

DIVISION 26: ELECTRICAL

26 0501	COMMON ELECTRICAL REQUIREMENTS
26 0503	ELECTRICAL UTILITY SERVICES
26 0519	LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 0533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
26 2417	CIRCUIT-BREAKER PANELBOARDS
26 2726	WIRING DEVICES
26 2816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 3200	GENERATOR
26 3600	AUTOMATIC TRANSFER SWITCH
26 5100	INTERIOR LIGHTING
26 5600	EXTERIOR LIGHTING
26 7000	FIRE DETECTION AND ALARM SYSTEM

END OF TABLE OF CONTENTS

SECTION 26 0501

COMMON ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. General electrical system requirements and procedures.
 - 2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
 - 3. Make electrical connections to equipment provided under other Sections.
 - 4. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

1.2 REFERENCES

- A. Reference Standards:
 - 1. National Fire Protection Association / American National Standards Institute:
 - a. NFPA 70-2011, National Electric Code (NEC).
 - 2. National Electrical Manufacturing Association Standards (NEMA):
 - a. NEMA 250-2008, 'Enclosure for Electrical Equipment (1000 Volts Maximum)'.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data:
 - a. Provide following information for each item of equipment:
 - 1) Catalog Sheets.
 - 2) Assembly details or dimension drawings.
 - 3) Installation instructions.
 - 4) Manufacturer's name and catalog number.
 - 5) Name of local supplier.
 - b. Furnish such information for following equipment:
 - 1) Section 26 2417: 'Circuit-Breaker Panelboards'.
 - 2) Section 26 2726 'Wiring Devices'
 - 3) Section 26 2816: 'Enclosed Switches And Circuit Breakers'.
 - 4) Section 26 3200" 'Generator'
 - 5) Section 26 3600: 'Automatic Transfer Switch'
 - 6) Section 26 5100: 'Interior Lighting Fixtures'.
 - 7) Section 26 5600: 'Exterior Lighting' for fixtures, poles, and associated control equipment.
 - c. Do not purchase equipment before approval of product data.
 - 2. Shop Drawings:
 - a. Submit on following equipment:
 - 1) Panelboards and gear.
 - 2) Light fixtures.
 - 3) Lighting controls
 - 4) Generator and ATS
 - 5) Fire alarm system
 - b. Indicate precise equipment to be used, including all options specified. Indicate wording and format of nameplates where applicable. Submit in three-ring binder with hard cover.
- B. Informational Submittals:

1. Test And Evaluation Reports:
 - a. Report of site tests, before Substantial Completion.
 2. Qualification Statement:
 - a. Electrical Subcontractor:
 - 1) Provide Qualification documentation if requested by Architect or Owner.
 - b. Installer:
 - 1) Provide Qualification documentation if requested by Architect or Owner.
- C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual
 - a. Operations and Maintenance Data:
 - 1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
 - b. Record Documentation:
 - 1) Manufacturers documentation:
 - a) Manufacturer's literature.
 - b) Include copy of approved shop drawings.

1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
 2. Material and equipment provided shall meet standards of NEMA or UL and bear their label wherever standards have been established and label service is available.
- B. Qualifications:
1. Electrical Subcontractor:
 - a. Company specializing in performing work of this section.
 - 1) Minimum five (5) years experience in electrical installations.
 - 2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
 - b. Upon request, submit documentation.
 2. Installer:
 - a. Licensed for area of Project.
 - b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
 - c. Upon request, submit documentation.

PART 2 - PRODUCTS

2.1 SYSTEMS

- A. Performance:
1. Design Criteria:
 - a. Materials and equipment provided under following Sections shall be by same Manufacturer:
 - 1) Section 26 2417: Panelboards.
 - 2) Section 26 2816: Enclosed Switches And Circuit Breakers.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Acceptable Installers:

1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.2 EXAMINATION

- A. Verification Of Conditions:
 1. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

3.3 INSTALLATION

- A. General:
 1. Locations of electrical equipment shown on Drawings are approximate only. Field verify actual locations for proper installation.
 2. Coordinate electrical equipment locations and conduit runs with those providing equipment to be served before installation or rough in.
 - a. Notify Architect of conflicts before beginning work.
 - b. Coordinate locations of power and lighting outlets in mechanical rooms and other areas with mechanical equipment, piping, ductwork, cabinets, etc, so they will be readily accessible and functional.
 3. Work related to other trades which is required under this Division, such as cutting and patching, trenching, and backfilling, shall be performed according to standards specified in applicable Sections.
- B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through rated walls, ceilings, and top plates of walls.

3.4 FIELD QUALITY CONTROL

- A. Field Tests:
 1. Test systems and demonstrate equipment as working and operating properly. Notify Architect before test. Rectify defects at no additional cost to Owner.
 2. Measure current for each phase of each motor under actual final load operation, i.e. after air balance is completed for fan units, etc. Record this information along with full-load nameplate current rating and size of thermal overload unit installed for each motor.

3.5 CLOSEOUT ACTIVITIES

- A. Training:
 1. Provide competent instructor to train Owner's maintenance personnel in operation and maintenance of electrical equipment and systems. Factory representatives shall assist this instruction as necessary. Schedule instruction period at time of final inspection.

END OF SECTION

SECTION 26 0503

ELECTRICAL UTILITY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install services as described in Contract Documents and as required by local serving agency.
 - 2. Complete cost of services.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.
 - 2. Coordinate new electrical service with serving utility. Pay all associated costs. Provide concrete pad for utility transformer. Provide conduit/wiring as shown on power riser diagrams.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Interface With Other Work: Coordinate with serving utility on all items. Verify supplied voltage prior to energizing service gear.

END OF SECTION

SECTION 26 0519

LINE-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Quality of conductors used on Project except as excluded below.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.

1.2 REFERENCES

- A. Definitions:
 - 1. Line Voltage: Over 70 Volts.

PART 2 - PRODUCTS

2.1 SYSTEMS

- A. Line Voltage Conductors:
 - 1. Copper with AWG sizes as shown:
 - a. Minimum size shall be No. 12 except where specified otherwise.
 - b. Conductor size No. 8 and larger shall be stranded.
 - 2. Insulation:
 - a. Standard Conductor Size No. 10 And Smaller: 600V type THWN or XHHW (75 deg C).
 - b. Standard Conductor Size No. 8 And Larger: 600V Type THHN, THWN, or XHHW (75 deg C).
 - c. Higher temperature insulation as required by NEC or local codes.
 - 3. Colors:
 - a. 208 / 120 V System:
 - 1) Black: Phase A.
 - 2) Red: Phase B.
 - 3) Blue: Phase C.
 - 4) Green: Ground.
 - 5) White: Neutral.
 - b. Conductors size No. 10 and smaller shall be colored full length. Tagging or other methods for coding of conductors size No. 10 and smaller not allowed.
 - c. For feeder conductors larger than No. 10 at pull boxes, gutters, and panels, use painted or taped band or color tag color-coded as specified above.
- B. Line Voltage Cables:
 - 1. Non-Metallic Sheathed Cable (NM) **shall not be used**. Metal Clad Cable (MC) may be used as restricted below:
 - a. Copper conductors
 - b. Sizes #12 through #8
 - c. Use only in indoor dry locations where:
 - 1) Concealed and not subject to damage.
 - 2) Not in contact with earth.

