

January 6, 2015

ADDENDUM NO. 1
to the
Iowa Department of Transportation
Proposal No. 13350
For Jasper County Rest Are I-80 WB
Letting Date: January 14, 2015

Notice To Bidders:

This Addendum is issued to incorporate the following additions, deletions, corrections, and/or clarifications to the terms or specifications and shall hereby be considered a part of the final contract documents. This Addendum shall supersede, modify and/or change all statements to the contrary in the bid proposal and shall take precedence over previous terms or specifications.

Bidders shall acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to disqualification. Bidders have the singular responsibility to make this Addendum available to all sub-bidders.

CHANGE:

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents dated 9-12-14 as noted below. All bidders shall confirm that the bidding document set(s) issued to them contain all pages scheduled on the Drawing Sheet Index and the Index to specifications in the Project Manual. Contact DOT for a complete copy if all items are not included.

Make the following modifications:

CHANGES TO THE SPECIFICATIONS:

1. Section 07 21 00 Thermal Insulation: Foam Control Plus 250 25 psi.R-10 from ACH Foam Technologies is approved for foam-plastic board insulation applications subject to compliance with all criteria identified.
2. Add Section 7 21 26 Fluid-Applied Membrane Air Barriers as follows:

SECTION 07 27 26
FLUID-APPLIED MEMBRANE AIR BARRIERS

GENERAL

RELATED DOCUMENTS

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

SUMMARY

Section includes fluid-applied, vapor-retarding membrane air barriers for concrete and CMU exterior wall assemblies.

DEFINITIONS

Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

ACTION SUBMITTALS

Product Data: For each type of product.

Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

INFORMATIONAL SUBMITTALS

Qualification Data: For Installer.

Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

QUALITY ASSURANCE

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

DELIVERY, STORAGE, AND HANDLING

Remove and replace liquid materials that cannot be applied within their stated shelf life.

Protect stored materials from direct sunlight.

FIELD CONDITIONS

Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

Protect substrates from environmental conditions that affect air-barrier performance.

Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PRODUCTS

MATERIALS, GENERAL

Source Limitations: Obtain primary air-barrier materials and accessories from single source from single manufacturer.

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

PERFORMANCE REQUIREMENTS

General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

Material Compatibility: Air-barrier materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by air-barrier manufacturer based on testing and field experience.

Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 283, ASTM E 783, or ASTM E 2357.

VAPOR-RETARDING MEMBRANE AIR BARRIER

Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric synthetic polymer membrane.

Products: Subject to compliance with requirements, provide one of the following:

BASF; Enershield-I / Enershield-FIL.

Carlisle Coatings & Waterproofing; Fire Resist Barritech NP

Henry Company; Air-Bloc 32MR.

Sto Corp; StoGuard VaporSeal.

TK-AirMax 2102 Non-Permeable Air Barrier

Physical and Performance Properties:

Dry-Film Thickness (Installed): 40-mils, minimum.

Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.

Vapor Permeance: Maximum 0.1 perm; ASTM E 96/E 96M.

Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.

Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

ACCESSORY MATERIALS

General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier material and other adjacent material(s) accessory material will be in contact with.

Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.

Counterflashing and Transition Strips: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced surface laminated to layer of adhesive with release liner backing; as recommended by air-barrier manufacturer for specific application.

Joint Reinforcing Strip: Air-barrier manufacturer's glass-fiber-mesh tape.

Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

Adhesive and Tape: Air-barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

Sprayed Polyurethane Foam Sealant: One- or two-component, foamed-in-place, polyurethane foam sealant, 1.5- to 2.0-lb/cu. ft density; flame-spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants."

Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

EXECUTION

EXAMINATION

Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.

Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

Verify that masonry joints are flush and completely filled with mortar.

Proceed with installation only after unsatisfactory conditions have been corrected.

SURFACE PREPARATION

Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

Remove excess mortar from masonry ties, shelf angles, and other obstructions.

At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

JOINT TREATMENT

Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air-barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.

