to avoid and minimize damage to cables prior to final termination. Cable bundles shall not be allowed to hang from ceiling spaces down to the floor during construction except on a daily basis where contractor is actively placing, pulling and tagging communications cabling.

I. Plywood backboards will be used on the walls of the Equipment and Telecommunication Rooms.
   1. Hardwood, ¾-inch x 4-ft x 8ft.
   2. Type A/C with smooth side installed to interior spaces and long dimension installed vertically.
   3. Fire retardant with factory-applied, indelible stamping that indicates fire treated rating.
   4. Painted with two coats of white or very light color latex paint. DO NOT paint over one or more of the factory stampings, which shall be in a conspicuous and inspectable location on each backboard.
   5. Free of defects (knots and voids shall be considered a defect).
   6. Properly secured to walls as indicated on drawings.
   7. Mechanically secured with approved anchors to ensure equipment support rating of 50 pounds per linear foot of wall space.

3.3 WORK PERFORMANCE

A. Coordinate location of equipment with other trades to minimize interferences.

B. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Architect as required by limited working space.

C. Holes shall not affect structural sections such as ribs or beams.

D. Holes shall be laid out in advance. The Architect shall be advised prior to drilling through structural sections for determination of proper layout.

E. Any holes created in walls, floors, or ceilings by the Contractor are to be sealed with fire rated systems and methods according to all national, state, and local codes.

F. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factory of 1.5, which shall conform to any specific requirements in the Construction Documents.

G. The Contractor is responsible for repairing and or replacing any damage caused by their workforce at no additional cost to the Owner/User, or the Owner/User's representatives.

3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

B. Prevent damage from rain, dirt, sun and ground water by storing equipment on elevated supports and covering all sides with securely fastened protective rigid or flexible waterproof coverings.

C. Protect piping by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

D. During construction, cap the top of all conduits and raceway installed vertically.

E. During installation, protect equipment against entry of foreign matter on the inside, and vacuum clean both inside and outside before testing and operating.

F. Damaged equipment, as determined by the Architect, shall be replaced.

G. Protect painted surfaces with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.

H. Repaint damaged "FINISH" paint on equipment and materials with painting equipment and finished with same quality of paint and workmanship as used by the original manufacturer so repaired areas are not obvious.

I. Conduit back boxes, floor boxes, and poke thru's shall be vacuumed clean prior to the placement of communications cables.

J. Outside plant (underground) ducts and conduits shall be vacuumed and/or rodded and swabbed to remove foreign matter, water, mud, etc., prior to placement of communications cables.

3.5 LABELING

A. Power Outlets

1. Power outlet labels shall be machine-generated.
2. All power outlets designated for equipment shall be labeled on top.
3. Provide a second label on the bottom of the outlet cover plate indicating service panel number and circuit breaker number.
4. Text lettering to be 1/8" high.

B. Communications
   1. Communications cable, device, fixture, equipment and outlet labels shall be machine-generated. Hand labeling will not be acceptable.
   2. Labeling schema shall be Owner-approved prior to final or permanent labeling.
   3. Labels shall be generated using a white background with black alpha-numeric characters.
   4. Cable jacket labels shall be self-laminating, wrap type and shall be placed within 6-inches of the termination point at each end.
   5. Final, approved labeling shall correspond with system as-built drawings.

3.6 CLEANING

A. On a daily basis during construction and prior to Owner/User acceptance of the building, remove from the premises and dispose of all packing material and debris caused by work performed under Division 27 Information Communication Technology Cabling Systems specifications.

B. Remove all dust and debris from interiors and exteriors of electrical equipment, equipment room cabinets, racks and enclosures. Clean accessible current carrying elements prior to being energized.

C. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

D. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

END OF SECTION

SECTION 16753 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Labels.
2. Bands and tubes.
3. Underground-line warning tape.
4. Signs.
5. Cable ties.
6. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Labels.
2. Bands and tubes.
3. Underground-line warning tape.
4. Signs.
5. Cable ties.
6. Miscellaneous identification products.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for communications identification products.