- d. Not in concrete
- C. Standard Connectors:
- 1. Conductors No. 8 And Smaller: Steel spring wire connectors.
 - 2. Conductors Larger Than No. 8: Pressure type terminal lugs.
 - 3. Connections Outside Building: Watertight steel spring wire connections with waterproof, non-hardening sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
- 1. Conductors and cables shall be continuous from outlet to outlet.
 - 2. Do not use direct burial cable.
- B. Line Voltage Conductors:
- 1. Install service and feeder conductors in raceway. Install circuits in raceway in areas where these specifications do not allow use of MC cable. Run conductors of different voltage systems in separate conduits.
 - 2. Route circuits at own discretion, however, circuiting shall be as shown in Panel Schedules.
Neutrals:
 - a. Run separate neutrals for each circuit.
 - 3. Pulling Conductors:
 - a. Do not pull conductors into conduit until raceway system is complete and cabinets and outlet boxes are free of foreign matter and moisture.
 - b. Do not use heavy mechanical means for pulling conductors.
 - c. Use only listed wire pulling lubricants.
- C. Line Voltage Cables:
- 1. Route circuits at own discretion, however, circuiting and numbering shall be as shown in Panel Schedules.
 - 2. Support cables using approved staples, cable ties, straps, hangers, or similar fittings, spaced as required.
 - 3. Where installing in framing, do not bore holes in joists or beams outside center 1/3 of member depth or within **24 inches** of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width. Holes shall be one inch diameter maximum.
 - 4. Conceal cables within ceilings and walls of finished areas.
 - 5. Keep cables **6 inches** minimum from hot water pipes.
 - 6. Do not support cables from mechanical ducts or duct supports.
 - 7. Prohibited procedures:
 - a. Boring holes for installation of cables in vertical truss members.
 - b. Notching of structural members for installation of cables.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install grounding for electrical installation as described in Contract Documents except as excluded below.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. Manufacturers:
 - 1. Type One Acceptable Products:
 - a. 'Cadweld' by Erico International, Solon, OH www.erico.com.
 - b. 'ThermOweld' by Continental Industries, Tulsa, NE www.conind.com.
- B. Performance:
 - 1. Design Criteria:
 - a. Size materials as shown on Drawings and in accordance with applicable codes.
 - b. Bonding System Workmanship:
 - 1) The ground/earthing system shall be designed for high reliability and shall meet following criteria:
 - a) Local electrical codes shall be adhered to.
 - b) All grounding/earthing conductors shall be copper.
 - c) Regulatory Agency Sustainability Approvals requirements are required.
 - c. Rack and Cabinet Grounding/Earthing:
 - 1) Equipment and racks shall be bonded in accordance with methods prescribed in ANSI/TIA-942.
- C. Materials:
 - 1. Grounding And Bonding Jumper Conductors: Bare copper or with green insulation.
 - 2. Make grounding conductor connections to ground rods and water pipes using approved bolted clamps listed for such use.
 - 3. Service Grounding Connections And Cable Splices: Make by exothermic process.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Grounding conductors and bonding jumper conductors shall be continuous from terminal to terminal without splice. Provide grounding for following.
 - 1. Electrical service, its equipment and enclosures.
 - 2. Conduits and other conductor enclosures.

3. Neutral or identified conductor of interior wiring system.
 4. Main panelboard, power and lighting panelboards.
 5. Non-current-carrying metal parts of fixed equipment such as motors, starter and controller cabinets, instrument cases, and lighting fixtures.
- B. Grounding connection to main water supply shall be accessible for inspection and made within **6 inches** of point of entrance of water line to building. Provide bonding jumpers across water meter and valves to assure electrical continuity.
- C. Ground identified grounded (neutral) conductor of electrical system on supply side of main service disconnect.
- D. Pull grounding conductors in non-metallic raceways, in flexible steel conduit exceeding **72 inches** in length, and in flexible conduit connecting to mechanical equipment.
- E. Connect equipment grounds to building system ground.
1. Use same size equipment grounding conductors as Phased conductors up through #10 AWG.
 2. Use NEC Table 250-95 for others unless noted otherwise in Drawings.
- F. Run separate insulated grounding cable from each equipment cabinet to electrical panel. Do not use intermediate connections or splices. Affix directly to cabinet.
- G. On motors, connect ground conductors to conduit with approved grounding bushing and to metal frame with bolted solderless lug.

END OF SECTION

SECTION 26 0533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Quality of material and installation procedures for raceway, boxes, and fittings used on Project
 - 2. Furnish and install raceway, conduit, and boxes used on Project
- B. Related Requirements:
 - 1. Section 26 0501: 'General Electrical Requirements'.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. Manufacturers:
 - 1. Manufacturer Contact List:
 - a. Cooper B-Line
 - b. Hubbell Incorporated
 - c. Legrand
 - d. Thomas & Betts, Memphis, TN www.tnb.com or Thomas & Betts Ltd, Iberville, PQ (450) 347-5318.
- B. Materials:
 - 1. Raceway And Conduit:
 - a. Sizes:
 - 1) **3/4 inch** for exterior use, unless indicated otherwise.
 - 2) **1/2 inch** for interior use, unless indicated otherwise.
 - b. Types: Usage of each type is restricted as specified below by product.
 - 1) Galvanized rigid steel or galvanized intermediate metal conduit (IMC) is allowed for use in all areas. Where in contact with earth or concrete, wrap buried galvanized rigid steel and galvanized IMC conduit and fittings completely with vinyl tape.
 - 2) Galvanized Electrical Metallic Tubing (EMT), Flexible Steel Conduit
 - a) Allowed for use only in indoor dry locations where it is:
 - (1) Not subject to damage.
 - (2) Not in contact with earth.
 - (3) Not in concrete.
 - b) For metal conduit systems, flexible steel conduit is required for final connections to indoor mechanical equipment.
 - 3) Schedule 40 Polyvinyl Chloride (PVC) Conduit:
 - a) Allowed for use only underground or below concrete with galvanized rigid steel or IMC elbows and risers.
 - 4) Listed, Liquid-Tight Flexible Metal Conduit:
 - a) Use in outdoor final connections to mechanical equipment, length not to exceed **36 inches**.
 - 5) Pre-wired **3/8 Inch** Flexible Fixture Whips: Allowed only for connection to recessed lighting fixtures, lengths not to exceed **72 inches**.
 - c. Prohibited Raceway Materials:
 - 1) Aluminum conduit.
 - 2) Armored cable type AC (BX) cable.
 - 2. Raceway And Conduit Fittings:

