FAYDA ENGINEERING & ENERGY SOLUTIONS, LLC

ADDENDUM NO. 2

CHRISTIANA HIGH SCHOOL TRANSFORMER REPLACMENT & GENERATOR
FOR THE CHRISTINA SCHOOL DISTRICT
CSD PROJECT NO. CHR-2018-05
DATE: DECEMBER 31, 2018

1.0 This Addendum, Addendum No. 2, shall be made part of the Project Manual and Drawings dated December 2018 for the CHRISTIANA HIGH SCHOOL TRANSFORMER REPLACMENT & GENERATOR for the Christina School District.

2.0 Sealed bids for Christina School District Bid No. CHR-2018-05 – Christiana High School Transformer Replacement and Emergency Generator are due until **2:00 p.m. local time on Thursday, January 10, 2019. There is no change to bid due date.**

3.0 The temporary pad mounted transformer along with the primary and secondary cables and connections into the building are owned/leased by a 3rd party. The 3rd party will be responsible for the removal and disconnection of this equipment and shall not be included in the contractor's bid. Prime Contractor shall be responsible to schedule the removal of the existing transformer and connections by the 3rd party.

4.0 Changes to prior Addenda

4.1 Addendum #1, Article 7.0 identified "Effective 1/1/16, the prime contractor and all listed subcontractors must have a drug testing program in place. There is an Affidavit located with the Bid Form. Affidavits from the prime and all subs must be included with the contractor's bid."

Change:

The subcontractors do not need to submit their drug testing Affidavit, only the prime contractor.

5.0 Changes to Specifications

5.1 Add the following specification sections missing from the project manual:
1. 26 32 13 Emergency-Standby Generator
2. 26 36 00 Automatic Transfer Switches

6.0 Changes to Drawings

6.1 Drawing E10-02 & E13-01, omit removal of pad mounted transformer, cables and connections per Article 3.0 above.

7.0 Questions/Clarifications

7.1 There are no Questions/Clarifications

Edward Fayda, P.E.

EF/ef
18-1336 Addendum #2

Attachments: Specification Section 26 32 13, 26 36 00
cc: All Registered Plan holders
P-File

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SECTION 26 32 13
EMERGENCY/STANDBY GENERATOR

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Applicable provisions of the entire specifications, including Addenda, shall govern this section as fully as if repeated herein.

B. Refer specifically to the technical provisions of the 26 04 99 COMMON WORK RESULTS FOR ELECTRICAL.

1.2 RELATED DOCUMENTS

A. The work covered by this section of the specifications includes the furnishing of all labor, material, equipment and performance of all operations in connection with furnishing a new Emergency/Standby generator and an automatic transfer switch as indicated on the drawings and as specified herein.

B. The requirements of the conditions of the contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

C. The complete installation shall conform to the applicable sections of the latest edition of the National Electrical Code, Local Authorities having jurisdiction and the local utility serving the premises.

D. The work covered by this section of the specifications shall be coordinated with the related work.

1.3 SCOPE

A. This specification covers requirements for providing a factory built, prototype tested, production tested, field tested, complete and operable emergency/standby electric generating system, including all devices and equipment specified herein, shown on the drawings, and/or as required for the service. Materials and equipment shall be new and current, delivered to the site completely wired, tested, and ready for installation. This system shall include the following:

1. One (1) Engine-generator set rated 40kW/50kVA at 80% P.F., reach-in, (max 69dBa average) sound attenuated enclosure with 105^0C Rise, extended stack alternator.

2. Mounted and loose accessories, parts, tests, documents, and services, as needed to meet the performance requirements of this specification.

B. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

C. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

D. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service for a period of five (5) years. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.4 CODES AND STANDARDS

A. The generator set and its installation and on-site testing shall conform to the requirements of the following codes and standards:

1. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

2. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

3. FCC Part 15, Subpart B.

4. IEC8528 part 4. Control Systems for Generator Sets

5. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

6. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

7. IEEE587 for voltage surge resistance.

8. Mil Std 461D –1993. Military Standard, Electromagnetic Interference Characteristics.

9. Mil Std 462D - 1993. Military Standard, Measurement of Electromagnetic Interference Characteristics.

10. NEMA ICS10-1993 – AC Generator sets.

11. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.

12. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

13. UL508. The entire control system of the generator set shall be UL508 listed and labeled.

14. UL2200. The genset shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed.

15. EPA Compliant Engine Certified to current EPA emission standards for units of this size and fuel source.

B. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.5 ACCEPTABLE MANUFACTURERS

A. Only approved bidders shall supply equipment provided under this contract. Standard of Design & Construction is by Cummins Power Generation with microprocessor-based controls or Approved Equal. Equipment by other suppliers that meets the requirement of this specification is acceptable, if approved not less than ten (10) days before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.

B. Approved manufacturers subject to the requirements of this entire specification being met are:

1. Caterpillar
2. Kohler

C. The manufacturers identified above offer products similar in type, style and features. Listing does not indicate their product meets the requirements of this specification. It is the vendor and contractor’s responsibility to ensure full compliance subject to the terms of these specifications. In the event that a listed approved manufacturer does not meet the specifications during the submittal phase of the project, the contractor shall provide one that does at no additional cost to the owner.

1.6 SUBMITTALS

A. Within ten (10) days after award of contract, provide one (1) electronic submission of the following information for review:

1. Manufacturer’s product literature and performance data, sufficient to verify compliance to specification requirements.
2. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
3. Manufacturer's certification of prototype testing.
4. Manufacturer's published warranty documents.
5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
7. Manufacturer's installation instructions.

8. Upon final approval of the submission, provide five (5) bound copies for record purposes.

1.7 LITERATURE

A. The manufacturer shall have printed literature and brochures describing the standard series specified (not a one of a kind fabrication). Unless specified otherwise herein, all performance data and other information shall be as on the manufacturer's printed literature. Performance data shall be the result of test procedures in accordance with nationally recognized standards, plus such other procedures that are judged necessary by the manufacturer to insure maximum service reliability by the Engineer upon request.

1.8 SEQUENCE OF OPERATION

A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control and a redundant signal over the required network connection.

B. The generator set shall complete a time delay start period as programmed into the control.

C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.

3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous state.

5. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

6. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

7. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

PART 2 PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set shall be Cummins Model C40N6 and operate at 1800 rpm and at a voltage of: 208Y/120 Volts AC, three phase, 4-wire, 60 hertz.

2. The generator set shall be rated at 40 kW/50 kVA at 0.8 PF, Standby rating, based on site conditions of: Altitude 100 feet (30.5 meters), ambient temperatures up to 122°F (50°C).

3. The generator set rating shall be based on emergency/standby service.

4. Provide an extended stack alternator, capable of providing full single-phase output at the three phase rating of the generator.

5. Fuel source shall be Natural Gas.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.

3. The diesel engine-generator set shall accept a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

4. Motor starting capability shall be a minimum of 181kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified kVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 25%.

5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

2. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.2 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be natural gas, EPA Certified 4 cycle, naturally aspirated. Minimum displacement shall be 146.5 cubic inches (2.4 Liter), with 4 cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

2. Skid-mounted radiator and cooling system rated for full load operation in 122°F (50°C) ambient as measured at the alternator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H_2O restriction. Radiator shall be sized based on a

core temperature that is 20°F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.

3. Electric starter(s) capable of three complete cranking cycles without overheating.

4. Positive displacement, mechanical, full pressure, lubrication oil pump.

5. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

6. Natural Gas regulator, solenoid and wired controls.

7. Replaceable dry element air cleaner with restriction indicator.

8. Flexible supply and return fuel lines.

9. Provide fully regulated, constant voltage, current limited, and battery charger for each battery bank. The chargers shall be designed for heavy-duty industrial service, primarily to quickly recharge and maintain batteries that start internal combustion engines. Charger shall be rated a minimum of 5 amp / 10 amps, and be capable of operating in parallel with another like charger for reliability and added charging capacity.

10. Provide LED indication of general charger condition, including charging, fault, and equalize. Provide a 2 line LCD display to indicate charge rate, battery voltage, faults, and provide for charger set up.