Prime substrate and apply a single thickness of air-barrier manufacturer's recommended preparation coat extending a minimum of 3 inches along each side of joints and cracks. Apply a double thickness of fluid air-barrier material and embed a joint reinforcing strip in preparation coat.

TRANSITION STRIP INSTALLATION

General: Install strips, transition strips, and accessory materials according to air-barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

Prime substrates with number of prime coats needed to achieve required bond, with adequate drying time between coats.

Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.

Roll firmly to enhance adhesion.

Seal around all penetrations through air barrier with termination mastic/sealant, membrane counter-flashing or other procedures according to manufacturer's instructions, ensuring chemical compatibility among adjoining materials.

Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing strip.

Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

FLUID AIR-BARRIER MEMBRANE INSTALLATION

General: Apply fluid air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions. Apply fluid air-barrier material within manufacturer's recommended application temperature ranges.

Apply primer to substrates at required rate and allow it to dry.

Limit priming to areas that will be covered by fluid air-barrier material on same day. Reprime areas exposed for more than 24 hours.

Membrane Air Barriers: Apply a continuous unbroken air-barrier membrane to substrates according to the following thickness. Apply air-barrier membrane in full contact around protrusions such as masonry ties.

Vapor-Retarding Membrane Air Barrier: Total dry film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 40-mil dry film thickness applied in one or more equal coats.

Apply strip and transition strip over cured air-barrier material overlapping 3 inches onto each surface according to air-barrier manufacturer's written instructions.

Do not cover air barrier until it has been inspected by Owner's representative.

Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

FIELD QUALITY CONTROL

Inspections: Arrange for air/vapor barrier manufacturer's technical personnel to make periodic site visits to inspect materials, accessories, and installation for compliance with requirements. Inspections shall include the following at a minimum:

Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.

Continuous structural support of air-barrier system has been provided.

Surfaces are smooth, clean, and free of cavities and protrusions.

Site conditions for application temperature and dryness of substrates have been maintained.

Maximum exposure time of materials to UV deterioration has not been exceeded.

Surfaces have been primed, if applicable.

Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.

Termination mastic has been applied on cut edges.

Strips and transition strips have been firmly adhered to substrate.

Compatible materials have been used.

Transitions at changes in direction and structural support at gaps have been provided.

Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.

All penetrations have been sealed.

Air barriers will be considered defective if they do not pass inspections. Repair or replace defective installations according to manufacturer's written instructions.

Manufacturer's technical personnel shall provide written report stating that installation complies with manufacturer's written instructions.

CLEANING AND PROTECTION

Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than time period allowed by manufacturer, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.

Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

Remove masking materials after installation.

END OF SECTION 07 27 26

3. Section 08 44 13 Aluminum Storefront & Entrances: EFCO 960 Series is an approved system.
4. Section 08 51 13 Aluminum Windows:
 - A. 1.5: Warranty of aluminum finish should be for a period of 10 years.
 - B. EFCO 403 Series is an approved system.
5. Section 08 80 00 Glazing, 1.2.B.: Delete reference to Section 08 83 00 Mirrors. These are a part of the toilet accessories.
6. Section 10 21 13 Metal Toilet Compartments: Add the following as acceptable manufacturers:
Metpar Corporation, Sanymetal Products, Mills Company, All American Metal Manufacturers, General Partition Company, American Sanitary Partitions and Flush-Metal Partitions.

CHANGES TO DRAWINGS:

7. Sheet A10.01: Delete reference to Openings 114D and 114E in the Door Schedule. These openings do not exist.
8. Sheet A10.03:
 - A. Elevation B3: reference to Doors 114D & 114E should be changed to read 101A and 101B.
 - B. Glazing Framing table reference "SF-1" should read 2" x 6".
 - C. Glazing Framing table reference "CW-1" should be deleted. This is not used.