- a. Rigid Steel Conduit And IMC: Threaded and designed for conduit use.
- b. EMT:
 - 1) Compression type.
- c. PVC Conduit:
 - 1) PVC type. Use PVC adapters at all boxes.
 - 2) PVC components, (conduit, fittings, cement) shall be from same Manufacturer.
- d. Flexible Steel Conduit: Screw-in type.
- e. Liquid-tight Flexible Metal Conduit: Sealtite type.
- f. Expansion fittings shall be equal to OZ Type AX sized to raceway and including bonding jumper.
- g. Prohibited Fitting Materials:
 - 1) Crimp-on, tap-on, indenter type fittings.
 - 2) Cast set-screw fittings for EMT.
 - 3) Spray (aerosol) PVC cement.
- 3. Outlet Boxes:
 - a. Galvanized steel of proper size and shape are acceptable for all systems. Where metal boxes are used, provide following:
 - 1) Provide metal supports and other accessories for installation of each box.
 - 2) Equip ceiling and bracket fixture boxes with fixture studs where required.
 - 3) Equip outlets in plastered, paneled, and furred finishes with plaster rings and extensions to bring box flush with finish surface.
 - b. Telephone / data outlet boxes and other low voltage systems shall be 4" square box with plaster ring.
 - c. HVAC Instrumentation And Control:
 - 1) Junction boxes in mechanical equipment areas shall be 4 inches square.
 - 2) Boxes for remote temperature sensor devices shall be recessed single device.
 - 3) Boxes for thermostats shall be 4 inches square with raised single device cover.
- 4. Floor Boxes: Flush floor triple service cast iron capable of accepting 1" conduit entries. Separate compartments for 120V and low voltage systems. Heavy duty brass covers. Legrand/Wiremold or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification Of Conditions:
 - 1. Confirm dimensions, ratings, and specifications of materials to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

- A. Interface With Other Work:
 - 1. Coordinate with Divisions 22 and 23 for installation of raceway for control of plumbing and HVAC equipment.
 - 2. Coordinate with others for installation of raceways and boxes for owner provided low voltage systems.
 - 3. Before rough-in, verify locations of boxes with work of other trades to insure that they are properly located for purpose intended.
 - a. Coordinate location of outlet for water cooler with Division 22.
 - b. Coordinate location of outlets adjacent to or in millwork with GC before rough-in. Refer conflicts to Architect and locate outlet under his direction.
 - 4. Install pull wires in raceways installed under this Section where conductors or cables are to be installed under other Divisions.
- B. Conduit And Raceway:

1. Conceal raceways within ceilings, walls, and floors, except at Contractor's option, conduit may be exposed on walls or ceilings of mechanical equipment areas and above acoustical panel suspension ceiling systems. Install exposed raceway runs parallel to or at right angles to building structure lines.
 2. Keep raceway runs **6 inches** minimum from hot water pipes.
 3. Make no more than four quarter bends, 360 degrees total, in any conduit run between outlet and outlet, fitting and fitting, or outlet and fitting.
 - a. Make bends and offsets so conduit is not injured and internal diameter of conduit is not effectively reduced.
 - b. Radius of curve shall be at least minimum indicated by NEC.
 4. Cut conduit smooth and square with run and ream to remove rough edges. Cap raceway ends during construction. Clean or replace raceway in which water or foreign matter have accumulated.
 5. Bend PVC conduit by hot box bender and, for PVC **2 inches** in diameter and larger, expanding plugs. Apply PVC adhesive only by brush.
 6. Installation In Framing:
 - a. Do not bore holes in joists or beams outside center 1/3 of member depth or within **24 inches** of bearing points. Do not bore holes in vertical framing members outside center 1/3 of member width.
 - b. Holes shall be **one inch** diameter maximum.
 7. Underground Raceway And Conduit:
 - a. Bury underground raceway installed outside building **24 inches** deep minimum.
 - b. Bury underground conduit in planting areas **18 inches** deep minimum. It is permissible to install conduit directly below concrete sidewalks, however, conduit must be buried **18 inches** deep at point of exit from planting areas.
 8. Conduit And Raceway Support:
 - a. Securely support raceway with approved straps, clamps, or hangers, spaced as required.
 - b. Do not support from mechanical ducts or duct supports without Architect's written approval. Securely mount raceway supports, boxes, and cabinets in an approved manner by:
 - 1) Expansion shields in concrete or solid masonry.
 - 2) Toggle bolts on hollow masonry units.
 - 3) Wood screws on wood.
 - 4) Metal screws on metal.
 9. Prohibited Procedures:
 - a. Use of wooden plugs inserted in concrete or masonry units for mounting raceway, supports, boxes, cabinets, or other equipment.
 - b. Installation of raceway that has been crushed or deformed.
 - c. Use of torches for bending PVC.
 - d. Spray applied PVC cement.
 - e. Boring holes in truss members.
 - f. Notching of structural members.
 - g. Supporting raceway from ceiling system support wires.
 - h. Nail drive straps or tie wire for supporting raceway.
- C. Boxes:
1. Boxes shall be accessible and installed with approved cover.
 2. Do not locate device boxes that are on opposite sides of framed walls in the same stud space. In other wall construction, do not install boxes back to back.
 3. Locate boxes so pipes, ducts, or other items do not obstruct outlets.
 4. Install outlets flush with finished surface and level and plumb.
 5. Support switch boxes larger than two-gang with side brackets and steel bar hangers in framed walls.
 6. At time of substantial completion, install blank plates on uncovered outlet boxes that are for future use.

END OF SECTION

SECTION 26 2417

CIRCUIT-BREAKER PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install circuit-breaker panelboards as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Manufacturers:
 - 1. Manufacturer Contact List:
 - a. Cutler-Hammer Inc, Pittsburgh, PA www.eatonelectric.com.
 - b. General Electric Industrial Systems, Charlotte, NC www.geindustrial.com.
 - c. Siemens Energy & Automation, Alphrata, GA www.sea.siemens.com.
 - d. Square D Co, Palatine, IL www.us.squared.com.
- B. Performance:
 - 1. Capacities and ratings as scheduled.
- C. Material:
 - 1. Circuit-breaker type.
 - 2. Galvanized steel cabinets
 - 3. Bussing and lugs arranged as required.
 - 4. Multi-pole circuit-breakers shall be common trip.
 - 5. Circuit-breakers shall be molded case thermal magnetic type with inverse time characteristics.
 - 6. Main Panelboard:
 - a. Surface-mounted and front accessible.
 - b. Enclosures:
 - 1) NEMA Type 1.
 - c. Approved Products:
 - 1) Type PRL4B by Cutler-Hammer.
 - 2) Spectra Series by General Electric.
 - 3) Type P4 by Siemens.
 - 4) I-Line by Square D.
 - 7. Lighting And Appliance Panelboards:
 - a. Plug-on or bolt-on breakers. Multi-pole breakers shall be common trip.
 - b. Factory installed or provided circuit number identification for each breaker and space.
 - c. Cabinets shall be locking type with no exposed latches or screws when door is closed. Key panels alike and provide minimum of three keys.
 - d. Minimum dimensions of **20 inches** wide by **5-3/4 inches** deep.
 - e. Breakers specified to be shunt trip and shall include shunt trip accessories to remotely trip breaker using separate 120 V power source. Trip coil shall include coil-clearing contact to break coil current when breaker opens.
 - f. Use equipment from same manufacturer as main panelboard.

