

NOTICE TO INTERESTED VENDORS:

It is the policy of Delta City to provide preference to local businesses. The specifics of this policy are contained in the Delta City Purchasing Policy and Procedures, which is available for public inspection from the Delta City Recorder.

SECTION 26 3213

EMERGENCY ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of emergency electrical system work is indicated by drawings and schedules.
- B. Types of emergency system components specified in this section include the following:
 - 1. Automatic Transfer Switches (ATS)
 - 2. Emergency Generators (Diesel)
 - 3. Day Tanks
 - 4. Exhaust and Fuel Systems
 - 5. Remote Annunciator Panels
- C. CONDUCTORS/CABLES, RACEWAYS, AND ELECTRICAL BOXES AND FITTINGS are specified in applicable Division-26 Basic Materials and Methods sections.
- D. Refer to other Division-26 sections as applicable for work required in connection with emergency electrical systems.
- E. Refer to Division-23 sections for fuel tanks, piping and accessories required in conjunction with engine-generator units; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to wiring methods, materials, construction and installation of emergency electrical systems. Comply with applicable requirements of UL 924, "Emergency Lighting and Power Equipment" and UL 1008, "Automatic Transfer Switches". Provide system components, that are UL-listed and labeled.
- B. Comply with applicable requirements of NFPA Nos. 37, (99), 101, and 110 pertaining to stationary combustion engines, (health care facilities), life safety code, and emergency and standby power supplies.
- C. Comply with ANSI/NEMA Std. Pub. No. ICS 2, pertaining to AC automatic transfer switches. Comply with applicable requirements of ANSI/NEMA MG 1, "Motors and Generators", and MG 2, "Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators". Comply with applicable portions of IEEE Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to standby power.

1.4 SUBMITTALS:

- A. SHOP DRAWINGS: Submit the following:
 - 1. Dimensioned drawings of emergency electrical system components and accessories including, but not necessarily limited to generator sets, day tanks, transfer switches, instruments and accessories, (and) annunciator panels, (and) fuel line and exhaust piping). Show accurately scaled layouts of system components; indicate their spatial relationship to associated equipment; show connections to normal and emergency power feeders. Failure to submit said

- scaled lay-outs does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
2. Manufacturer's standard catalog data describing and depicting each engine-generator set, batteries, charger, tanks, and all ancillary equipment in sufficient detail to demonstrate complete specification compliance.
 3. Drawings depicting each of the following:
 - a. Base mounted equipment, with base and all attachments including anchor bolt template and recommended clearances for maintenance and operation.
 - b. Complete starting system, fuel system, cooling system, and exhaust system.
 - c. Electric wiring of relays, breakers, and switches with applicable single line and wiring diagrams and written description of operation and the instrumentation provided.
 - d. Enclosure (if applicable).
- B. Manufacturer's standard catalog data describing and depicting each transfer switch along with all ancillary equipment in sufficient detail to demonstrate complete specification compliance. In addition provide the following:
1. One-line diagram of each switch assembly and wiring diagram of each unit.
 2. A complete list of equipment and material to be provided, containing an adequate description of each separate item of equipment.
- C. OPERATION AND MAINTENANCE MANUALS: Submit four complete sets of operating manuals for each item of equipment and/or component outlining the step-by-step procedure required for system start up, operation, and shutdown. Include the manufacturer's name, model number, and a description of all equipment, complete with basic operating features. Describe in detail all maintenance procedures and a troubleshooting guide listing possible breakdowns and repairs for each piece of equipment. Include all factory service manuals, complete parts lists, simplified schematic diagrams of each system as installed, and the original. Include complete test reports specified in Part 3-Execution herein.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Provide emergency electrical systems and components, of types, ratings, and electrical characteristics indicated. Provide all system components thru one supplier to guarantee total system responsibility. Provide system and components capable of start and load transfer within 10 seconds of power outage.

2.2 ENVIRONMENTAL CONDITIONS:

- A. Provide system components and accessories as required to ensure proper system operation at rated capacities under the following environmental conditions:
1. Altitude: 4800 feet above sea level
 2. Maximum ambient temperature: 50 degrees C.
 3. Minimum ambient temperature: 0 degrees C.
 4. Seismic Zone as indicated in General Structural Notes.