CHANGES TO MECHANICAL SPECIFICATIONS:

9. Manufacturer Approved Equals:

	<u>SECTION</u>	<u>ITEM</u>	<u>APPROVED EQUAL</u>
A.	23 31 00 – HVAC Duct and Casings	Manufactured Duct	Lindab
B.	22 10 06 – Plumbing Specialties	Trench Drain & Wall Hydrants	Jay R Smith
C.	22 40 00 – Plumbing Fixtures	Supply Faucets	Moen Commercial

CHANGES TO MECHANICAL DRAWINGS:

10. NA

CHANGES TO ELECTRICAL SPECIFICATIONS:

11. Manufacturer Approved Equals:

	<u>SECTION</u>	<u>ITEM</u>	<u>APPROVED EQUAL</u>
A.	26 51 00 – Interior Lighting	Type L5 Series	Gammalux GB35B2
B.	26 51 00 – Interior Lighting	Type L5 Series	Finelite HP-2 ID
C.	26 51 00 – Interior Lighting	Type L6	Gammalux GB34D2
D.	26 51 00 – Interior Lighting	Type L6	Finelite HP-2 ID

CHANGES TO ELECTRICAL DRAWINGS:

12. Sheet E01.00 – Lower Level Plan – Lighting:

Purchasing Section
800 Lincoln Way, Ames, Iowa 50010

P: 515-239-1310 F: 515-239-1538
DOT.purchasing@dot.iowa.gov

A. Storage 114: Add type OC3 occupancy sensor in south west corner.

13. Sheet E05.00 – Electrical Schedules:

A. Light Fixture Schedule:

- i) Type L5, L5A, L5B: Change from Lutron Ecosystem Enabled Dimming (ES Option) to 0-10V dimming (DIM Option)
- ii) Type L6: change from Lutron Ecosystem Enabled Dimming (ES Option) to 0-10V dimming (DIM Option).
- iii) Type LW1: change mode number to: S132-K442-S-02-T-V0-0-40-TE.

ADDITIONS:

1. Electrical Specification sections are attached (Section 26 32 14 Engine Generators & 26 3600 Transfer Switches).

2. Section 26 09 55 Electric Heating Cables (attached) to the electrical specifications:

3. All Wood Roof Decking (Section 06 15 16) and Glued Laminated Construction (Section 06 18 00) are to be factory finished for all wood components, both interior and exterior. All metal components (gusset plates and ties) are to be painted in the field; high performance for exterior locations.

All Bidders must sign and return this Addendum for the bid opportunity referenced above. Failure to do so may subject the Bidder to disqualification. If a bid response has already been submitted, this Addendum shall be signed and emailed or faxed to the Purchasing Section prior to the scheduled Letting Date.

Company Name (*please print*)

Date

Signature

Sincerely,



Renee R. Shirley
Director of Purchasing
Phone No. 515-239-1578 Fax No. 515-239-1538
Renee.shirley@dot.iowa.gov

SECTION 26 32 14
ENGINE GENERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator set.
- B. Remote control panel.
- C. Battery and charger.
- D. Weatherproof enclosure.

1.02 RELATED REQUIREMENTS

- A. Division 00 - Procurement and Contracting Requirements
- B. Division 01 - General Requirements
- C. Section 26 36 00 - Transfer Switches: Automatic transfer switch.

1.03 REFERENCE STANDARDS

- A. NECA/EGSA 404 - Recommended Practice for Installing Generator Sets; National Electrical Contractors Association; 2007.
- B. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2003.
- D. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.
- E. NFPA 99 - Standard for Health Care Facilities; National Fire Protection Association; 2005.
- F. NFPA 110 - Standard for Emergency and Standby Power Systems; National Fire Protection Association; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. CSA C22.2 No. 14
- B. CSA 282
- C. CSA 100
- D. EN 61000-6
- E. EN 55011
- F. FCC Part 15 Subpart B
- G. ISO 8528
- H. IEC 61000
- I. UL 508
- J. UL 2200
- K. UL 142

