

SECTION 263213 - PACKAGED GENERATORS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes packaged generator for power supply of an optional standby system with the following features:
1. Diesel fueled, UL 2200 listed, engine driven generator set.
 2. Engine mounted radiator-cooling system.
 3. Engine exhaust-silencing system.
 4. Generator set mounted control panel.
 5. Remote annunciator panel(s).
 6. Vibration isolation system.
 7. Starting batteries and battery charging system.
 8. Factory installed, UL 2200 listed, sound attenuating enclosure.
 9. UL listed, doubled walled, sub-base fuel storage tank.
 10. Factory testing.
 11. Field testing, and start-up and commissioning services.
 12. Demonstration and training Services.
 13. Maintenance Services.
- B. Related Sections include the following:
1. Division 26 Section "Automatic Transfer Switches" for automatic transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.2 SUBMITTALS

- A. Product Data: The Product Data Submittal shall be submitted as an action submitted and include the following neatly bound with page numbers and tab type dividers:
1. Cover page containing at a minimum the project name, Engineer's project number, purchase order number, title of the submission, date of submission, manufacturer's name and address, Vendor's name and address, sales contact's information and technical contact's information.
 2. Table of Contents.
 3. Bill of Materials.
 4. Factory published specification sheet indicating standard and optional accessories, ratings, etc.
 5. Manufacturer's catalog cut sheets of all auxiliary components such as isolators, battery charger, silencer, exhaust flex, main circuit breaker, etc.
 6. Engine mechanical data at varying loads up to full load, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, noise data, fuel consumption, etc.

7. Emissions data.
 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 motor starting capability.
 10. Generator resistances, reactances and time constants.
 11. Generator current decrement curve.
 12. Generator thermal damage curve.
 13. Certified summary of prototype-unit test report.
 14. Manufacturer's and/or Dealer's written warranty.
 15. Maintenance Service written agreement.
 16. Nearest factory authorized service organization's contact information.
- B. Shop Drawings: Shop Drawings shall be submitted as an action submittal and include the following:
1. Dimensional elevation and layout drawings of the generator set, enclosure and related accessories.
 2. Weights of all equipment.
 4. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.
 5. Jacket water heater connection diagram.
 6. Control panel schematics.
 4. Interconnect wiring diagram of complete standby system for each site, including generator, automatic transfer switches, enclosure distribution panel, remote alarm indications.
- C. Qualification Data: For installer and manufacturer.
- D. Source quality-control test reports: Submit the following reports as an informational submittal within ten (10) days of units shipment from the factory and prior to commissioning of the unit.
1. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
 2. Report of sound generation.
 3. Report of exhaust emissions showing compliance with applicable regulations.
- E. Field quality-control test reports: Submit as an informational submittal the field quality control test reports required by this section.
- F. Operation and Maintenance Data: For packaged generators and accessories to include operation, and maintenance manuals.
- 1.3 QUALITY ASSURANCE
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
 2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with ASME B15.1.
- E. Comply with NFPA 37.
- F. Comply with NFPA 70.
- G. Comply with NFPA 110 requirements for Level 1 emergency power supply system (EPSS).
- H. Comply with UL 2200.
- I. Engine Exhaust Emissions: Comply with applicable federal, state and local government requirements.
- J. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.
- K. Comply with NFPA 30.
- 1.4 COORDINATION
- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified on the structural drawings.
- 1.5 WARRANTY
- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five (5) years from date of Substantial Completion.

1.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve (12) months full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Products: Subject to compliance with requirements, provide packaged generator products manufactured by Cummins Power Systems, Inc. or equivalent products by one of the following:
 - 1. Cummins Power Systems
 - 2. Kohler Co.; Power Systems Division
 - 3. Caterpillar

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Nominal ratings as indicated on the drawings.
 - 2. Output Connections: As indicated on the drawings.
- D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
2. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
3. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
4. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
5. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
6. Excitation System: Provide permanent magnet excitation for power source to voltage regulator. Performance shall be unaffected by voltage distortion caused by nonlinear load.
7. Start Time: 10 seconds; comply with NFPA 110, Type 10, EPSS requirements.