C. Provide samples for each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products if so requested.

D. Identification Schedule:

1. Outlets: Scaled drawings indicating location and proposed designation (labeling schema).
2. Backbone Cabling: Riser diagram showing each communications room, backbone cable, and proposed backbone cable designation (labeling schema).
3. Racks: Scaled drawings indicating location and proposed designation (labeling schema).
4. Patch Panels: Enlarged scaled drawings showing rack row, number, and proposed designations (labeling schema).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 70 and TIA 606-B.

B. Comply with ANSI Z535.4 for safety signs and labels.

C. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Equipment Identification Labels:

1. Machine-generated, adhesive, tape style labels shall contain black letters on a white field.
2. Engraved phenolic (lamacoid style) labels shall contain white letters on a black field.
3. Provide labels for all racks, cabinets and enclosures.
4. Install labels on highest, centered location of each rack, cabinet and enclosure.

B. Cable Identification Labels:

1. Machine-generated, adhesive, self-laminating wrap style cable jacket labels shall contain black letters on a white field.
2. Apply cable jacket labels within 6-inches of termination point at each end.
3. Cable jacket labels shall correspond to the approved labeling schema and to the as-built documentation.

C. Patch Panel Labels:

1. Machine-generated, adhesive, tape style labels shall contain black letters on a white field.
2. Engraved phenolic (lamacoid style) labels shall contain white letters on a black field.
3. Provide labels for every termination patch panel, copper and fiber.
4. Install patch panel labels on highest, left-most location of each panel.
5. Patch panel labels shall correspond to the approved labeling schema and to the as-built documentation.

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester or vinyl flexible labels with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating protective shields over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels:
    a. Machine-printed, permanent, waterproof black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Minimum Nominal Size:

    a. 1-1/2 by 6-inches (37 by 150 mm) for raceway and conductors.
    b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
    c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters of raceway or cable they identify, that stay in place by gripping action.

2.5 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground 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 degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, and ANSI Z535.4.
2. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL-FIBER CABLE".

C. Tag, Nonconducting Polyolefin: Type I:

1. Pigmented polyolefin, bright colored, continuous-printed on one side with the inscription of the utility**,** compounded for direct-burial service.
2. Width: 3-inches (75 mm).
3. Thickness: 4 mils (0.1 mm).
4. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
5. Tensile According to ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

D. Tag, Nonconducting Multilayer Laminate: Type II:

1. Multilayer laminate, consisting of high-density polyethylene scrim coated with pigmented polyolefin; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3-inches (75 mm).

3. Thickness: 12 mils (0.3 mm).
4. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).
5. Tensile According to ASTM D882: 400 lbf (1780 N) and 11,500 psi (79.2 MPa).

E. Tag, Detectable: Type ID:

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3-inches (75 mm).
3. Overall Thickness: 5 mils (0.125 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
6. Tensile According to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

F. Tag, Detectable, reinforced: Type IID:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Width: 3-inches (75 mm).
3. Overall Thickness: 8 mils (0.2 mm).
4. Foil Core Thickness: 0.35 mil (0.00889 mm).
5. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
6. Tensile According to ASTM D882: 300 lbf (1334 N) and 12,500 psi (86.1 MPa).

2.6 SIGNS

A. Baked-Enamel Signs:
1. Preprinted aluminum signs, high-intensity reflective, pre-punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14-inches (250 by 360 mm).

C. Laminated-Acrylic or Melamine-Plastic Signs:
1. Engraved Legend: with white letters on black face or white letters on a dark gray background.
2. Thickness:

a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.

3. Attachment: Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting or Self-adhesive.

4. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) According to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) According to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C) According to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Maroon/Burgundy.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain 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 PREPARATION

A. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

H. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
3. Provide label 6-inches (150 mm) from cable end.

I. Snap-Around Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6-inches (150 mm) from cable end.

J. Self-Adhesive Wraparound Labels:

1. Secure tight to surface at a location with high visibility and accessibility.
2. Provide label 6-inches (150 mm) from cable end.

K. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2-inches (50 mm) high.

