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PART 1 – GENERAL

1.01 GENERAL

Emergency stand-by power systems shall be provided by the Contractor and installed, tested, commissioned and warranted as required in the Contract Documents as supplemented by this STANDARD SPECIFICATION.

1.02 CODES AND PERMITS

All electrically related work, installations, equipment, and devices shall conform to the requirements of the following listed standards as a minimum. The electrical design engineer shall be permitted to increase/enhance the requirements but SHALL NOT be permitted to decrease/reduce these requirements.

A. NFPA 70 National Electrical Code
B. NFPA 110 Standard for Emergency and Standby Power Systems
C. NEMA Standards Publication 250-2008
D. Local utility company standards and installation guidelines with respect to service entrance and metering
E. USEPA Non-Road Sources Emissions Standards 40 CFR 89
F. All municipal and state regulations regarding electrical installations and “on-site” power generation equipment.

1.03 SCOPE OF WORK

Provide, install, test, warrant, commission, and conduct acceptance testing for a completely operational Emergency Standby Power System as described in NFPA 110, NFPA 70 and other related standards to include all devices, assemblies, external wiring and accessory items as specified herein. All equipment shall be new, factory prototype test supported, and placed in service.

1.04 SUBMITTALS

Submittals shall be provided as specified in the Contract Documents.

PART 2 – PRODUCT DESCRIPTION

A. The contractor shall provide a diesel fueled emergency stand-by power system. This shall include the generator, controls, enclosure, sub-base fuel tank and automatic transfer switch. The contractor shall provide a complete system, products of a single manufacturer, or separate items covered under the generator manufacturer's warranty.

B. Acceptable manufacturers:

1. Generators
    a. Cummins
    b. Caterpillar
    c. Generac
2. Automatic Transfer Switch
    a. Cummins
    b. ASCO
    c. Generac

2.01 EQUIPMENT

A. General - The equipment/material/services shall consist of:

1. A diesel engine driven electrical power generating set
2. An equipment protective enclosure
3. An automatic power transfer switching assembly
4. A skid-base or sub base style fuel storage tank assembly with necessary accessories
5. Ancillary equipment assemblies/components as described herein
6. Technical services/labor for final acceptance testing and commissioning

B. Equipment Description(s):

1. Diesel-Engine Powered Generator Set
    a. The prime mover shall be 4-cycle diesel powered with on-board battery charging alternator, spin-on fuel, lube, and (as required) coolant filter(s), dry-element air cleaner, and an integral set-mounted radiator cooling system.
    b. The engine shall be certified to U.S. EPA Non-Road Source Emissions Standards 40 CFR 89 requirements.
    c. The main alternator shall be a brushless, 4-Pole, revolving field type with the rotor close-coupled to the prime mover by way of a flexible disc design.

d. Alternator cooling shall be provided by a direct-drive centrifugal blower-fan design.
e. Excitation shall be:
    i) PMG (permanent magnet) design for all units sized 30 KW or greater.
    ii) Units sized smaller than 30 KW shall have PMG excitation or an excitation system designed and constructed such that an integral excitation boost function working with a torque-matching type automatic voltage regulator (AVR) provides supplementary excitation power in response to the application of large load(s) resulting in the minimization of generator output voltage dip and recovery time. Voltage and frequency dip shall not exceed 15% and shall have a recovery time of no more than 8 seconds.
f. The main alternator shall be a broad range, 12-lead, field re-connectable for 120/208V, 120/240V, and 277/480V, three-phase, four wire output unit with an integrated load circuit breaker.
g. The generator shall meet or exceed all Emergency Standby Power ISO Standards.
h. The generator set-mounted control system shall have the features listed below.
    i) Integrated isochronous governing and fuel control in accordance with ISO 3046, AS 2789, DIN 6271, and BS 5514 standards.
    ii) An integrated 3-Phase sensing voltage regulation system with automatic single and three- phase fault regulation.
    iii) Integrated AC protective functions to include over/under voltage, short-circuit, over-current, and overload protective warning and shut-down features.
    iv) An integrated engine management system to include configurable cycle-cranking functions and configurable start sequencing.
    v) A comprehensive warning and shut-down protection system to include configurable warning and shut-down conditions.
    vi) Data display(s) to include 3-Phase AC voltage output, load current, engine oil pressure, coolant temperature, DC voltage/current, non-resettable engine elapsed (run) hours, fault status, and a fault reset function.
    vii) The control panel shall be of NEMA 3R or better construction.
i. The main alternator shall be constructed such that it meets the requirements of NEMA Class H insulation with temperature rise of 125 °C or better.
j. The generator set housing shall include the following features at a minimum:
    i) Directly attachable to either the generator skid base or fuel tank.
    ii) Stainless steel assembly hardware.