1.05 SYSTEM DESCRIPTION

- A. The work includes supplying and installing a complete integrated generator system. The system consists of a propane generator set with related component accessories and automatic transfer switches specified under a separate section.
- B. The Owner shall provide a 500 gallon propane tank for the completion of all testing.
- C. A complete system load test shall be performed after all equipment is installed.
- D. The automatic transfer switch specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: The submittal shall include:
 - 1. Factory published specification sheet.
 - 2. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.
 - 3. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.
 - 4. Weights of all equipment.
 - 5. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
 - 6. Interconnect wiring diagram of complete emergency system, including generator, switchgear, battery charger, control panel, and remote alarm indications.
 - 7. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.
 - 8. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
 - 9. Generator resistances, reactances and time constants.
 - 10. Generator locked rotor motor starting curves.
 - 11. Manufacturer's and dealer's written warranty.
- 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, installation, and starting of product.
- D. Operation Data: Include instructions for normal operation covering the generator, switchgear, and auxiliary components. Two sets.
- E. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.
- C. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.
- D. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept unit on site on skids. Inspect for damage.
- B. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.09 WARRANTY

- A. Two Year Standby (ISO 8528-1: ESP) Generator Set Warranty
 - 1. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Kohler Power Systems: www.kohlerpower.com
- B. Caterpillar Inc: www.caterpillar.com.
- C. Cummins Engine Company, I: www.cummins.com.
- D. MTU Onsite Energy: www.mtuonsiteenergy.com
- E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Description: NFPA 110, engine generator system to provide source of power for Level 1 applications conforming to NFPA 99.
- B. The generator set shall be Standby Duty rated at [170] ekW/[170] KVA, 1800 RPM, 0.8 power factor, 240 V, 1-Phase, 60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 110F (43.3C) and altitude of 1,000.0 feet (304.8 m).

2.03 ENGINE

- A. The engine shall be liquid propane fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 - D2 Emissions Cycle at specified ekW / bHP rating. Utilization of the "Transition Program for Equipment Manufacturers" (also known as "Flex Credits") to achieve EPA certification is not acceptable. The in-cylinder engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder.
- B. The engine will be equipped with an isochronous electronic governor to maintain +/- 0.25% steady state frequency variation from steady state no load to steady state full load.
- C. Type: Water-cooled inline or V-type, four stroke cycle, electric ignition internal combustion engine.
- D. Rating: Sufficient to operate under 10 percent overload for one hour in an ambient of 90 degrees F at elevation of 1000 feet.
- E. Fuel System: Propane.
- F. Engine speed: 1800 rpm.
- G. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.
- H. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.
- I. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.
- J. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.
- K. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.
- L. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

2.04 GENERATOR

- A. The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G3 of IEC. The excitation system shall be of brushless construction.
- B. Generator: NEMA MG 1, single phase, four pole, reconnectable brushless synchronous generator with brushless exciter.
- C. Rating: As noted above kW, As noted above kVA, at 0.8 power factor, 240-120 volts, 60 Hz at 1800 rpm.
- D. Insulation Class: H.
- E. Temperature Rise: 130 degrees C Standby.
- F. Automatic Voltage Regulator: The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.
- G. Motor Starting: Provide locked rotor motor starting capability of skVA per respective engine at 30% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.
- H. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Include manual controls to adjust voltage droop, voltage level (plus or minus 5 percent) and voltage gain.

2.05 CIRCUIT BREAKER

- A. Provide a generator mounted 80% circuit breaker, molded case, Qty.(2): 600 amp and 100 amp trip, 2 pole, NEMA 1/IP22. Breaker shall utilize a solid state trip unit. The breaker shall be UL/CSA Listed of IEC construction and connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

2.06 CONTROLS - GENERATOR SET MOUNTED

- A. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.
- B. Environmental: The generator set control shall be tested and certified to the following environmental conditions.
 - 1. -40°C to +70°C Operating Range
 - 2. 95% humidity non-condensing, 30°C to 60°C
 - 3. IP22 protection
 - 4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
 - 5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
 - 6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
 - 7. Shock: withstand 15G
- C. Functional Requirements: The following functionality shall be integral to the control panel.
 - 1. The control shall include a 33 x 132 pixel, 24mm x 95mm, positive image, transfective LCD display with text based alarm/event descriptions.
 - 2. Audible horn for alarm and shutdown with horn silence switch
 - 3. Standard ISO labeling
 - 4. Multiple language capability
 - 5. Remote start/stop control