2.3 ENGINE

- A. The engine shall be four-stroke cycle, water-cooled, compression ignition diesel. It shall meet specifications when operating on number 2 domestic burner oil. The engine shall be rated to produce the electrical output indicated on the drawings after the all parasitic loads losses. The engine shall be equipped with fuel, lube oil, and intake air filters; fuel transfer pump; fuel priming pump; service meter; and gear-driven water pump.
- B. Provide a fan bearing radiator with a vertical core and horizontal air discharge. The radiator shall be sized by the engine manufacturer.
 1. The radiator fan shall be powered directly by the engine crank shaft, driven by a series of belts and sheaves sized to insure a fan speed sufficient to generate the required airflow through the radiator core.
 2. The fan shall be of steel construction. The radiator shall have OSHA approved heavy duty fan and core guards.
 3. The radiator shall have sufficient capacity to maintain safe engine operation at 100% of the generator output up to a temperature of 104°F at the, with 0.5 inches of water column external static resistance at the radiator fan.
 4. The radiator shall be equipped with factory plumbed low level switch to insure minimum coolant level.
- C. The engine air cleaner shall be engine mounted with dry element.
- D. The engine starting system shall include 24 volt DC starting motor, starter relay, and automatic reset circuit breaker to protect against butt engagement. Batteries shall be maintenance free, lead acid types provided with battery heating pads and mounted near the starting motor. A corrosion resistant or coated steel battery rack shall be located to avoid spillage from servicing of fuel and oil filters. Required cables will be furnished and sized to satisfy circuit requirements. The system shall be capable of starting the engine within 10 seconds.

1. A dual rate 10 ampere battery charger shall be provided which shall accept 120 volt AC single phase input to provide DC output of the provided battery or battery set. It shall be fused on the AC input and DC output, and incorporate current limiting circuitry to avoid the need for a crank disconnect relay. An AC voltage power switch shall be mounted on the face of the charger and shielded from accidental switching. The charger shall include an AC ammeter and voltmeter, a failure malfunction alarm switch, and be housed in a NEMA 1 enclosure suitable for wall mounting.
- E. Jacket water heater(s) shall be provided to maintain coolant temperature of 90°F while the engine is idle. Heaters shall match existing heater voltage and amps and connect to existing AC power that was previously connected to the original generator and include thermostatic controls. Hoses to and from the heater shall be industrial quality, which exhibit long life in operational environments. Manual shutoff valves shall be incorporated to isolate the heater during servicing.
- F. The engine control shall control engine speed while optimizing both steady state and transient engine performance. The control will monitor all significant engine parameters, and adjust engine performance according to speed, altitude, temperature, aftercooler temperature, and engine condition. It shall incorporate revisable control software capable of reconfiguring engine operation to desired performance levels.
1. Engine governing shall maintain steady state speed regulation of +/- 0.25%.
- G. The lubrication oil pump shall be a positive displacement type that is integral with the engine and gear driven from the engine gear train. The system shall incorporate full flow filtration with bypass valve to continue lubrication in the event of filter clogging.
1. The filter shall incorporate a self-lubricating, free rotating seal and have a nonmetallic core sufficiently rigid to minimize movement or shifting of the filtration media.
- H. The fuel system shall be integral with the engine.
1. In addition to the standard filter, the fuel system shall include a primary fuel filter between the fuel tank and transfer pump to screen large contaminants.
 2. A fuel/water separator shall protect the fuel system from water damage.
 3. Fuel shall be piped from the filter/water separators to the intake of the engine fuel pump, and then to the engine.
 4. A manual fuel-priming pump shall facilitate priming and bleeding air from the system.
 5. Flexible fuel lines between engine and fuel supply shall be installed to isolate vibration.
- I. The engine exhaust system shall be installed to discharge combustion gases quickly and silently with minimum restriction. System including silencer shall be designed for minimum restriction.
1. A critical (25 dBA reduction at twenty-three (23) feet) type silencer and flexible stainless steel exhaust fitting properly sized shall be furnished and installed by the manufacturer within the enclosure. 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 back-pressure does not exceed the maximum limitations specified by the engine manufacturer.