- g. Approved Products.
 - 1) Type PRL1a by Cutler-Hammer.
 - 2) Type AL or AQ by General Electric.
 - 3) Type P1 by Siemens.
 - 4) Type NQOD by Square D.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Label panelboards with **1/16 inch** thick laminated plastic composition material with contrasting color core. Engraved letters shall be **1/4 inch** high.
- B. Provide typewritten circuit schedules in lighting and distribution panelboards to identify panelboard and load served by each branch breaker.
- C. Arrange conductors neatly within panelboards.

3.2 PROTECTION

- A. Protect panelboards and interior components from paint, gypsum board compound, dirt, dust, and other foreign matter during construction.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install wiring devices complete with plates as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 26 0501: 'Common Electrical Requirements'.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Manufacturers:
 - 1. Manufacturer Contact List:
 - a. Cooper Wiring Devices
 - b. Hubbell
 - c. Leviton
 - d. Pass & Seymour
 - 2. Product Options:
 - a. Devices of single type shall be from same Manufacturer.
 - b. Verify device and plate color with architect and owner prior to ordering.
- B. Devices:
 - 1. Switches: 20 AMP, single pole, specification grade.
 - 2. Receptacles: 20 AMP, specification grade
 - 3. Ground Fault Circuit Interrupter (GFCI): 15 AMP, specification grade.
- C. Plates:
 - 1. Standard Cover Plates:
 - a. Office / Occupied Areas:
 - 1) Nylon or high impact resistant thermoplastic.
 - 2) Color shall match wiring device.
 - b. All Other: Stainless Steel.
 - c. Ganged switches shall have gang plates.
 - d. Exterior devices shall have weatherproof "in-use" covers
 - e. Approved Manufacturers.
 - 1) Cooper.
 - 2) Hubbell.
 - 3) Leviton.
 - 4) Pass & Seymour.EXECUTION

2.2 INSTALLATION

- A. Install devices flush with walls, straight, and solid to box.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install enclosed breakers and disconnect switches as described in Contract Documents, except those provided integral with equipment.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS ASSEMBLIES

- A. Manufacturers:
 - 1. Approved Manufacturers.
 - a. Enclosed breakers and disconnects: Same as Manufacturer of Project's panelboards.
 - b. Fuses.
 - 1) Cooper Bussmann, Ellisville, IL www.cooperbussmann.com.
 - 2) Edison Fuse, Ellisville, IL (314) 391-3443.
 - 3) Ferraz Shawmut, Newburyport, MA www.ferrazshawmut.com.
 - 4) Littelfuse Inc, Des Plaines, IL www.littelfuse.com.
- B. Disconnects:
 - 1. Heavy-duty quick-make, quick-break type, fused or non-fused unless as indicated on plans.
 - 2. Provide interlock to prevent opening of door when switch is in ON position.
 - 3. Provide means to lock switch in OFF position with padlock.
 - 4. Disconnects for motor circuits shall be horsepower rated.
 - 5. Enclosures:
 - a. Interior: NEMA Type 1.
 - b. Exterior: NEMA Type 3R.
 - 6. Fuses:
 - a. Fuse fused disconnects with dual-element time delay fuses and equip with rejection type fuse holders.
 - b. Fuses on Project shall be from single manufacturer.
 - c. Fuse sizes shall match equipment nameplate MOP where applicable.
- C. Enclosed circuit breakers: Service entrance rated with solid neutral and ground bar with ratings as shown on drawings. NEMA 1 enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Label disconnects to indicate equipment served, such as Heat Pump HP-1. Use **1/16 inch** thick laminated plastic composition material with contrasting color core. Engraved letters shall be **1/4 inch** high. Attach labels with screws.

END OF SECTION

Section 26 3200 GENERATOR

1. General

1.1. Description of System & Site

- 1.1.1. Provide a 175 kW integrated, standby power system to supply electrical power at 120/208 Volts, 60 Hertz, 3 Phase. . The generator shall consist of a liquid cooled diesel engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.
- 1.1.2. The site is an NEC ordinary location with no specific harsh environment requirements.
- 1.1.3. The genset shall be applied at the listed ambient and elevation. Bidders to submit the generators rated power output at 100 ambient (°F) and 500 elevation (Ft).
- 1.1.4. Bidders are to submit the genset's sound level in dBA at 23 ft based on the configuration specified.

1.2. Requirements of Regulatory Agencies

- 1.2.1. An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.
- 1.2.2. The generator set must conform to applicable NFPA requirements.
- 1.2.3. The generator set must include a listing for the UL2200 standard for stationary engine generator assembly.
- 1.2.4. The generator set must meet EPA federal emission guidelines for stationary emergency power generation.

1.3. Manufacturer Qualifications

- 1.3.1. This system shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility. Approved suppliers are Generac Industrial Power or an approved equal.
- 1.3.2. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.
- 1.3.3. Manufacturer's authorized service representative shall meet the following criteria:
 - 1.3.3.1. Certified, factory trained, industrial generator technicians
 - 1.3.3.2. Service support 24/7
 - 1.3.3.3. Service location within 200 miles
 - 1.3.3.4. Response time of 4 hours
 - 1.3.3.5. Service & repair parts in-stock at performance level of 95%

1.4. Submittals

- 1.4.1. Engine Generator specification sheet
- 1.4.2. Controls specification sheet(s)
- 1.4.3. Installation / Layout dimensional drawing
- 1.4.4. Wiring schematic
- 1.4.5. Sound data

- 1.4.6. Emission certification
- 1.4.7. Warranty statement

2. Engine

2.1. Engine Rating and Performance

- 2.1.1. The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.
- 2.1.2. The engine shall support a 100% load step.
- 2.1.3. The generator system shall support generator start-up and load transfer within 10 seconds.

2.2. Engine Oil System

- 2.2.1. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter with internal bypass and replaceable element.
- 2.2.2. The engine shall operate on mineral based oil. Synthetic oils shall not be required.
- 2.2.3. The oil shall be cooled by an oil cooler which is integrated into the engine system.

2.3. Engine Cooling System

- 2.3.1. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.
- 2.3.2. Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.
- 2.3.3. A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

2.4. Engine Starting System

- 2.4.1. Starting shall be by a solenoid shift, DC starting system.
- 2.4.2. The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendations. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.
- 2.4.3. The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.
- 2.4.4. The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

2.5. Engine Fuel System

- 2.5.1. The engine fuel system shall be designed for operation on #2 diesel fuel and cold weather diesel blends.
- 2.5.2. The engine shall include a primary fuel filter, water separator, manual fuel priming pump, and engine flexible fuel lines must be installed at the point of manufacture. Element shall be replaceable paper type.
- 2.5.3. The engines suction line shall be fitted with a check valve to secure prime for the engines injection pump.