iii) Rain collar and rain cap/exhaust constructed such that rainwater, sleet, snow, sand etc. is precluded from entry to the exhaust system whether the engine is running or not.
iv) Easily accessed lifting points suitable for spreader bars and/or a forklift.
v) Compatibility with sub-base fuel tanks.
vi) Designed for use out-of-doors in ambient temperatures ranging up to 50 degrees Celsius.
vii) Constructed such that the electrical stub-up area(s) mates with that of its associated generator set.
viii) Designed with a minimum wind rating of 150 mph.
ix) A sufficient number of recessed doors on all sides for ready access to all service points.
x) Access doors equipped with the means to securely lock them with standard commercial padlocks.
xi) The enclosure shall be coated with factory applied weather and corrosion resistant paint.
xii) The enclosure shall be constructed such that, with the unit running under 100% of its rated load, sound pressure at seven meters (approximately 23 feet) does not exceed:

_____ No special sound attenuation is required

_____ db

_____ As determined by an attached sound survey

2. Generator Set Fuel Storage Tank:
   a. The fuel storage tank shall be an sub-base style with sufficient capacity for the generator set to run at 100% of its rated load for 36 continuous hours. The fuel tank capacity shall not exceed 1200 gallons. If the fuel volume required to comply with the specified run-time exceeds 1200 gallons the contractor shall notify and coordinate with the City of Savannah for a fuel spillage containment plan.
   b. The tank shall be of double-walled design compliant with UL 142 and NFPA 37.
   c. The tank shall be equipped with UL listed venting devices, a rupture basin leak detection device, a tank level indicator (fuel gauge) device, and a lockable (padlock) type fuel fill cap.
   d. The tank shall have all necessary threaded penetrations and pick-up tube(s) for supply and return fuel lines to/from the engine (size as recommended by the

engine manufacturer), venting, filling, and etc. devices. Flexible fuel lines, applicable fittings and necessary loss-of- prime prevention devices shall be supplied by the vendor.

e. The tank shall be constructed such that a minimum of four (4) inches of clearance exists between all points of the tank bottom and the surface to which it is mounted in order to provide air circulation to reduce/eliminate corrosion-causing moisture accumulation.
f. The tank shall be constructed such that its overall height does not exceed 36 inches.
g. The tank shall have accommodations for anchoring to a concrete pad.
h. The tank shall be constructed such that a generator set with housing may be securely fastened on top of it with stainless steel hardware.
i. The electrical conduit stub-up area shall mate with the generator and housing mounted to it and shall be readily accessible by service/installation personnel by way of removing an access plate from the tank after the entire structure (generator, housing, and tank) is assembled.
j. The generator set and housing shall be securely mounted on top of the fuel tank with Grade 8 stainless steel hardware. This hardware shall be supplied by the vendor.
k. All external surfaces including the bottom of the fuel tank shall have a minimum of two (2) coats of a polyurea factory applied coating.