11. The charger shall be compliant to the same RFI/EMI and voltage surge performance as are specified for the genset control.

B. Coolant heater

1. Engine-mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL 499 listed and labeled.

2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall provisions to isolate the heater for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

3. The 120V, 1 phase coolant heater shall be provided with a 120VAC or 240VAC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104°F (40°C) in a 40°F (4°C) ambient, in compliance with NFPA 110 requirements, or the temperature required for starting and load pickup requirements of this specification.

C. Provide vibration isolators, spring and pad type, in quantities as recommended by the generator set manufacturer.

D. Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40°F ambient temperature when fully charged.

E. Provide critical exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The mufflers shall be critical grade. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards. For housed units, the silencer must be mounted within the genset enclosure.

2.3 AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL 1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 80°C.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5% above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12%, based on the standby rating of the generator set.

2.4 GENERATOR SET CONTROL AND PROTECTION

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, protection and control functions for the generator set. The control system shall also be designed to allow local monitoring and

control of the generator set, and remote monitoring and control as described in this specification.

B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

2.5 CONTROL FEATURES AND FUNCTIONS

A. Control Switches

1. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

2. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

3. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

4. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

1. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

2. Analog voltmeter, ammeter, frequency meter, power factor meter, and kilowatt (kW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output. Both analog and digital metering are required.

3. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of

rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

4. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

C. Generator Set Alarm and Status Display

1. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. Functions indicated by the lamps shall include:

   a. The control shall include five configurable alarm-indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the genset. They shall also be configurable for color, and control action (status, warning, or shutdown).

   b. The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

   c. The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.
   d. The control shall include an amber common warning indication lamp.

2. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

   a. low oil pressure (warning)
   b. low oil pressure (shutdown)
   c. oil pressure sender failure (warning)
   d. low coolant temperature (warning)
   e. high coolant temperature (warning)
   f. high coolant temperature (shutdown)
   g. high oil temperature (warning)
   h. engine temperature sender failure (warning)
   i. low coolant level (warning)
   j. fail to crank (shutdown)
   k. fail to start/overcrank (shutdown)
   l. overspeed (shutdown)
   m. low DC voltage (warning)
   n. high DC voltage (warning)
   o. weak battery (warning)
   p. low fuel-daytank (warning)
   q. high AC voltage (shutdown)

r. low AC voltage (shutdown)
s. under frequency (shutdown)
t. over current (warning)
u. over current (shutdown)
v. short circuit (shutdown)
w. ground fault (warning) (optional--when required by code or specified)
x. over load (warning)
y. emergency stop (shutdown)
z. (4) configurable conditions

3. Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

D. Engine Status Monitoring

1. The following information shall be available from a digital status panel on the generator set control:

a. engine oil pressure (psi or kPA)
b. engine coolant temperature (degrees F or C)
c. engine oil temperature (degrees F or C)
d. engine speed (rpm)
e. number of hours of operation (hours)
f. number of start attempts
g. battery voltage (DC volts)

2. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

E. Engine Control Functions

1. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

2. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

3. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

4. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

5. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

6. The following settings shall be field set and verified upon final installation of the emergency system:

    1. Generator Start: 1 second minimum, 2 seconds maximum.
    2. Generator Transfer: 5 seconds minimum, 8 seconds maximum.
    3. Generator Re-Transfer: 15 minutes minimum, 20 minutes maximum.
    4. Generator Cool Down: 15 minutes.

A. Alternator Control Functions

1. The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

2. A microprocessor-based protection device shall be provided to individually monitor all phases of the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The device shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.

3. A microprocessor-based protection device shall be provided to monitor all phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 Article 445.

4. Controls shall be provided to monitor the kW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

5. A microprocessor-based AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds. The system shall monitor individual phases and be connected line to neutral on 3-phase 4-wire generator sets, and for systems that are solidly grounded.

6. When required by National Electrical Code or indicated on project drawings, the control system shall include a ground fault-monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

B. Other Control Functions

1. The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

2. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32 VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

C. Control Interfaces for Remote Monitoring

1. No field connections for control devices shall be made in the AC power output enclosure. Provide the following features in the control system:
2. Form "C" dry contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
3. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
4. A fused 10 amp switched 24 or 12 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

5. A fused 20 amp 24 or 12 VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
6. The control shall be provided with a direct serial communication link for the communication network interface as described elsewhere in this specification and shown on the drawings.