2. The silencer and all interior exhaust piping shall be "lagged" by the installer to maintain a surface temperature not to exceed 150°F. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

J. The engine and generator shall be assembled to a common base by the packaged-generator manufacturer. The generator set base shall be designed and built by the packaged-generator manufacturer to resist deflection, maintain alignment, and minimize resonant linear vibration.

2.4 FUEL OIL STORAGE.

D. Sub base Mounted Fuel Oil Tank: Factory installed and piped, double walled, fuel oil tank, complying with UL 142. Features include the following:

9. Tank level indicator.
10. Normal and emergency vent.
11. Low fuel level switch.
12. High fuel level switch.
13. Leak detector switch.
14. Provide fuel oil storage tank with a fuel storage capacity for a minimum of 48 hours of continuous operation at 100% rated power output and a secondary fuel pump that will connect to a remote tank that will fill the base fuel tank. This pump shall be controlled automatically, such that it will keep the base tank full.
15. Vandal-resistant fill cap.
16. Containment Provisions: 110%.
17. Four point lifting provisions.
18. Electrical stub-up space.

2.5 CONTROL PANEL

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Provide a generator mounted control panel for complete control and monitoring of the engine and generator set functions. Panel shall include automatic start/stop operation; adjustable cycle cranking, digital AC true RMS metering with phase selector switch, digital engine monitoring, shutdown sensors and alarms with horn and reset, adjustable cool-down timer and emergency stop push-button. Panel shall incorporate self-diagnostics capabilities and fault logging. Critical components shall be environmentally sealed to protect against failure from moisture and dirt. Components shall be housed in a NEMA 1/IP22 enclosure with hinged lid.

C. Provide the following digital readouts:

1. Engine oil pressure

2. Coolant temperature
 3. Engine RPM
 4. System DC Volts
 5. Engine running hours
 6. Generator AC volts
 7. Generator AC amps
 8. Generator frequency
 9. kW meter
 10. Percentage of rated Power
 11. kVA meter
 12. kVAR meter
 13. Power Factor meter
 14. KWHR meter
- D. Provide the following indications for protection and diagnostics according to NFPA 110, level 1:
1. Low oil pressure
 2. High water temperature
 3. Low coolant level
 4. Over-speed
 5. Over-crank
 5. Emergency stop depressed
 7. Approaching high coolant temperature
 8. Approaching low oil pressure
 9. Low coolant temperature
 10. Low voltage in battery
 11. Control switch not in automatic position
 12. Low fuel level
 13. Fuel tank rapture
 14. Battery charger ac failure
 15. High battery voltage
 16. Generator supplying load
- E. Provide a remote annunciator to meet the requirements of NFPA 110, Level 1 where indicated on the drawings. 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.
- F. Provide programmable protective relay functions inside the control panel to include the following:
1. Under-voltage
 2. Over-voltage
 3. Over-frequency
 4. Under-frequency
 5. Reverse power
 6. Over-current (phase and total)
 7. kW level (overload)
 8. Three spare LED's
 9. Four spare inputs

- G. Provide Remote Emergency-Stop Push button at the unit and located at a second location as designated by the owner. Push button shall be Safety Technology International, Inc. Model – 2239 Stopper Station with yellow shell, octagonal push to activate / turn to reset button, mini stopper II clear protective cover without horn, and custom lettering “GENERATOR SHUTDOWN”.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:
 - 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 - 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
 - 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
 - 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. The alternator housing shall be one piece and mount directly to the engine flywheel housing. Engine torque shall be transmitted through a torsional coupling to the alternator rotor. The alternator-ventilating fan shall mount directly to the rotor assembly.
- B. The revolving field coils shall be precision wet layer wound with epoxy based material applied to each layer of magnet wire.
- C. Alternator pitch: 2/3.
- D. Stator and rotor shall have Class H insulation.
- E. Alternator shall be equipped with 120 volt AC single phase space heater.
- F. The alternator shall be provided with permanent magnet excitation system that shall derive excitation current from a pilot exciter mounted on the rotor shaft. It shall enable the alternator to sustain 300% of rated current for ten seconds during a fault condition.
- G. The alternator shall be provided with digital voltage regulator capable of sensing true RMS in three phases of alternator output voltage, or operating in single phase sensing mode.