L. Snap-Around, Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

M. Underground-Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8-inches (150 to 200 mm) below finished grade. Use

multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16-inches (400 mm) overall.
2. Limit use of underground-line warning tape to direct-buried cables.
3. Install underground-line warning tape for direct-buried cables and cables in raceways.

N. Cable Ties: General purpose, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations with high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify covers of each junction and pull box with self-adhesive labels containing wiring system legend.

D. Faceplates: Label individual faceplates with self-adhesive labels. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation, numbered clockwise when entering room from primary egress, composed of the following, in the order listed:

1. Wiring closet designation.
2. Colon.
3. Faceplate number.

E. Modular Jack Inserts (User end): Each modular jack insert shall be labeled. Label shall be placed under the clear, acrylic label window of each faceplate. Each modular jack shall be labeled with its individual, sequential designation composed of the following, in the order listed:
1. Patch panel designator.
2. Individual patch panel port number designator.

F. Equipment Room Labeling:

1. Racks, Frames, and Enclosures: Identify front and rear of each with self-adhesive labels containing equipment designation.
2. Patch Panels: Label individual patch panels in each rack, starting at top and working down, with self-adhesive labels.
3. Patch panel ports (individual data outlets): Label each outlet with a self-adhesive label indicating the following, in the order listed:

a. Room number being served.
b. Colon.
c. Faceplate number.

G. Backbone Cables: Label each cable with a vinyl-wraparound label or self-adhesive wraparound label indicating the location of the far or other end of the backbone cable. Patch panel or punch down block where cable is terminated should be labeled identically.

H. Horizontal Cables: Label each cable with a vinyl-wraparound label or self-adhesive wraparound label indicating the following, in the order listed:

1. Room number.
2. Colon.
3. Faceplate number.

I. Locations of Underground Lines: Underground-line warning tape for copper, coaxial, hybrid copper/fiber, and optical-fiber cable.

J. Instructional Signs: Self-adhesive labels.

K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures: Self-adhesive labels, Baked-enamel warning signs or Metal-backed, butyrate warning signs.

1. Apply to exterior of door, cover, or other access.

L. Equipment Identification Labels:

1. Indoor Equipment: Self-adhesive label, Baked-enamel signs, Metal-backed butyrate signs, Laminated-acrylic or melamine-plastic sign.
2. Outdoor Equipment: Laminated-acrylic or melamine-plastic sign, Stenciled legend 4 inches (100 mm) high].
3. Equipment to Be Labeled:

a. Communications cabinets and racks.
b. Uninterruptible power supplies.
c. Computer room air conditioners.
d. Power distribution components.
e. Communications grounding/bonding bus bars

END OF SECTION

PRE-CONSTRUCTION CONFERENCE CHECK-LIST

Project: **Elementary Addition to Sumter Central High School**

Funding: **Local**

Location: **TBD**

Date/Time: **TBD**

DCM Insp:

Please note that all items listed below may not be applicable to this project.

1. **Introductions / Sign In**

2. **Owner's Comments**

3. **Preface / Pass Along To Others**

4. **General Contractor's Team Members (contact information)**

   Project Manager: _____

   Superintendent: _____

5. **Verify all alternates accepted**.

6. **E-Verify. Alabama Immigration Law. Be sure that all subcontractors comply with E-Verify requirements.**

7. **List of Sub-Contractors, submit for approval.**
   A Complete list of sub-contractors must be submitted and approved by the Architect and Owner prior to any work commencing. Contractor cannot replace subs unless approved by the Architect and Owner (GCS 41)

8. **Cost Breakdown and Progress schedule.**
   Cost breakdown and progress schedule must be submitted and approved on proper state forms prior to first pay request. **GC is required to provide an updated progress schedule at each OAC.**

   Start: Completion Date: Days:

9. **Method of approving monthly pay request.**
   Due by the 25th of each month. Architect will verify, sign and forward to Owner, who will forward to DCM, if applicable.

10. **Allowances.**
    A. With the exception of quantity allowances, all allowances indicated are contingency allowances and therefore the Owner may transfer balances for other discretionary uses. Overhead and profit margins SHALL NOT BE ADDED to any amount drawn from original Allowance(s) regardless of the indicated use.