2.3 AUTOMATIC TRANSFER SWITCHES:

- A. Provide contactor type automatic transfer switches compatible with electric sets, and of continuous ampere rating sufficient to meet requirements of both maximum set output and normal power service. Switches that employ interlocking handles and circuit breakers to affect transfer are not acceptable. Provide 4 pole switches where distribution system is provided with ground fault protective relaying, or where indicated on drawings. Provide switches of voltage and phase indicated, and with the following features and characteristics:
1. Provide precision calibrated voltage sensors to monitor the normal power source and signal the electric set to start on a partial loss of power on any phase or where feedback voltages exist. Provide adjustability to signal start-up when line voltage drops 5 percent to 20 percent below pick-up voltage setting, and to signal shutdown when line voltage returns to 75% to 100% of normal.
 2. Provide a time delay relay, adjustable from 1 to 10 seconds, to delay the signal to start to avoid nuisance start ups on momentary voltage dips or power outages.
 3. Provide voltage sensors to sense return of normal power; and a time delay, adjustable 2 to 60 minutes, to delay the retransfer of load to normal to avoid short term fluctuations in normal power restoration.
 4. Provide an engine cool-down timer, adjustable from 0 to 5 minutes, for unloaded engine cool-down time. Timer shall engage after retransfer to normal.
 5. Provide pilot light to indicate switch in normal position and pilot light to indicate switch in emergency position. Mount pilot lights in front face of enclosure.
 6. Obtain operating current for transfer and retransfer from the source that the load is to be transferred. Provide automatic bypass to retransfer the load from the electric set to the normal source if the electrical set output interrupts after normal source restores voltage.
 7. Provide switch to simulate an interruption of power from the normal source.
 8. Provide manual operator with removable handle for manual operation of the switch.
 9. Provide clock exerciser to automatically start the electrical set at regular intervals and allow it to run for a preset time period; minimum of 30 minutes per week. Equip with selector switch to permit selection of "without load" or "with load" operation.
 10. Provide means to electrically disconnect the control section from the transfer switch for maintenance service during normal operation.
- B. **RATING AND PERFORMANCE:** Rate automatic transfer switch for continuous duty when enclosed in a non-ventilated NEMA 1 enclosure. Rate switch for all classes of load, both inductive and non-inductive, at 600 volts; and tungsten lamp load at 205 volts.
- C. Switch must be capable of closing into and withstanding fault current of 65,000 amperes RMS symmetrical at 600 volts, for units 225 amps and larger and 30,000 amperes RMS symmetrical on units 200 amps and less.
- D. **CONSTRUCTION:** Provide operating mechanism with sufficient mechanical and electrical interlocks to prevent simultaneous energizing both normal and standby service. Provide main contacts with arc suppression and heat dissipation devices to provide dependable transfer of highly inductive loads. Equip switch with terminal lugs for either copper or aluminum conductor.
- E. **ENCLOSURE:** Enclose switch in heavy gauge, welded seam construction, NEMA 1 enclosure.

- F. MANUFACTURERS: Subject to compliance with requirements, provide automatic transfer switches of one of the following:
1. ASCO, Inc.
 2. Onan Corp.
 3. Russelectric Co.
 4. Zenith Controls, Inc.
 5. Kohler Power System
 6. Generac