1. It shall exhibit the following operational characteristics:
 - a) Alternator output voltage maintained within +/- 0.25% of rated value for any load variation between no load and full load steady state conditions.
 - b) Telephone Influence Factor (TIF) of less than 50.
 2. The regulator shall include provisions for alternator output voltage adjustment.
- H. The alternator shall be able to provide motor starting capability of 1500 sKVA at 35% voltage drop as defined per NEMA MG 1.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Factory mounted, Level 1 sound attenuated (approximately -25dBA reduction at twenty-three (23) feet), weather resistant generator set enclosure constructed from steel.
- B. The enclosure shall have lockable, gasketed doors with 180° door swing, and stainless steel and stainless steel latch handle.
- C. The enclosure shall be equipped with an external vertical discharge scoop to direct cooling and reduce noise.
- D. Acoustical insulation shall be provided with reflective silver mylar layer and meet UL standard 94 HF1 for flammability classification.
- E. The enclosure features shall include: pitched roof, internal exhaust silencer, radiator guard and unrestricted airflow design.

2.9 FINISHES

- A. Generator Set and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.
- B. Outdoor Enclosure and Fuel Tank Base: The enclosure and fuel tank base shall have a fade, scratch and corrosion resistant baked RhinoCoat finish. The finish shall be the manufacture's standard of color(s).

2.10 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Full load run at rated power factor.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Transient and steady-state governing.
 - 6. Single-step load pickup.
 - 7. Safety shutdown.
 - 8. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged generator performance.
- B. Examine roughing-in of electrical connections. Verify actual locations of connections before packaged generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with packaged generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify system components according to Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection (except those indicated to be optional) for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.
 - d. Verify that measurements are within manufacturer's specifications.
 - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
 - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- C. Coordinate tests with tests for transfer switches and run them concurrently.
- D. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- E. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest as specified above.
- I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 263213

SECTION 263600 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes automatic transfer switches rated 600 V and less.

1.2 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 70.
- D. Comply with NFPA 99.
- E. Comply with NFPA 110.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Caterpillar.
 - b. Kohler Power Systems.
 - c. Onan/Cummins Power Generation.
 - d. Asco

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 2. Switch Action: Double throw; mechanically held in both directions.
 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

- G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.
- H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- J. Battery Charger: For generator starting batteries.
 - 1. Float type rated 2 A.
 - 2. Ammeter to display charging current.
 - 3. Fused ac inputs and dc outputs.
- K. Enclosures: General-purpose NEMA 250, Type as shown on drawings, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with Level 1 equipment according to NFPA 110.
- B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.
- C. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.
- D. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.
- E. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the two sources are synchronized in phase.
- F. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated.
- G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer.
- H. Automatic Transfer-Switch Features:
 - 1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of

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nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
13. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:

- a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
- b. Push-button programming control with digital display of settings.
- c. Integral battery operation of time switch when normal control power is not available.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Floor-Mounting Switch: Anchor to floor by bolting.
 1. Concrete Bases: 4 inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Section 260529 "Hangers and Supports for Electrical Systems."
- B. Identify components according to Section 260553 "Identification for Electrical Systems."
- C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
 - f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
- C. Coordinate tests with tests of generator and run them concurrently.
- D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- E. Remove and replace malfunctioning units and retest as specified above.
- F. Prepare test and inspection reports.
- G. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below. Refer to Section 017900 "Demonstration and Training."
- B. Coordinate this training with that for generator equipment.

END OF SECTION 263600