2.6. Engine Controls

- 2.6.1. Engines that are equipped with an electronic engine control module (ECM), shall monitor and control engine functionality and seamlessly integrate with the genset controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the genset controller in standard language – fault code numbers are not acceptable.
- 2.6.2. For engines without ECM functionality or for any additional genset controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.
- 2.6.3. Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.7. Engine Exhaust & Intake

- 2.7.1. The engine exhaust emissions shall meet the EPA emission requirements for standby power generation.
- 2.7.2. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.
- 2.7.3. The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.
- 2.7.4. For gensets in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.
- 2.7.5. The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

3. Alternator

- 3.1. The alternator shall be the voltage and phase configuration as specified in section 1.1.1.
- 3.2. The alternator shall be a 4-pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

- 3.3. The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating (250% for 50Hz operation) for 10 seconds.
- 3.4. The alternator shall support 100 skVA with a maximum voltage dip of 20%.
- 3.5. Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.
- 3.6. The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.
- 3.7. The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise. The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.
- 3.9. An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

4. Controls

- 4.1. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.
- 4.2. The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: bi-fuel control, engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.
- 4.3. Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.
- 4.4. The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.
- 4.5. Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.
- 4.6. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.
- 4.7. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.
- 4.8. In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

- 4.9. The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), communications support via RS232 and RS485. Additional I/O must be an available option.
- 4.10. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.
- 4.11. The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

5. Engine / Alternator Packaging

- 5.1. The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.

A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

- 5.3. The generator shall include a unit mounted auxiliary power load center. All ancillary AC devices (block heater, battery charger, alternator strip heater, etc) shall have a dedicated breaker within the load center.

5.4. Enclosure

5.4.1. The genset shall be packaged with an aluminum level 1 sound attenuating enclosure with 150MPH wind kit.

5.4.2. The enclosure shall be completely lined with sound deadening material. This material must be of a self extinguishing design with a reflective surface for enhanced serviceability.

5.4.3. The enclosure shall be made of with a minimum thickness of 16 gauge. The enclosure is to have hinged, removable doors to allow access to the engine, alternator and control panel. The hinges shall allow for door fit adjustment. Hinges and all exposed fasteners will be stainless steel or Sermagard coated. The use of pop-rivets weakens the paint system and not allowed on external painted surfaces. Each door will have lockable hardware with identical keys.

5.4.4. The enclosure shall be coated with electrostatic applied powder paint, baked and finished to manufacturer's specifications. The color will be manufacturer's standard. The enclosure shall utilize an upward discharging radiator hood. Due to concerns relative to radiator damage, circulating exhaust, and prevailing winds, equipment without a radiator discharge hood will not be acceptable.

5.4.6. The genset silencer shall be mounted on the discharge hood of the enclosure. Due to architectural concerns, silencers mounted on the top of the generator enclosure are not acceptable. Gensets with silencers mounted inside the main generator compartment are acceptable only if the silencer is thermally wrapped to minimize heat stress on the surrounding components.

5.5. Sub-base fuel tank

5.5.1. The packaging shall include a double wall, sub-base mounted, UL142 listed fuel tank. The tank shall be sized to provide 70 hours of run time at full load (950 gal +/-25 gal for generator specified).

5.5.2. The tank shall include fuel suction and return connections, normal and emergency vents, secondary containment emergency vent and rupture basin sensor, mechanical fuel level indication and a stub-up area convenient for electrical conduit entry.

5.5.3. The fuel tank shall use an electric fuel sensor to provide an analog indication of fuel level. The

controller shall have a warning indication on low fuel level and provide optional shutdown functionality for low, low fuel level.

5.5.4. The fuel tank must be supplied by the engine-generator set manufacturer and be installed before shipment.

6. Loose Items

Supplier to itemize loose parts that require site mounting and installation. Preference will be shown for gensets that factory mount items like mufflers, battery chargers, etc.

6.2. Spare Parts:

6.2.1. Fuses: One spare set

6.2.2. Filters One spare set (air, fuel, oil)

6. Additional project requirements

6.3. Factory testing

6.3.1. Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

6.3.1.1. Verify voltage & frequency stability.

6.3.1.2. Verify transient voltage & frequency dip response.

6.3.1.3. Load test the generator for 2 hours.

6.4. Manuals

6.4.1. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

6.5. Installation

6.5.1. Contractor shall install the complete electrical generating system including all external fuel connections in accordance with requirements of NEC, NFPA, and the manufacturer's recommendations as reviewed by the Engineer.

6.6. Service

6.6.1. Supplier of the genset and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

6.7. Warranty

6.7.1. The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of ten (10) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.

6.7.2. The warranty period shall commence when the standby power system is first placed into service.

Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

6.8. Startup and Commissioning

6.8.1. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to validate the completed installation and to perform an initial startup inspection to include:

6.8.1.1. Ensuring the engine starts (both hot and cold) within the specified time.

6.8.1.2. Verification of engine parameters within specification.

6.8.1.3. Verify no load frequency and voltage, adjusting if required.

6.8.1.4. Test all automatic shutdowns of the engine-generator.

6.8.1.5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

7.7. Training

7.7.1. Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

7.7.2. Training is to include manual operation of system.

SECTION 26 3600

AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.1 Scope

Furnish and install automatic transfer switch (ATS) 120/208V, 3-phase with overlapping neutral, 800A, 42KAIC. ATS shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.2 Acceptable Manufacturers

Automatic transfer switch shall be ASCO Series 300 or equal. ATS and generator shall be furnished by the same supplier for this project.

1.3 Codes and Standards

The automatic transfer switches and accessories shall conform to the requirements of:

- A. UL 1008 - Standard for Automatic Transfer Switches
- B. CSA C22.2 No.178 – 1978
- C. NFPA 70 - National Electrical Code
- D. NFPA 99 – Health Care Facilities
- E. NFPA 110 - Emergency and Standby Power Systems
- F. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- G. NEMA Standard ICS10-2005 (formerly ICS2-447) - AC Automatic Transfer Switches
- H. NEC Articles 700, 701, 702
- I. International Standards Organization ISO 9001: 2008
- J. IEC 60947 – 6 – 1

PART 2 PRODUCTS

2.1 Mechanically Held Transfer Switch

- A. The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include over current disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

- B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.
- C. All main contacts shall be silver composition. Switches rated 800 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- E. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- F. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.2 Group 'G' Controller with Integrated User Interface Panel

- A. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.
- B. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, inherent serial communications capability, and the ability to communicate via the Ethernet through optional communications module
- C. A single controller shall provide single and three phase capability for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to $\pm 1\%$ of nominal voltage. Frequency sensing shall be accurate to $\pm 0.1\text{Hz}$. Time delay settings shall be accurate to $\pm 0.5\%$ of the full scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C, and storage from -55 to + 85 degrees C.
- D. The controller shall be enclosed with a protective cover and be mounted separate from the transfer switch unit for safety and ease of maintenance. Sensing and control logic shall be provided on printed circuit boards.
- E. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1. IEC 60947 – 6 – 1 Multiple Function Equipment Transfer Switching Equipment. 61000-4 Testing And Measurement Techniques - Overview
 - a. IEC 61000 – 4 - 2 Electrostatic Discharge Immunity
 - b. IEC 61000 – 4 - 3 Radiated RF Field Immunity
 - c. IEC 61000 – 4 - 4 Electrical Fast Transient/Burst Immunity

- d. IEC 61000 – 4 - 5 Surge Immunity
 - e. IEC 61000 – 4 – 6 Conducted RF Immunity
2. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions

2.3 Enclosure

- A. The ATS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
- B. Controller shall be mounted on, visible, and operational through enclosure door.