6. Local run/off/auto control integral to system microprocessor
 7. Cooldown timer
 8. Speed adjust
 9. Lamp test
 10. Push button emergency stop button
 11. Password protected system programming
- D. Digital Monitoring Capability: The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.
1. Engine
 - a. Engine oil pressure
 - b. Engine oil temperature
 - c. Engine coolant temperature
 - d. Engine RPM
 - e. Battery volts
 2. Generator
 - a. Generator AC volts (Line to Line, Line to Neutral and Average)
 - b. Generator AC current (Avg and Per Phase)
 - c. Generator AC Frequency
 - d. Generator kW (Total and Per Phase)
 - e. Generator kVA (Total and Per Phase)
 - f. Generator kVAR (Total and Per Phase)
 - g. Power Factor (Avg and Per Phase)
 - h. Total kW-hr
 - i. Total kVAR-hr
 - j. % kW
 - k. % kVA
 - l. % kVAR
- E. Alarms and Shutdowns: The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:
1. Engine Alarm/Shutdown
 - a. Low oil pressure alarm/shutdown
 - b. High coolant temperature alarm/shutdown
 - c. Loss of coolant shutdown
 - d. Overspeed shutdown
 - e. Overcrank shutdown
 - f. Low coolant level alarm
 - g. Low fuel level alarm
 - h. Emergency stop depressed shutdown
 - i. Low coolant temperature alarm
 - j. Low battery voltage alarm
 - k. High battery voltage alarm
 - l. Control switch not in auto position alarm
 - m. Battery charger failure alarm
 2. Generator Alarm/Shutdown
 - a. Generator Over Voltage
 - b. Generator Under Voltage
 - c. Generator Over Frequency
 - d. Generator Under Frequency
 - e. Generator Reverse Power
 - f. Generator Overcurrent
- F. Inputs and Outputs:

1. Programmable Digital Inputs: The Controller shall include the ability to accept six (6) digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.
 2. Digital Outputs: The control shall include the ability to operate six (6) programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC.
 3. Discrete Outputs: The control shall include the ability to operate one (1) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.
- G. Maintenance: All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control:
1. Engine running hours display
 2. Service maintenance interval (running hours or calendar days)
 3. Engine crank attempt counter
 4. Engine successful starts counter
 5. 20 events are stored in control panel memory
 6. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 14 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
 - a. Day of week
 - b. Time of day to start
 - c. Duration of cycle
- H. Remote Communications: The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.
- I. Remote Annunciator (NFPA 99/110, CSA 282): Provide a remote annunciator to meet the requirements of NFPA 110, Level 1.
1. The annunciator shall provide remote annunciation of all points stated above and shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.
 2. Ability to be located up to 800 ft from the generator set

2.07 COOLING SYSTEM

- A. The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F* ambient air entering the room or enclosure (If an enclosure is specified). The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.08 FUEL SYSTEM

- A. Fuel System: The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi.

2.09 EXHAUST SYSTEM

- A. A critical grade silencer, companion flanges, and flexible stainless steel exhaust fitting properly sized shall be furnished and installed according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe size shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer.

2.10 STARTING SYSTEM

- A. Starting System:
1. Starting Motor: A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

2. Jacket Water Heater: Jacket water heater shall be provided and shall be sized to insure that genset will start within the specified time period and ambient conditions.
3. Batteries: A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.
4. Battery Charger: A 3 amp current limiting battery charger shall be furnished to automatically recharge batteries. The charger shall be dual charge rate with automatic switching to the boost rate when required. The battery charger shall be mounted on the genset package or inside the genset enclosure/room.