2.4 ENGINE GENERATOR UNITS:

- A. Provide 60 hertz alternating-current standby-diesel engine-driven generator units of voltage, phase and capacities indicated. Base rating of electric sets upon operation after deducting power required for output for all necessary operating accessories, (including remote or direct drive radiator fans, fuel pumps, etc.) and under environmental conditions specified. Provide electric sets rated and capable of producing KW specified at 0.8 power factor for continuous standby duty. Certify performance of the electric set series by means of independent testing laboratory tests for full power rating stability, and voltage and frequency regulation.
- B. Provide stationary, water cooled, full diesel, compression ignition, four stroke cycle, multi-cylinder, in-line or V-type engine. Arrange engine for direct connection to an alternator current generator; do not exceed engine speed of 1800 RPM at full rated load. Completely assemble engine, alternator, and components on a single base before shipping.
- C. OVERCURRENT PROTECTIVE DEVICES: Provide overcurrent protective devices mounted in generator enclosure to match ratings of overcurrent protective devices providing service to normal power side of transfer switches.
- D. LUBRICATION SYSTEM: Equip engine with a pressure lubricating system. Provide spin-on type full flow lubricating oil filters. Equip filter with bypass valve to insure oil circulation if filters are clogged. Include dipstick oil level indicator. Provide lube oil heater for engine generator units located outdoors or where ambient temperature requires lube oil heating.
- E. ENGINE COOLING SYSTEM: Provide engine cooling system that operates fully automatically while the engine is running. The cooling system coolant shall use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor ambient temperature of the application. All coolant pumps shall be centrifugal type. Each engine shall have an engine-driven primary pump.
- F. The engine cooling radiator shall be:
1. Engine/skid mounted at the front of the mounting base. Provide coolant in accordance with manufacturer's recommendation.
- G. Equip engine with thermostatically controlled water jacket heater on all water cooled units. On air-cooled engines provide an oil base heater. The heater voltage shall match available voltage at the site. Make all necessary connections of jacket and oil base heaters.
- H. AIR CLEANER: Provide reusable element air cleaner of size and type recommended by the engine manufacturer.
- I. STARTING: Equip engine with a 12 volt electric starting motor of sufficient capacity to crank the engine at a speed that will allow full diesel starting of the engine. Disengage starter automatically when engine starts.
- J. Provide engine start-stop switch with functions including reset, run/start, stop and

automatic mode. Provide adjustable cycle cranking and cool down operation.

- K. Provide rack mounted lead-acid battery set mounted integrally with electric set base. Provide sufficient capacity for cranking the engine a minimum of 4 cranking periods with 2-minute intervals between cranks. Each cranking period shall have a maximum duration of 15 seconds. Provide capacity and voltage recommended by engine manufacturer. Equip with all necessary interconnecting cables. Provide suitable float type battery charger to maintain the batteries in charged condition.
- L. BATTERY CHARGER: Provide suitable automatic SCR voltage regulated battery charger with a maximum charge rate, as recommended by the manufacturer, to maintain batteries at full capacity during standby conditions. Equip with ammeter to indicate charge rate and protect circuit by either fuses or circuit breakers. Design charger such that it will not be damaged during engine cranking.
- M. ENGINE INSTRUMENTS: Provide a unit mounted console with the following items:
 - 1. Lubricating oil pressure gauge
 - 2. Lubricating oil temperature display
 - 3. Coolant fluid inlet/outlet temperature display
 - 4. Coolant temperature gauge
 - 5. Run time meter
 - 6. Fuel meter display
 - 7. Tachometer display
 - 8. Battery charge rate ammeter
 - 9. Engine Start-stop switch
- N. EXHAUST SYSTEM: Provide a critical type exhaust silencer, flexible exhaust connector, and all exhaust piping and insulation as required. Flexible sections shall be made of convoluted seamless tube without joints or packing. Expansion joints shall be the bellow type. Expansion and flexible elements shall be stainless steel suitable for diesel-engine exhaust gas at 1000 degrees F.
- O. Comply with manufacturer's recommendations. Wrap the entire exhaust system, from manifold to roof or wall penetration with exhaust insulation blankets as manufactured by Advanced Thermal Products, Inc., Santa Ana, California. Install per manufacturer's instructions.
- P. ENGINE PROTECTION DEVICES: Provide the following engine protection devices with indicating light annunciation for each device:
 - 1. Low-oil pressure cut-out
 - 2. High air temperature cut-out
 - 3. Overspeed cut-out
- Q. MOUNTING: Equip electric set with a suitable base for mounting on a level surface. Provide vibration isolators, rated for seismic zone specified herein, between the electric set and base. Concrete base shall be designed by a Structural Engineer. All costs arising from design shall be paid by Manufacturer.
- R. FUEL: Provide engine capable of satisfactory performance on commercial grade diesel fuel as recommended by manufacturer.
- S. GOVERNOR: Equip engine with a high performance isochronous electronic governor to maintain frequency within the limits, as specified below by controlling engine and alternator speed.
 - 1. Stability: + or - 0.33 percent at rated load

2. Speed Regulation: 5 percent maximum load to rated load
- T. The governor shall be configured for safe manual adjustment during operation of the engine-generator from 90 to 110 percent of rated frequency.