PART 3 OPERATIONS

3.1 Controller Display and Keypad

- A. A 128*64 graphical LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through communications port. The following parameters shall only be adjustable via DIP switches on the controller.
 1. Nominal line voltage and frequency
 2. Single or three phase sensing on normal
 3. Transfer operating mode configuration, (open transition, or delayed transition)

All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or manuals.

3.2 Voltage and Frequency Sensing

- A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup ,dropout, and trip settings capabilities (values shown as % of nominal unless otherwise specified).

<u>Parameter</u>	<u>Sources</u>	<u>Dropout/Trip</u>	<u>Pickup/Reset</u>
Undervoltage	N & E	70 to 98%	85 to 100%
Overvoltage	N & E	102 to 116%	2% below trip
Underfrequency	N & E	85 to 98%	86 to 100%
Overfrequency	N & E	101 to 111%	2% below trip

- B. Repetitive accuracy of all settings shall be within 1% at +25C
- C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
- D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency. *Note: Single phase sensing on emergency*

- E. The backlit 128*64 graphical display shall have multiple language capability. Languages can be selected from the user interface.

3.3 Time Delays

- A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals, adjustable 0 to 6 seconds. It shall be possible to bypass the time delay from the controller user interface.
- B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes 59 seconds for controlled timing of transfer of loads to emergency. It shall be possible to bypass the time delay from the controller user interface.
- C. A generator stabilization time delay shall be provided after transfer to emergency adjustable 0 or 4 seconds.
- D. A time delay shall be provided on retransfer to normal, adjustable 0 to 9 hours 59 minutes 59 seconds. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
- E. A cooldown time delay shall be provided on shutdown of engine generator, Adjustable 0 to 60 minutes 59 seconds.
- F. All adjustable time delays shall be field adjustable without the use of special tools.
- G. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minutes 59 seconds time delay in any of the following modes:
 - 1. Prior to transfer only.
 - 2. Prior to and after transfer.
 - 3. Normal to emergency only.
 - 4. Emergency to normal only.
 - 5. Normal to emergency and emergency to normal.
 - 6. All transfer conditions or only when both sources are available.
- H. In the event that the alternate source is not accepted within the configured Failure to Accept time delay, the common alert indication shall become active.
- I. The controller shall also include the following built-in time delay for delayed transition operation.
 - 1. A time delay for the load disconnect position for delayed transition operation adjustable 0 to 5 minutes 59 seconds.

3.4 Additional Features

- A. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.
- B. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred.
- C. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed when the ATS is connected to the emergency source.
- D. A single alarm indication shall light up the alert indicator and de – energize the configured common alarm output relay for external monitoring.
- E. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- F. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal (green) and emergency (red) source, as determined by the voltage sensing trip and reset settings for each source.
- G. LED indicating light shall be provided to indicate switch not in automatic mode (manual); and blinking (amber) to indicate transfer inhibit.
- H. LED indicating light shall be provided to indicate any alarm condition or active time delay (red).
- I. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
- J. A variable window inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO feature 27.
- K. An engine generator exercising timer shall be provided to configure weekly and bi- weekly automatic testing of an engine generator set with or without load for 20 minutes fixed. It shall be capable of being configured to indicate a day of the week, and time weekly testing should occur.
- L. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency. This inhibit signal can be enabled through the keypad or serial port.
- M. System Status - The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key. This screen shall display a clear description of the active operating sequences and switch position. For example,

**Normal Failed
Load on Normal
TD Normal to Emerg
2min15s**

Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual are not permissible.

- N. Self Diagnostics – The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status input signals to the controller which may be preventing load transfer commands from being completed.
- O. Communications Interface – The controller shall be capable of interfacing, through an optional serial communication port with a network of transfer switches, locally (up to 4000 ft.). Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control, and setup of parameters.
- P. Data Logging – The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non – volatile memory.

1. Event Logging

- 1. Data and time and reason for transfer normal to emergency
- 2. Data and time and reason for transfer emergency to normal
- 3. Data and time and reason for engine start
- 4. Data and time engine stopped
- 5. Data and time emergency source available
- 6. Data and time emergency source not available

2. Statistical Data

- 1. Total number of transfers
- 2. Total number of transfers due to source failure
- 3. Total number of day’s controller is energized
- 4. Total number of hours both normal and emergency sources are Available
- 5. Total time load is connected to normal
- 6. Total time load is connected to emergency
- 7. Last engine start
- 8. Last engine start up time
- 9. Input and output status

4.1 Additional Features

A. Accessory Package - An accessory bundle shall be provided that includes:

1. A fully programmable engine exerciser with seven independent routines to exercise the engine generator, with or without load on a daily weekly, bi – weekly, or monthly basis.
2. Event log display that shows event number, time and date of events, event type, and reason (if applicable). A minimum of 300 events shall be stored.
3. RS – 485 communications port enabled.
4. Common alarm output contact.

(This feature shall be equal to ASCO accessory 11BE, and shall be capable of being activated for existing switches through optional accessory dongle).

B. Controller Power Supply - A backup power UPS shall be provided to allow controller to run for 3 minutes minimum without AC power. (This feature shall be equal to ASCO accessory 1UP, and shall be capable of being added to existing switches without modification).

C. Current Sensing Card - A load current metering card shall be provided that measures either single or three phase load current. It shall include current transformers (CT's) and shorting block. Parameters shall be able to be viewed via the user interface. (This feature shall be equal to ASCO accessory 23GA (single phase), 23GB (three phase), and shall be capable of being added to existing switches without modification).

D. Communications Module – Shall provide remote interface module to support monitoring of vendor's transfer switch, controller and optional power meter. Module shall provide status, analog parameters, event logs, equipment settings & configurations over embedded webpage and open protocol. Features shall include:

1. Email notifications and SNMP traps of selectable events and alarms may be sent to a mobile device or PC.
2. Modbus TCP/IP, SNMP, HTTP, SMTP open protocols shall be simultaneously supported.
3. Web app interface requiring user credentials to monitor and control the transfer switch supporting modern smart phones, tablets and PC browsers. User will be able to view the dynamic one-line, ATS controls status, alarms, metering, event logging as well as settings.
4. Secure access shall be provided by requiring credentials for a minimum of 3 user privilege levels to the web app, monitor (view only), control (view and control) and administrator (view, control and change settings). 128-Bit AES encryption standard shall be supported for all means of connectivity.
5. Shall allow for the initiating of transfers, retransfers, bypassing of active timers and the activating/deactivating of engine start signal shall be available over the embedded webpage and to the transfer switch vendor's monitoring equipment.
6. An event log displaying a minimum of three-hundred (300) events shall be viewable and printable from the embedded webpages and accessible from supported open protocols.
7. Four (4) 100 Mbps Ethernet copper RJ-45 ports, two (2) serial ports, and LEDs

- for diagnostics.
8. DIN rail mountable.