    B. Each contingency allowance shall be a "line item" on the Schedule of Values.

C. The following allowance(s) are a part of this project:

-
-

D. If applicable, note special material/equipment delivery dates associated with allowances.

-

11. Change Orders Requests. No work prior to final approval; Architect can approve in writing if emergency.

A. All changes in work are to be submitted via Change Order Request, regardless of monetary value.

B. COR's must be submitted in sequential order on GC letterhead.

C. All COR's must be broken down to the fullest degree, including breakdown of GC's cost by GC's labor, materials, subcontractor, sub-subcontractor cost and OH&P. Subcontractor and sub-subcontractor cost must be documented with copies of quotes detailing OH&P included.

D. COR's applied to allowances cannot include OH&P.

E. Credit COR's must include a minimum of 5% OH&P.

F. Upon Owner and/or Architects' approval of COR's, a revised Change Order and Allowance Usage log will be sent to GC via email.

G. GC is to maintain a COR Log and present updated copy at each OAC meeting.

H. NOTE: The following information is required for <u>ALL</u> Change Order Requests submitted:

a. Each material number shall include an invoice / quote listing unit quantities, unit price, and extended total.

b. Each labor number shall include a breakdown showing number of laborers, hours of labor worked, hourly wage, and extended total.

c. Each equipment number shall have an invoice / quote listing the hours of use, hourly rate, and extended total.

I. An official Change Order to the State <u>CANNOT</u> be prepared if all backup paperwork is not provided and accounted for.

J. This information is required for all contractors, subcontractors, and sub-subcontractors.

12. Shop Drawings.

A. Submittal Schedule must be submitted to Architect at or before Pre-Construction Conference. Correlate this submittal schedule with the listing of subcontractors and with list of materials as specified in contract documents. The submittal schedule should be in chronological order following the critical timing of the approval of submittals in accordance with the Work Progress Schedule.

B. Submit all items proposed for use in work. Do not combine submittals with requests for substitutions

C. Must bear GC's action stamp as APPROVED OR APPROVED AS NOTED. Contractor shall review and stamp approval and submit shop drawings, product data and samples far enough in advance to allow ample time for Architect review. Color selections may take longer than actual submittal approval, but in any case will not be given via phone calls. If submittals are not marked as approved by the GC, they will be returned without action.

D. Digital Copies: Provide via email to submittals@lathanassociates.com. Do not send directly to Architect. **See attached Sample.**

E. Submittal Preparation:

- **Include the following information on transmittal / email.**
  - Date
  - Project Name and Architect's Project Number.
  - Name of the General Contractor and Contact within company.
  - Subcontractor/Supplier.
- Clearly state **Number** and title of appropriate Specification Section and **Description** of Item and if applicable
  - Name of the Manufacturer.
  - Model / Style of Item

General Contractor must review and approve shop drawings and submittals prior to submitting to Architect. Allow the Architect no less than three (3) weeks for initial review. Allow more time if the Architect must delay processing to permit coordination with the sequence of construction, related specification divisions, engineers, consultants and owner's representatives. Allow no less than two (2) weeks for reprocessing.

NOTE: No extension of Contract Time and/or additional costs will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.

F. Material shall not be fabricated or work performed without approval of respective submittal.

G. GC is to maintain copies of all approved shop drawings at the site and have available for architect and/or engineers at all times.

H. GC is to maintain a Submittal Log and present updated copy log at each OAC meeting.

I. **Important:** Contractor shall perform no portion of the work for which the contract documents require submittal and review of Shop Drawings, Data, Installer Qualifications, etc. until respective submittal has been approved by the Architect.

J. **Important:** Submittals are not Contract Documents and are not used to make changes in scope of project or intent of Contract Documents, and not used to request or IMPLY substitutions or to otherwise make changes in project requirements.

K. **Important:** The only changes that can be made to the project once it is bid, is through Change Order Requests and Approvals.