2.6 ACCESSORIES

A. The generator set shall be provided with a 3P-200A Frame/150A trip. Breaker shall be Electronic, fully adjustable with L and I settings. Settings to be determined by Power System Study. Circuit breaker shall be sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

Outdoor Weather-Protective Enclosure-Quiet Site II

1. The generator set shall be provided with an outdoor enclosure to reduce the average sound level to a maximum of 76dBa. The package shall comply with the requirements of BS ISO 8528-4 2005, BS 7671:2008 + A1:2011 IET Wiring Regulations 17th Edition and relevant regional Codes for electrical installations for all the wiring materials and component spacing. The total assembly of generator set, enclosure, and sub-base fuel tank (when used) shall be designed to be lifted into place using spreader bars. This is required for bottom four point lift. other enclosure may be provided with single point and two point high level lifting arrangements and/or forklift packets in the enclosure base.
2. Enclosure shall provide ample airflow for generator set operation at rated load in an ambient temperature of 50DegC. The enclosure shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be designed to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

3. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two-step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

   a. Primer thickness, 0.5-2.0 mils. Topcoat thickness, 0.8-1.2 mils.

   b. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

   c. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.

   d. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.

e. Salt Spray, per ASTM B117-90, 1000+ hours.

f. Humidity, per ASTM D2247-92, 1000+ hours.

g. Water Soak, per ASTM D2247-92, 1000+ hours.

2. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

3. Enclosure shall be constructed of minimum 12-gauge steel for framework and 14-gauge steel for panels. All hardware and hinges shall be stainless steel.

4. A factory-mounted exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

5. The enclosure shall include the following maintenance provisions:

a. Flexible coolant and lubricating oil drain lines that extend to the exterior of the enclosure, with internal drain valves.

b. External radiator fill provision.

6. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 69 dBA at any location 7 meters from the generator set in a free field environment. Insulation in the enclosure shall be made with non-hydroscopic materials.

7. The enclosure shall be insulated with non-hydroscopic materials.

B. Miscellaneous

1. Mounted & Wired battery Charger

2. Internally Mounted & Insulated Exhaust System

3. Stub-Up Access

4. Flexible fuel piping, connectors and regulator.

5. All Connections to the generator set shall be flexible and all conduit within enclosure shall be EMT.

6. Red indicating light on exterior of enclosure to indicate generator is running. Light shall be 100W vaportite with red globe and screw-in LED lamp.

7. Green indicating light on exterior of enclosure to indicate generator is automatic and ready to assume load with no faults. Light shall be 100W vaportite with green globe and screw-in LED lamp.

8. Contractor to provide natural gas regulator to convert incoming gas pressure of 2PSI to required pressure at generator. Generator manufacturer to provide solenoid valve, flexible connections and required appurtenances.

9. Remote Emergency Shutdown Pushbutton Station, located adjacent to the Automatic Transfer Switch.

2.7 REMOTE ANNUNCIATOR

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings or in a location that can be conveniently monitored by facility personnel. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

C. Provide wiring requirements to Electrical Contractor.

PART 3 EXECUTION

3.02 FACTORY TESTING

A. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance. Test shall be conducted at 0.8 PF and run for 2 Hours at full load. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

B. Complete engine/generator and transfer switch shall be shipped by the manufacturer, F.O.B. to the job site. Contractor shall be responsible for receiving storage and installation of equipment as indicated on the drawings.

3.03 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.04 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Provide a four (4) hour load bank test. First hour, unit shall operate at 25% load; second hour, unit shall operate at 50% load; third hour unit shall operate at 75%; fourth hour, unit shall operate at 100% of rated standby load. Provide test results including oil pressure and temperature, coolant temperature, amperage, voltage and kW in 15-minute intervals. Report shall include unit serial number, model number, date of test and name of service technician.

C. Upon verification that all systems are compliant, generator shall be started and tested for proper operation and adjusted to ensure output characteristics as specified hereinbefore.