This option shall be equivalent to ASCO accessory 72EE

- E. Transfer Alarm** - An audible alarm with silencing feature shall be provided to signal each time transfer to emergency occurs. (This feature shall be equal to ASCO accessory 62W).
- F. Surge Suppression** – A TVSS with a surge current rating of 65kA shall be provided with individually matched fused metal oxide varistors (MOVs). It shall include LED status indication of normal operation, under voltage, power loss, phase loss or component failure. Shall include form C dry contacts for external alarm or monitoring. The unit shall be enclosed in a Noryl housing rated NEMA 4, 12, and 4X. Shall comply with UL 1449 3rd edition (This feature shall be equal to ASCO accessory 73, and shall be capable of being added to existing switches).

PART 5 ADDITIONAL REQUIREMENTS

5.1 Tests and Certification

- A.** The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B.** The ATS manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2008.

5.2 Service Representation

- 5.2.1 The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.
- 5.2.2 The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.
- 5.2.3 For ease of maintenance, the transfer switch nameplate shall include drawing numbers and serviceable part numbers.

SECTION 26 5100
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install lighting system as described in Contract Documents, complete with lamps.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.
- C. Reference Standards:
 - 1. Federal Communications Commission (FCC):
 - a. Code of Federal Regulations (CFR):
 - 1) FCC 47 CFR Part 18, 'Industrial, Scientific, and Medical Equipment.'
 - 2. Institute of Electrical and. Electronics Engineers (IEEE) / American National Standards Institute (ANSI):
 - a. IEEE / ANSI C62.41.1-2002, 'Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.'

PART 2 - PRODUCTS

2.1 ASSEMBLIES

- A. Manufacturers: Provide fixtures equal to those specified in fixture schedule.
- B. Factory Assembly:
 - 1. Fixtures shall be fully assembled complete with necessary wiring, sockets, lamps, reflectors, ballasts, auxiliaries, plaster frames, recessing boxes, hangers, supports, lenses, diffusers, and other accessories essential for complete working installation.
- C. Controls: Provide automatic lighting controls in accordance with the requirements of the 2018 NC Energy Conservation Code. See drawings for vacancy sensor requirements and acceptable manufacturers. Submit for approval.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Interface With Other Work:
 - 1. Coordinate fixture locations with GC and other trades.
 - 2. In mechanical equipment rooms, coordinate locations of light fixtures with equipment locations to provide proper room illumination without obstruction. Suspend fixtures that must be mounted below pipes, ducts, etc, with chains or other Architect approved method.
- B. Securely mount fixtures. Support fixtures weighing **50 lbs** or more from building structural members.
- C. Where recessed fixtures are to be installed, provide openings, plaster rings, etc, of exact dimensions for such fixtures to be properly installed. Coordinate fixture installation with ceiling type and thickness.

Terminate circuits for recessed fixtures in an extension outlet box near fixture and connect with specified flexible conduit.

3.2 ADJUSTMENT

- A. Repair scratches or nicks on exposed surfaces of fixtures to match original undamaged conditions.

END OF SECTION

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install exterior lighting system as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 26 0501: Common Electrical Requirements.

PART 2 - PRODUCTS

2.1 SYSTEM

- A. Materials:
 - 1. Exterior Fixtures:
 - a. Provide as scheduled. Finishes to be selected.
 - 2. Exterior Lighting Control:
 - a. Photo Cell:
 - 1) 120 volts.
 - 2) Approved Products.
 - a) Paragon: CW201-00.
 - b) Tork: 2101.

PART 3 - EXECUTION

3.1 INSTALLATION

- 1. Locate photocells outside buildings under soffits and away from any light source and direct sunlight. Orient to north sky.

END OF SECTION

SECTION 26 7000

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install fire alarm and detection system as described in Contract Documents.
 - 2. Furnish and install **raceways**, cable and conductors, boxes, and miscellaneous items necessary for complete system.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 72, 'National Fire Alarm and Signaling Code.' (2010 Edition).
- B. Underwriters Laboratories:
 - 1. UL 1481, 'Power Supplies for Fire-Protective Signaling Systems'.
 - 2. UL 268, 'Smoke Detectors for Fire Alarm Systems'.
 - 3. UL 464, 'Audible Signal Appliances'.
 - 4. UL 521, 'Heat Detectors for Fire Protective Signaling Systems'.
 - 5. UL 864, 'Control Units and Accessories for Fire Alarm Systems'.

1.3 SUBMITTALS

- A. Submittals:
 - 1. Shop Drawings:
 - a. Prepared by authorized factory representative and including:
 - 1) Single line diagram of actual system. Typical riser diagrams are not acceptable.
 - 2) Complete wiring diagrams.
 - 3) Manufacturer's original catalog data and descriptive information on each piece of equipment to be used.
- B. Informational Submittals:
 - 1. Certificates:
 - a. Certificate of completion, from Manufacturer's Representative, in accordance with NFPA 72 requirements.
- C. Closeout Submittals:
 - 1. Include following information in Operations And Maintenance Manual:
 - a. Operations and Maintenance Data:
 - 1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
 - 2) Provide instruction manual from Manufacturer that explains what is to be done in event of various indications.
 - b. Record Documentation:
 - 1) Include copy of approved shop drawings.

1.4 QUALITY ASSURANCE

- A. Regulatory Agency Sustainability Approvals:
 - 1. System shall meet approval of authority having jurisdiction (AHJ). NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
 - 2. Equipment, devices, and cable shall be UL listed for use in fire alarm systems.