L. **Important:** After receiving approved digital submittals, General Contractor is responsible for printing and delivering 2 hard copies of the approved shop drawings to the Architect within 10 days. Submittals are not considered complete until 2 copies have been received by the Architect. This may have a direct effect on pay requests or final payment.

13. CAD Files / PDF

A. This project was bid under the assumption that electronic CAD files would not be available.

B. Electronic CAD files are owned individually by each design professional according to discipline. If electronic CAD files or portions thereof are made available, be reminded that electronic CAD files can be manipulated and do not constitute the Contract Documents. The business of acquiring such files shall be between the contractor and the individual design professional. Fees may or may not be applicable. It shall be the Contractor's responsibility to investigate and procure at no added expense to the Owner.

C. PDF files shall be made available to the General Contractor for use during construction.

14. Advanced notice of required inspections.

The contractor will contact the architect by e-mail at inspections@lathanassociates.com of the date the project will be ready for an inspection by the DCM Inspector: Pre-Roofing, Fire Above Ceiling, Final, and Year End. Special Inspections shall be required for all work of the Storm Shelters and the Fire Water Lines. Schedule well in advance to prevent delays.

- Inspections must be requested 14 days in advance.
- When the DCM Inspector confirms the inspection time, the Architect will send an e-mail confirming the inspection time and date.
- Cancellations of any scheduled inspection must be received in writing by e-mail no less than 48 hours prior to the schedule inspection. If an inspection is cancelled, it will be rescheduled subject to the DCM Inspector's availability.
- If an inspection is cancelled less than 48 hours prior to the schedule inspection, the re-inspection fee of$1,500 will be charged.

15. Inspection Minimum Requirements.

The following minimum requirements listed below are provided to aid the contractors and architect in determining if a project is ready for a required inspection.

- Pre-Construction Conference
  - Required Attendees: Contractor, Owner, Architect, Major Subcontractors
  - Inspection Requirements:
    - ✓ Signed construction contract
    - ✓ Verification of payment of permit fee
    - ✓ Contractor's Statement of Responsibility and Quality Assurance Plan (for storm shelter)
    - ✓ Fire Alarm Contractor's Certification (from State Fire Marshal)
    - ✓ ADEM permit, if more than 1 acre of land is disturbed

- Pre-Construction Conference for Storm Shelter
  - Required Attendees: Contractor, Owner, Architect, Structural Engineer, Major Subcontractors, Special Inspections Representative
  - Inspection Requirements:
    - ✓ DCM Inspector must have already received Contractor's Statement of Responsibility and Quality Assurance Plan

- Pre-Roofing Conference
  - Required Attendees: Contractor, Owner, Architect, Roofing Subcontractor, Roofing Manufacturer's Representative
  - Inspection Requirements:
    - ✓ Roofing submittals must be approved by the architect prior to pre-roofing conference
    - ✓ Roofing manufacturer must provide documentation that roof design and roofing materials meet code requirements for wind uplift and impact resistance
    - ✓ Copy of sample roofing warranty

- Above-Ceiling Inspections
  - Required Attendees: Contractor, Owner, Architect, MEP Engineers, Major Subcontractors, DCM Inspector
  - Inspection Requirements:
    - ✓ All work must be completed except for installation of ceiling tiles and/or hard ceilings
    - ✓ Space must be conditioned

- ✓ Permanent power must be connected unless otherwise arranged with the DCM Inspector
- ✓ Grease duct must be inspected and approved by the DCM Inspector prior to fire wrapping and Above-Ceiling Inspection

- Life Safety Inspections and Final Inspections
  - Required Attendees: Contractor, Owner, Architect, Engineers, Major Subcontractors, Local Fire Marshal, DCM Inspector
  - Inspection Requirements:
    - ✓ Fire alarm certification
    - ✓ Kitchen hood fire suppression system certification
    - ✓ General Contractor's 5-Year Roofing Warranty (ABC Form C-9)
    - ✓ General Contractor's Five Year Building Envelope
    - ✓ Above ground and below ground sprinkler certifications
    - ✓ Completed Certificate of Structural Engineer 's Observations for storm shelters
    - ✓ Emergency and exit lighting tests
    - ✓ Fire alarm must be monitored
    - ✓ Elevator Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor
    - ✓ Boiler/Vessels Inspection completed and Certificate of Operation provided by the State of Alabama Department of Labor
    - ✓ Flush test for underground sprinkler lines (witnessed by local fire marshal, fire chief and/or DCM Inspector)
    - ✓ Flush/pressure test for new and/or existing fire hydrants
    - ✓ Must have clear egress/access and emergency (for first responders) access to building
    - ✓ Must have ADA access completed