2.11 ENCLOSURE

- A. Enclosure: The complete engine generator set, including generator control panel, engine starting batteries and fuel tank, shall be enclosed in a factory assembled, weather protective enclosure mounted on the structural base.
 1. A weather resistant enclosure of steel with electrostatically applied powder coated baked polyester paint. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel. Handles shall be key lockable, all doors keyed alike, and hinges shall be zinc die cast or stainless steel. Access doors shall be hinged and can be lifted off after opening 90 degrees. Intake openings shall be screened to prevent the entrance of rodents or pests.
 2. Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain valves. Cooling fan and charging alternator shall be fully guarded to prevent injury.

2.12 ACCESSORIES

- A. Remote Annunciator Panel: Surface mounted panel with brushed stainless steel. Provide audible and visible indicators and alarms required by NFPA 110.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA/EGSA 404.

3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Provide full load test utilizing portable test bank for four hours minimum at a 1.0 PF at nameplate rating. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal. Loadbank, cables and other equipment required for this test to be supplied by the genset supplier.
- C. Test alarm and shutdown circuits by simulating conditions.

3.03 ADJUSTING

- A. Adjust generator output voltage and engine speed.

3.04 CLEANING

- A. Clean engine and generator surfaces. Replace oil and fuel filters.

3.05 ON-SITE TRAINING

- A. Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

3.06 CLOSEOUT ACTIVITIES

- A. Demonstrate operation to Owner's operating personnel:
- B. Describe loads connected to emergency system and restrictions for future load additions.
- C. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency power.

3.07 MAINTENANCE

- A. Provide service and maintenance of engine generator for two years from Date of Substantial Completion.
- B. Include two annual service visits with replacement of oil and all filters

END OF SECTION

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Includes service entrance rated transfer switches.

1.02 RELATED REQUIREMENTS

- A. Division 00 - Procurement and Contracting Requirements
- B. Division 01 - General Requirements
- C. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 32 13 - Engine Generators: For interface with transfer switches.
 - 1. Includes related demonstration and training requirements.
- H. Section 26 32 13 - Engine Generators: Testing requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. UL 1008: Underwriters Laboratories standard for automatic transfer switches.
- C. CSA: C22.2 No. 178 certified
- D. NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702.
- E. NFPA 101: Life safety code
- F. NFPA 110: Standard for emergency and standby power systems
- G. IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings.
- H. IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems.
- I. NEMA ICS10: AC automatic transfer switch equipment
- J. UL 50/508: Enclosures
- K. EN61000-4-11: Voltage dips and interruption immunity
- L. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013. (ANSI/NETA ATS)
- M. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - 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 Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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.
- 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.
- D. Specimen Warranty: Submit sample of manufacturer's warranty.
- E. Evidence of qualifications for installer.
- F. Evidence of qualifications for maintenance contractor (if different entity from installer).
- G. 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.
- H. Manufacturer's certification that products meet or exceed specified requirements.
- I. 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.
- J. Maintenance contracts.
- K. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
 - 1. Authorized service facilities located within 100 miles of project site.
- C. Products: Listed, classified, and labeled by Underwriters Laboratories Inc. (UL) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches 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 transfer 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. Two Year Warranty
 - 1. The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables used during

the course of repair. Submittals received without written warranties as specified will be rejected in their entirety.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches:
 - 1. ASCO Power Technologies, a brand of Emerson Network Power:
www.emersonnetworkpower.com.
 - 2. Eaton Corporation: www.eaton.com.
 - 3. General Electric Company: www.geindustrial.com.
- B. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 AUTOMATIC TRANSFER SWITCH

- A. Performance and Construction
 - 1. The automatic transfer switch shall be of double throw construction operated by a reliable solenoid driven mechanism. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
 - 2. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
 - 3. For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability will not be considered.
 - 4. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
 - 5. The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity.
 - 6. A dielectric test at the conclusion of the withstand and closing tests shall be performed.
 - 7. The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
 - 8. All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
 - 9. Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
 - 10. A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
 - 11. Switches composed of molded case breakers, lighting contactors or components thereof will not be acceptable.
 - 12. The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall conform to NEMA temperature rise standards.
 - 13. The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.

14. Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
15. Unless specified otherwise on the drawings, the switch shall be mounted in a NEMA 1 enclosure.

B. Control

1. The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:
 - a. Easy-to-view 4 x 20 LCD display with long lasting LED indicators.
 - b. Control panel shall display voltage and frequency of both sources.
 - c. The user shall be able to view the last 16 recorded events.
 - d. Capability for external communication and network interface.
 - e. Adjustments to all settings shall be made from the front of the panel without opening the door.
2. The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.
3. All programmable and control functions shall be pass code protected and accessible through the keypad.
4. The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.
5. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.
6. The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency shall be adjustable to 1% resolution to facilitate accurate transfer.
7. To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory and allow automatic daylight savings time adjustment.

2.03 AUTOMATIC SEQUENCE OF OPERATION

- A. The ATS shall incorporate adjustable three phase under voltage sensing on the normal source.
- B. When the voltage of any phase of the normal source is reduced to 80% (adjustable) of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
- C. The ATS shall incorporate adjustable under voltage and under frequency sensing on the emergency source.
- D. When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within 95% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
- E. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be retransferred to the normal source after a time delay of 0 to 60 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
- F. If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.

2.04 STANDARD ACCESSORIES

- A. Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.
- B. Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
- C. A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.

- D. An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and be programmed to anticipate the zero crossing point to minimize switching transients.
- E. An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.
- F. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.
- G. The controller shall accept a remote peak shave or test input to signal the transfer switch to the emergency position.
- H. A set of customer contacts shall be provided to indicate both emergency and normal source position.

2.05 EXERCISER ACCESSORIES

- A. Additional Auxiliary Contact (A3) - Closed when the transfer switch is in Source 2 position.
- B. Additional Auxiliary Contact (A4) - Closed when the transfer switch is in Source 1 position.
- C. Programmable Clock Exerciser (CDP) – This will replace the timer exerciser and allow for a 365 day cycle.
- D. Voltage Imbalance Monitor (VI) - Three Phase sensing shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

2.06 ADDITIONAL ACCESSORIES

- A. Universal Motor Load Disconnect (UMD) - Auxiliary contacts opens 0 – 5 minutes prior to transfer in either direction, re-closes after transfer. Can be configured for pre-transfer, post transfer or both.
- B. Sequential Universal Motor Load Disconnect (A62) – Multiple auxiliary contacts open prior to transfer in either direction, re-closes after transfer. Can be configured for pre-transfer, post transfer or both.
- C. Communications interface card (ZNETM) – RS-485 Modbus
- D. Test Switch (6A) - Maintained
- E. Digital Meter (M80) - Measures and displays true RMS volts, amps and frequency in a three-phase power system.
- F. Digital Meter (M82) - Includes M80 functions plus Watts, KVA, KVAR, PF, etc. w/Modbus RS485 port.
- G. Digital Meter (M83) – Includes M82 functions plus THD capability and Modbus RS485 port.
- H. Additional Auxiliary Contacts (A3) - Closed when the transfer switch is in Source 2 position.
- I. Additional Auxiliary Contacts (A4) - Closed when the transfer switch is in Source 1 position.
- J. Alarm panel (CTAP) – Alarm on transfer to emergency w/silence button & light.
- K. Disconnect Switch (DS) - Inhibits transfer in either direction when in inhibit. (Std on 800A and above).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of transfer switches 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 transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install transfer switches 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 26 05 29.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- G. Provide grounding and bonding in accordance with Section 26 05 26.
- H. Identify transfer switches and associated system wiring in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Automatic Transfer Switches:
 - 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 control wiring insulation-resistance tests listed as optional are not required.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- E. Perform field inspection and testing in accordance with Section 01 40 00.
- F. Inspect and test in accordance with NETA STD ATS, except Section 4.
- G. Perform inspections and tests listed in NETA STD ATS, Section 7.22.3.

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. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.
- B. Coordinate with related generator demonstration and training as specified in Section 26 32 13.
- C. Demonstrate to the owner's designated representative the operation of transfer switch in normal and emergency modes.