2.5 FUEL SYSTEM:

- A. Equip engine with primary and secondary fuel filters with replaceable elements, and an engine driven fuel pump, all mounted on the engine. Provide fuel system piping of size and type recommended by the engine manufacturer. Provide fuel tank(s) as follow(s):
 1. Provide fuel tank, sufficient for (48) hours operation at full load, mounted between generator support rails.

2.6 ELECTRIC ALTERNATOR:

- A. Provide direct connected, engine driven, single bearing, synchronous type alternator with electrical characteristics indicated.
- B. INSTANTANEOUS VOLTAGE DIP: Limit voltage dip of engine generator set to less than 30 percent upon application of full rated power. Accomplish voltage regulation by means of a solid state voltage regulator. Inherently regulated machines are acceptable in sizes under 6KW.
- C. Stability: 1 percent of its mean value at any constant load from no load to full load for solid state regulators.
- D. Regulation: Plus or minus 2 percent maximum no load to full load for solid state regulators.
- E. Where more than 40 percent of the load is comprised of rectifiers and/or thyristors, provide power to voltage regulator by means of ceramic type permanent magnet pilot excitor, capable of 80 percent automatic controlled SCR/Thyristor loading.
- F. Provide instrument panel and console with the following:
 1. Manual reset circuit breaker
 2. A.C. voltmeter
 3. A.C. ammeter
 4. Voltmeter-ammeter phase selector switch with "off" position
 5. Frequency meter
 6. Start-Stop switch
 7. Remote start terminals
 8. Solid state cycle cranking control
 9. Engine safety alarm lights and contact
 10. Provide automatic solid state overload protection, under frequency protection, and volts/hertz characteristics.

2.7 WEATHERPROOF ENCLOSURE:

- A. Provide weatherproof enclosure for engine generator unit. Enclosure shall house all components including engine, alternator, batteries, battery charger, fuel tank and controls. Provide one piece roof with drip edge on all four sides and with formed roof stiffeners to support silencer. Provide angle iron frame around the entire bottom of the enclosure to attach to mounting surface. Provide doors on each side for access to engine, alternator and all components. Provide all doors with continuous piano type hinges with stainless steel pins. Provide lockable 2-point latches on all doors, keyed alike. Provide a welded fixed open air intake louver panel on each side to accomplish air

intake. Provide a framed expanded metal core guard to accomplish air discharge. Assemble all components with plated bolts and nuts. Caulk all seams to prevent rust bleed through. Clean and paint all components with manufacturer's standard rust inhibiting primer. Provide finish coat paint color to match pad mounted transformer. All openings shall be provided with screen material to exclude entrance of rodents.

2.8 SAFETY SYSTEM AND REMOTE ANNUNCIATOR:

- A. Provide all wiring, devices, equipment, and components to automatically activate the appropriate signals and initiate the appropriate annunciation as specified herein.
- B. Provide remote annunciator panel in surface enclosure (locate as directed by Owner/Architect or as indicated on drawings) with the features specified and with audible and visual alarm indication of the following conditions:
 - 1. Low engine temperature (engine heater not functioning).
 - 2. High temperature prealarm - engine temperature approaching shut down.
 - 3. Low oil pressure prealarm - engine oil pressure approaching shut down.
 - 4. Unit shut down due to low oil pressure.
 - 5. Unit shut down due to high temperature.
 - 6. Unit shut down due to overcrank.
 - 7. Unit shut down due to overspeed.
 - 8. Emergency (or normal) power source supplying load.
 - 9. Battery charger malfunction.
 - 10. Low fuel - main tank contains less than a 3 hour supply.
 - 11. Low battery voltage.
 - 12. System ready no alarm conditions present, all controls in "automatic".
 - 13. Audible alarm silence push button.
- C. MANUFACTURER: Subject to compliance with requirements, provide engine-driven generator sets of one of the following:
 - 1. Caterpillar Tractor Co.
 - 2. Cummins Engine Co.
 - 3. Kohler Co.
 - 4. Onan Corp.
 - 5. Spectrum Detroit Diesel
 - 6. Generac

PART 3 – EXECUTION

3.1 INSTALLATION OF ENGINE-GENERATOR SYSTEMS:

- A. Install standby engine-generator sets as indicated, in accordance with the equipment manufacturer's written instructions, and with recognized industry practices, to ensure that engine-generator sets fulfill requirements. Comply with NFPA and NEMA standards pertaining to installation of standby engine-generator systems and accessories.
- B. Provide vibration isolation mounting and anchoring of generator set to concrete slab.
- C. Install fuel oil and piping to standby generator equipment. Comply with manufacturer's instructions and recommendations.