- Year-End Inspections
  - Required Attendees: Contractor, Owner, Architect, Engineers and /or Major subcontractors may also be required to attend
  - Inspection Requirements:
    - ✓ Owner 's list of documented warranty items

16. Above Ceiling Inspection by the Architect, Engineers and DCM Inspector.

No above ceiling work is to be done after the Above Ceiling Inspection other than correction of deficiencies noted during the inspection. (Pre-Above Ceiling Inspection)

Fire Caulking Tented fixtures Wire at Light Fixtures Debris
Temporary Lighting Penetrations Pipe Saddles
Insulation - No Kraft - Exposed Fire-Rated FSK or FRK - Type III, Class A.

17. Other inspections required before work is covered.

A. Local inspectors may require a full range of inspections on this project, footings, under-slab, etc. A wall inspection will be held before any finish paints are applied.
B. Material Testing.

18. Observation report distribution.

Architect will submit field reports promptly to the Owner, GC, DCM Inspector. Architect will fill in all blanks on the field report form.
(GCS 16 & MP 8D)

19. Record drawings, definitions of procedures.

G.C. is to keep all changes made in the field red lined daily. Cut and paste all addendums onto the plans at their respected locations. One clean set of plans is to be secured at the job trailer at all

times for review by all interested parties. This set with changes could be used as the record drawings. Final pay approval is subject to receipt of these as-built drawings.

20. Project sign and other job signs.

State required sign is the only sign allowed on project.
Job trailers with contractor and/or sub-contractor names are allowed.

21. Overall phasing of project.

Superintendent is responsible to plan ahead in order to avoid delays and conflicts. GC is to advise Architect on delays of critical path items. Superintendent is to be on site at all times when any work is in progress; no exceptions (GCS 6A & B)

22. Contractor's duty to coordinate work of separate contractor.

Contractors employed by others for installation of data, computer and etc. (GCS 40D)

23. Use of existing site, building and access drive.

A. Use of existing building site for lay down is to be determined by local owner and Architect. Local owner will advise contractor on proper route to site. Material delivery times are to be made as to not interfere with the school bus schedule. Area is to be reviewed after this meeting, if necessary. Maintain traffic flow.

B. No workmen are allowed in existing building, unless prior approval is granted by the Owner and arranged by the General Contractor. There is to be no communication between workers and faculty/staff or students; through vocal, looks, stares or body language.

C. Since most projects are hard hat areas, the worker's name will be on his/her hat for identification purposes.

D. If a faculty/staff member or student is causing a problem with a worker, the worker is to report the incident to the Project Superintendent. The Superintendent should then report the incident to the Owner. Under no circumstances should the Worker try and handle the problem by him/herself.

E. There is to be no profanity on the job site.

F. School Lunchroom is off limits to workers.

G. Use of existing site, building and access drive.

H. Workmen are expected to dress appropriately. Tee-shirts are expected to be non-offensive to all parties.

I. State school properties are tobacco free areas. No smoking, chewing, or dipping of tobacco products are allowed.

J. State school properties are drug free areas. Vehicles are subject to search and seizure by law enforcement authorities.

K. Firearms are not allowed on school property. Cased, uncased, loaded, or unloaded.

24. Use of existing toilets.

There will be no use of existing toilets. G.C. is to provide proper number of toilets for all workers.
School telephone is off limits.

25. Coordinate any utilities supplied by the Owner / New equipment.

A. Existing sites, normally water only.
B. Coordination - OAC /Sub Meetings
C. New equipment utilities may be different than those existing utilities that the design is based upon. Coordinate with actual equipment cut sheets submitted and approved.