D. Upon successful completion of test, a report shall be prepared, indicating the following items:

1. Time & date of report
2. Personnel present
3. KW rating of load bank
4. Output characteristics under no-load and full load conditions to include:

    (1) Voltage - line to line, line to neutral (All Phases)
    (2) Amperage
    (3) Frequency
    (4) Oil Pressure
    (5) Coolant Temperatures
    (6) Run time at start
    (7) Run time at completion

5. Generator start time
6. Generator transfer
7. Generator re-transfer
8. Generator time delay stop
9. Any abnormalities found

One (1) copy of the report shall be provided in each of the Operating & Maintenance Manuals as described in Section 23 04 99.

3.05 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than four (4) hours in duration and the class size shall be limited to five (5) persons. Training date shall be coordinated with the facility owner and not held on the date of generator startup.

3.06 SERVICE AND SUPPORT

A. The manufacturer of the generator set shall maintain service parts inventory at a central location, which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 10 years.

3.07 WARRANTY

A. The complete standby electric power system, including 1800 r/min engine-generator set, transfer switch, enclosure, load bank, and all appurtenances, shall be warranted for a period of five (5) years or fifteen hundred (1,500) operating hours, whichever occurs first, from the date of commissioning against defects in materials and workmanship. Multiple warranties for individual components (engine, generator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be detailed in available written documents. In the judgment of the Engineer, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

B. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

C. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

3.08 SERVICE CONTRACT

A. Provide a comprehensive five (5) year service and maintenance contract to provide all scheduled preventive and maintenance on the generator, engine, and transfer switch. Contract shall include all mileage, per diem, and travel expenses. No extras will be granted for this work.

END OF SECTION

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SECTION 26 36 00
TRANSFER SWITCHES

PART 1 - GENERAL

1.1. GENERAL PROVISIONS

1. Applicable provisions of the entire specifications, including Addenda, shall govern this section as fully as if repeated herein.

2. Refer specifically to the technical provisions of Section 26 04 99, "COMMON WORK REQUIREMENTS FOR ELECTRICAL".

1.2. RELATED DOCUMENTS

1. The requirements of the conditions of the contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.

2. The complete installation shall conform to the applicable sections of the latest edition of the National Electrical Code, Local Authorities having jurisdiction and the local utility serving the premises.

3. The work covered by this section of the specifications shall be coordinated with the related work.

1.3. SCOPE OF WORK

1. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

2. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product and employed by the generator set supplier shall service the transfer switches.

1.4. CODES AND STANDARDS

1. The automatic transfer switch shall conform to the requirements of the following codes and standards:

    i. EN55011, Class B Radiated Emissions

    ii. EN55011, Class B Conducted Emissions

    iii. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity. Similar waveforms are described in ANSI/IEEE 62.41-1991

    iv. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity

v. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity

vi. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity

vii. IEC 1000-4-6 Conducted Field Immunity

viii. IEC 1000-4-11 Voltage Dip Immunity

ix. NFPA20 – Fire Pumps. Transfer switches serving fire pumps shall be specifically listed and labeled for that application.

x. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.

xi. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.

xii. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

xiii. NEMA ICS10-1993 – AC Automatic Transfer Switches.

xiv. UL 891 – Low Voltage Switchboards.

xv. UL1008. The transfer switch shall be UL listed and labeled.

2. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.5. ACCEPTABLE MANUFACTURERS

1. Refer specifically to Section 01 25 13 “Product Substitution Procedures” for substitution requirements.

2. Only approved manufacturers shall supply equipment provided under this contract. Equipment specifications for this project are based on microprocessor-based transfer switches manufactured by Cummins Power Systems. Equipment by other suppliers that meets the requirement of this specification are acceptable, if approved not less than ten (10) days before scheduled bid date. Proposals must include a line by line compliance statement based on this specification. Approval of substitute manufacturers will be announced by addendum.

1.6. SERVICE AND SUPPORT

1. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

2. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.