3.06 MAINTENANCE

- A. Provide to Owner at no extra cost, a separate maintenance contract for the service and maintenance of transfer switches 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.
- B. Conduct site visit at least once every 12 months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.
- C. Provide trouble call-back service upon notification by Owner:
 - 1. Provide on-site response within 12 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.

- D. 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

SECTION 26 09 55
ELECTRIC HEATING CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric heating cable
- B. Temperature controller for heating cable.

1.02 RELATED SECTIONS

- A. Section 03 30 00 - Cast-In-Place Concrete.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
 - 1. Provide detailed layout of cable. Indicate length and spacing of cable required.
 - 2. Indicate junction boxes, temperature sensor location, and starting and ending locations of cable.
 - 3. Indicate current requirement of system.
 - 4. Indicate mechanical and electrical service locations and requirements.
- D. Manufacturer's Instructions: Indicate installation instructions and recommendations.
- E. Project Record Documents: Record actual locations of heating cable and temperature sensor.
- F. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.
- G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer: company specializing in manufacturing products specified in this Section having at least 20 years experience with electric heating systems.
- B. All resistance heating cable equipment furnished under this section shall be supplied by a single manufacturer.
- C. Products Requiring Electrical Connection: Listed as classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 COORDINATION

- A. Coordinate installation of heating cable with Electrical Contractor, Concrete Contractor and General Contractor.
- B. Coordinate installation of heating cable with installation of concrete framework and concrete placement.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 - PRODUCTS

2.01 ELECTRIC HEATING CABLES

- A. Manufacturers:
 - 1. Bylin Engineered Systems
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Assembly: UL listed and labeled assembly with mounting accessories and built in controls.
- C. Heating Element: Resistance cable. Self regulating cable is not acceptable for this application.
- D. Resistance Cable Heater Construction: high-tensile-strength resistance wire wrapped in Kapton and then encased in silicone rubber for electrical insulation. Insulation shall be rated at 150

degrees Celsius to allow heating cable to produce up to 12 watts per lineal foot. Silicone insulation shall be surrounded by metal braid to provide ground path. Silicone over jacket shall be extruded over metal braid for mechanical protection.

E. Rating: 240V.

2.02 ACCESSORIES

A. Temperature controller:

1. The temperature controller shall include the following features.
 - a. Digital display
 - b. Battery free memory backup
 - c. Early start feature
 - d. Seven day programmable timer
 - e. Integral GFCI for load
 - f. Temperature sensor to be embedded between the heating cable
 - g. Automatic and manual modes

B. Aluminum tape: 2" wide, for attachment and to create a heat transfer fin.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Installer to field verify that the subfloor with cement board or the concrete framework is clean, dust free and ready to receive work prior to installation.
- C. Installer to verify field measurements are as shown on Drawings.
- D. Installer to verify that required utilities are available, in proper location, and ready for use.
- E. Beginning of installation means installer accepts conditions.
- F. Complete installation shall conform to appropriate local codes and shall be in accordance with manufacturer's specification.
- G. Resistance cable shall be laid out within heated area.
- H. For best design and longest life heating cable should not cross over expansion joints.
- I. Install cable in accordance with installation instructions and detailed layout drawings from manufacturer.
- J. Cable spacing in thin-set, mortar or concrete: shall not be less than 1".
- K. Floor warming temperature sensor shall be embedded in thin-set, mortar or concrete positioned midway between the heating cable runs.
- L. All floor warming cables shall be embedded in thin-set, mortar or concrete.

3.02 FIELD QUALITY CONTROL

- A. Test continuity of heating cable.
- B. Perform insulation resistance (megger) test on each resistance cable heater before, during, and after installation. Minimum acceptable megger reading shall be 10 megohms.
- C. Measure voltage and current at each unit.
- D. Submit written test report to supplier showing values measured on each test for each cable.

3.03 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
 1. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, and operator instructions available during demonstration.
 2. Have authorized technical representative of control unit manufacturer present during demonstration.

END OF SECTION