- D. Electrical Identification: Refer to Section 260553 for requirements.

3.2 GROUNDING:

- A. Provide equipment grounding connections for system components.

3.3 TESTING:

- A. Upon completion of installation of engine-generator system and after building circuitry has been energized with normal power source, (including all VFD's and other motor starters), test engine-generator to demonstrate standby capability and compliance with requirements. Provide start-up and testing by factory authorized representative in accordance with manufacturer's recommendations. Perform each of the following tests (as a minimum) and submit written report of results of each as part of the Operation and Maintenance Manuals required herein:
1. Mimic a normal power outage by de-energizing normal power source to the facility. Verify engine start, transfer, and operation of all loads satisfactorily. Re-energize normal power, and verify proper performance of load retransfer, engine cool down, and engine shut down. Record and report all results.
 2. Mimic a generator test by operating the "test mode" switch (with facility still energized by normal power). Verify engine start, transfer, and operation of all loads satisfactorily. Return "test" switch to normal, and monitor performance of load retransfer, engine cool down, and engine shut down. Record and report all results.
 3. Perform a safety run test in accordance with the following:
 - a. Provide all fluids, equipment, and test instrumentation to perform complete tests.
 - b. Perform and record all engine manufacturer's recommended pre-starting checks and inspections.
 - c. Verify the proper operation of all controls, gauges, instruments, and set points.
 - d. Verify the proper operation of the emergency stop switch, the over-speed limit switch, oil overfill limit, oil low limit, and the over- and under-frequency limits. Where digital controls prevent direct access to safety switches, the manufacturer's representative shall utilize a field service computer and manufacturer's field service software to demonstrate the control's monitoring of engine speed, oil pressure and coolant temperature.
 - e. Perform an engine load run test. Provide all fluids, equipment, load banks, and test instrumentation to perform complete tests.
 4. Perform and record all engine manufacturer's recommended prestarting checks and inspections.
 5. Tests:
 - a. 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 specification parameters.
 - b. Continuous engine load run test:
 - i. Provide a resistance load bank and make temporary connections for full load test.

- ii. Readings shall be taken at 15 minute intervals shall include the following:
 1. Output amperes, voltage, real and reactive power, power factor and frequency.
 2. Lube-oil pressure.
 3. Coolant, lube-oil, exhaust, and ambient temperatures.
 - iii. Operative the engine generator set for 4 hours at 100% of rated load.
 - iv. Remove load from the engine generator set. Shut down the engine generator set.
6. Perform tests required by NFPA 110 acceptance tests that are additional to those specified here including, but not limited to, a "cold start" test and a one step rated load pickup test. The AHJ (Authority Having Jurisdiction) shall be notified in advance and shall have the option to witness the tests.
 7. Inspect lube oil filter for excessive metal, abrasive foreign particles, etc. If corrective action is necessary, perform all above run tests again after corrections have been made. Check all engine and mounting bolts for tightness and/or visible damage. Inspect and verify engine-generator shaft alignment by means of dial indicator.
- B. After completion of all tests, provide engine fluid and diesel fuel to refill all engine fluids and refill diesel fuel tank to capacity.

3.4 ON SITE TRAINING:

- A. Conduct a training course for operating staff as designated by the Owner. The training period shall consist of a total of 8 hours of normal working time distributed between two shifts, and shall start after the system is functionally complete but prior to final acceptance. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment as well as all major elements of the operation and maintenance manuals. Additionally, the course instruction shall demonstrate all routine maintenance operations such as oil change, oil filter change, air filter change, etc.

3.5 FIELD ENGINEER:

- A. Provide a qualified field engineer to supervise the installation of the engine generator set, transfer, etc., assist in the performance of the on-site tests, and instruct personnel as to the operational and maintenance features of the equipment.

3.6 SERVICE AND SUPPORT

- A. The manufacturer of the generator set shall maintain service parts inventory at a central location that is accessible to the service location 24 hours per day, 365 days per year.
- B. The generator set shall be serviced by the local service organization (during the warranty period) 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.

END OF SECTION 26 3213