PART 2 - PRODUCTS

2.1 SYSTEMS

- A. Manufacturers:
 - 1. Acceptable Manufacturers:
 - a. Fire-Lite Alarms, Northford, CT www.firelite.com.
 - b. EST by Edwards, Bradenton, FL www.edwardsutcfs.com.
 - c. Silent Knight Security Systems, Northford CT www.silentknight.com.
 - d. Equal as approved by Architect before bidding..
- B. Performance:
 - 1. Design Criteria:
 - a. Automatic fire alarm system consisting of control panel, power supplies, alarm initiating devices, notification appliances, and off-site communicating devices. System shall be non-coded, addressable, and monitored for integrity of conductors.
 - b. Class A loop type initiating device circuits and Class A loop type notification appliance circuits.
 - c. Equipment and accessories furnished under this Specification shall be standard products of single manufacturer, or include written statement by Control Panel Manufacturer confirming compatibility of components and inclusion of these components under system warranty.
- C. Operation:
 - 1. Operation Sequences:
 - a. Operation of manual station or automatic activation of any smoke detector, heat detector, or sprinkler flow device shall:
 - 1) Cause system notification appliances to operate.
 - 2) Indicate device in alarm on control panel.
 - 3) Initiate off-site alarm notification system.
 - 4) Indicate device in alarm on remote annunciator.
 - b. System shall return to normal when operated device is returned to normal and control panel is manually reset, except alarms may be silenced as specified below.
 - c. Alarm may be silenced by switch in control panel.
 - 1) Ring Back Feature: When silenced, this shall not prevent the resounding of subsequent alarms if another zone should alarm.
 - d. Green pilot LED, or other visual annunciation, shall normally be on indicating that system is receiving normal power. In addition, failure of normal power shall be annunciated.
 - e. Trouble alarm and annunciation, operating together, shall signal trouble condition. Following conditions shall signal trouble condition:
 - 1) Failure of normal power.
 - 2) Opens or short circuits on indicating circuits.
 - 3) Disarrangements in system wiring.
 - 4) Control panel circuit board removal.
 - 5) Ground faults.
 - 6) Trouble silencing switch shall silence trouble alarm, but visual annunciation shall remain on until system is restored to normal. As ring-back feature, trouble alarm shall resound as reminder to return silencing switch to normal position.
 - f. Supervisory LED, separate from trouble LED, and alarm, operating together, shall signal operation of supervisory device, such as control valve tamper, low air pressure, and low temperature switches. Alarm silence switch shall operate in same manner as trouble alarm.

- D. Components:
1. Control Panel:
 - a. Listed under UL Standard 864.
 - b. Solid-state design with flush or semi-flush mounting.
 - c. Control functions shall be behind locked door with annunciating devices visible through door. Single key shall operate all keyed functions in system. Provide three keys.
 - d. Each addressable loop shall be electrically supervised in accordance with wiring style specified.
 - e. Provide integral surge protection.
 - f. Make provisions for connection to off-site alarm notification system including all required programming. Provide separate dry contacts for alarm and supervisory/trouble alarms.
 - g. Power Supply:
 - 1) Provide indication of normal power supply.
 - 2) Loss of normal power shall activate trouble alarm.
 - 3) Meet requirements of and size in accordance with UL Standard 1481 and NFPA 72.
 - 4) Include standby batteries, charger, and automatic transfer equipment.
 - h. Visual Annunciation:
 - 1) Separate indication on each device for alarm, trouble, or supervisory conditions.
 - 2) Visual indication shall be by LED lights or other easily identifiable method.
 - 3) Fault or trouble condition on any device shall not affect any other device.
 - i. Audible Horn Alarm Annunciation:
 - 1) Provide separate and distinct alarm signals for alarm and trouble conditions.
 - 2) Alarm signal shall also operate strobe lights, if specified.
 - 3) Provide alarm silence switches at control panel.
 - 4) Trouble alarm shall be horn integral to control panel.
 - 5) Supervisory alarm may be same audible alarm as trouble alarm, but with separate visual annunciation.
 2. Off-Site Alarm Notification System
 - a. Provide two (2) telephone lines to fire alarm control panel.
 - b. Provide dialer system equipment and programming compatible with Owner selected monitoring service.
 - c. Owner will arrange for monitoring connection contract.
 3. Alarm Initiating Devices:
 - a. Smoke Detectors:
 - 1) Photoelectric type.
 - 2) Listed under UL Standard 268.
 - 3) Provide visual indication of alarm on unit.
 - b. Heat Detectors:
 - 1) Non-settable 135 deg F fixed temperature.
 - 2) Provide visible indication that device has operated.
 - 3) Listed under UL Standard 521.
 - c. Manual Fire Alarm Boxes:
 - 1) Non-coded and double-action requiring two actions to initiate alarm. Breakable glass type is not approved.
 - 2) Box shall mechanically latch when actuated and require key to reset. Key shall match control panel door lock.
 4. Notification Appliances:
 - a. Color: Red
 - b. Combination Horn / Strobe:
 - 1) Wall mounted flush or semi-flush.
 - 2) Non-coded audible output of 90 dB minimum at 10 feet.
 - 3) Integrally mounted flashing light unit with block letters 'FIRE.' Minimum light intensity as specified on plans and flash rate between one and three Hertz.
 - 4) Listed under UL Standards 464 and 1971.
 - c. Strobe Only:
 - 1) Wall mounted flush or semi-flush.
 - 2) Integrally mounted flashing light unit with block letters 'FIRE.' Minimum light intensity as specified on plans and flash rate between one and three Hertz.
 - 3) Listed under UL Standard 1971.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fire alarm and detection systems as indicated, in accordance with Equipment Manufacturer's written instructions, and complying with applicable portions of NEC, NFPA, and NECA's 'Standard of Installation.'
 - 1. Mounting Heights:
 - a. Unless otherwise indicated, mount center of outlets or boxes at following heights above finish floor:
 - 1) Control Panel: 72 inches to top.
 - 2) Wall-Mounted Horn / Strobe: 90 inches or 6 inches below ceiling, whichever is greater.
 - 3) Wall-Mounted Strobe: 90 inches or 6 inches below ceiling, whichever is greater.
 - 4) Manual pull stations: 48 inches.
 - 5) Remote annunciator panel: 48 inches.
- B. Identification:
 - 1. Post copy of wire identification list inside fire alarm panel door or other area accessible to fire alarm service personnel.
 - 2. Print location of circuit disconnecting means inside panel.
- C. Conductors:
 - 1. Install conductors and make connections to water flow switches, valve tamper switches, low air pressure switches, and duct smoke detectors.
 - 2. Loop wires through each device on zone for proper supervision. Tee-taps not permitted.
 - 3. Minimum conductor size shall be 14 AWG unless otherwise specified.
- D. Do not install ceiling mounted detectors within 36 inches of air discharge grilles. Do not install manual fire alarm boxes within 24 inches of light switches. Coordinate with other trades as required.
- E. Cables are required to be in conduit only where they are subject to physical damage and for stubs above ceilings from boxes in wall. Secure cables above ceilings with J-hooks.

3.2 FIELD QUALITY CONTROL

- A. Field Tests:
 - 1. Provide factory-trained representative to perform complete system testing in presence of Owner's representative and local fire department personnel upon completion of installation.
 - a. Test each initiating and annunciating device for proper operation, except fixed temperature heat detectors.
 - b. Test operation of trouble annunciation on each circuit.
 - c. Perform complete testing of control panel functions including off-site monitoring.

3.3 CLOSEOUT ACTIVITIES

- A. Instruction Of Owner:
 - 1. Instruct Owner's Representative in proper operation and maintenance procedures.

3.4 PROTECTION

- A. Provide dust protection for installed smoke detectors until finish work is completed and building is ready for occupancy. Protect conductors from cuts, abrasion and other damage during construction.

END OF SECTION