3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

1.7. WARRANTY

1. The Automatic Transfer Switch and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

2. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

1.8. LITERATURE

1. The manufacturer shall have printed literature and brochures describing the standard series specified (not a one of a kind fabrication). Unless specified otherwise herein, all performance data and other information shall be as on the manufacturer's printed literature. Performance data shall be the result of test procedures in accordance with nationally recognized standards, plus such other procedures that are judged necessary by the manufacturer to insure maximum service reliability by the Engineer upon request.

1.9. SUBMITTALS

1. Shop drawings will be required for all work covered under this specification section. Refer specifically to Section 26 04 99 “Common Work Requirements for Electrical” for additional special shop drawing requirements.

1.10. OPERATING AND MAINTENANCE MANUALS

1. Furnish Operating and Maintenance Manuals for the Engine-generator set and each transfer switch as specified in Section 26 04 99, "COMMON WORK REQUIREMENTS FOR ELECTRICAL”.

1.11. AS-BUILT DRAWINGS

1. As-built drawings will be required for all work covered under this specification section. Refer specifically to Section 26 04 99 “Common Work Requirements for Electrical” for special As-Built requirements.

PART 2 - PRODUCTS

2.1. POWER TRANSFER SWITCH

2.01 Ratings: One (1) transfer switch shall be provided. This transfer switch shall be 3 pole, 4 wire.

A. Emergency/Standby Transfer Switch No. 1:

1. Provide a 150A, 3 pole, 208Y/120VAC, 3 Phase, 4 Wire, Cummins Model OTPC 150 located within the Electric Room. Controls shall equal Cummins Level 2.

B. Main contacts shall be rated for 600 Volts AC minimum.

C. Transfer switch shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

D. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings and at the specified voltage. The transfer switch and its upstream protection shall be coordinated. The transfer switch shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

2.02 Connections

A. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

B. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

2.03 Network Card

A. Provide a network card for integration with the remote monitoring software.

2.2. TRANSFER SWITCH CONTROL

1. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

A. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED

indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

B. High intensity LED lamps to indicate that the transfer switch is "not in auto" (due to control being disabled or due to bypass switch (when used) enabled or in operation) and "Test/Exercise Active" to indicate that the control system is testing or exercising the generator set.

C. "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

D. "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

E. "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

F. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC-based service tool or an operator display panel.

G. Security Key Switch to allow the user to inhibit adjustments, manual operation or testing of the transfer switch unless key is in place and operated.

H. Analog AC meter display panel, to display 3-phase AC Amps, 3-phase AC Volts, Hz, KW load level, and load power factor. The display shall be color-coded, with green scale indicating normal or acceptable operating level, yellow indicating conditions nearing a fault, and red indicating operation in excess of rated conditions for the transfer switch.

I. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:

1. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.

2. Display source status, to indicate source is connected or not connected.

3. Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

4. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

   a. Set nominal voltage and frequency for the transfer switch.

   b. Adjust voltage and frequency sensor operation set points.

   c. Set up time clock functions.

   d. Set up load sequence functions.

   e. Enable or disable control functions in the transfer switch, including program transition.

   f. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

5. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

6. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

7. Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

8. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

2. Internal Controls

   A. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.

B. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

1. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

2. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

3. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

4. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

5. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

6. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

7. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

8. Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

C. All transfer switch sensing shall be configurable from a Windows 7 PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. Designs utilizing DIP switches or other electromechanical devices are not acceptable. The transfer control shall incorporate a series of diagnostic LED lamps.

D. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

E. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-120 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).

F. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service. The control system shall be designed and prototype tested for operation in ambient temperatures from -40°C to +70°C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

G. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

3. Control Interface

A. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

B. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

C. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.

2.3. ENCLOSURE

1. Enclosures shall be UL listed. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.

2. Transfer switch equipment shall be provided in a NEMA 1R or better enclosure.

PART 3 - EXECUTION

3.1. OPEN TRANSITION SEQUENCE OF OPERATION

1. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

A. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

B. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

C. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

D. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

E. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

A. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

B. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

C. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3.2. FACTORY TESTING

1. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

3.3. ON-SITE ACCEPTANCE TEST

1. Site Tests: An installation check and building load test shall be performed by the manufacturer’s local representative. The Engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall

include automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination.

END OF SECTION