3. Automatic Transfer Switch:
   a. The Automatic Transfer Switch (ATS) shall be a 4-Pole, Double-Throw device with a switched neutral, mechanical lug wire termination devices integrated. The ATS shall be capable of both manual and automatic operation. Four-Pole automatic transfer switches shall be provided with programmed transition and intermediate position configuration.
   b. The ATS shall be rated for continuous operation of the main utility service as required by NFPA 70 Article 700, (voltage and current rating shall equal or exceed the main utility service to the station).
   c. The ATS shall be equipped with a NEMA TYPE 4 enclosure. Stainless steel NEMA Type 4X and NEMA 1 enclosures are not acceptable.
   d. The ATS shall be 100% compliant with UL 1008.
   e. The ATS shall be 100% compliant with NFPA 70 and 110.
   f. The ATS shall be 100% compliant with NEMA ICS 10 and IEEE 446.
   g. The ATS shall be equipped with arc chutes to cool and quench arcing with barriers to prevent inter-phase flashover.

h. The ATS shall be the power contactor type. Circuit breaker or molded case switch type are not acceptable.
i. The ATS shall be rated to carry 100% of its rated current at rated voltage.
j. The ATS shall be equipped with a minimum of two sets of dry form-C contacts (one set for each power source) for remote indication of which power source (Normal or Emergency) is connected to the load. These contacts shall be rated for a minimum of 10 AMPS at 250VAC and shall be readily accessible at terminal strips for easy field wiring.
k. The ATS shall be equipped with a manual operating capability suitable for safe end-user operation.
l. The ATS operating mechanism shall be of open transition (break-before-make) design with mechanical and electrical interlocking feature(s) which preclude connecting the load to more than one power source at a time.
m. The ATS transfer mechanism shall be designed and constructed such that three (3) distinct positioning conditions exist with respect to the load connection. These conditions shall be:
    i) Load connected to NORMAL (utility) power source.
    ii) Load connected to EMERGENCY (generator) power source.
    iii) Load not connected to any power source, (intermediate).
n. The ATS transfer mechanism shall be designed and constructed such that the end-user may place it in any one of its three (3) position conditions with the control set for manual operation and it will remain in that position unattended until is manually placed in another position, or the control is set for automatic operation.
o. The ATS main contacts shall be manufactured of high pressure silver alloy material to resist burning and pitting in order to extend their anticipated service life.
p. The ATS shall, at a minimum, be equipped with the user-adjustable time delay features listed below:
q. Time Delay – Engine Start
r. Time Delay – Normal to Emergency Transfer
s. Time Delay – Load Disconnected from all Power
t. Time Delay – Emergency to Normal (Re-Transfer)
u. Time Delay – Engine Cool down Period
v. The ATS control shall be equipped with a user-programmable exerciser function which allows for the programming of exercise start and stop times, length of exercise period, day of the exercise, single weekly or multiple exercise events,

and a manual exercise initiate/terminate function which does not require special tooling and/or software.

w. The ATS integrated control shall also have the features/functions listed below as a minimum:
    i) Voltage sensing of all normal (utility) power source phases with user-adjustable pick-up and drop-out points.
    ii) Voltage sensing of at least one phase of the emergency (generator) power source with user-adjustable pick-up and drop-out points.
    iii) Control push button(s) and/or switch(s) to initiate a system test and/or override selected time delays.
    iv) End-User-programmable exercise and test functions for exercising/testing under "with load" and "without load" conditions.
    v) Front panel indicator display(s) showing power source availability and which source the load is connected to. This display shall be constructed such that constant exposure to sunlight and/or weather conditions do not degrade its readability.

4. Ancillary Equipment:
    a. The engine-driven generator shall be equipped with a tank style coolant/block heater sized according to the engine manufacturer's recommendation to assist with rapid engine starting and stabilization.
    b. The engine coolant/block heater assembly shall be equipped with a six (6) foot long AC power cord configured with a NEMA 5-20P male plug for 120VAC or 6-20P male plug for 240VAC as applicable for easy power removal during service and/or repair events.
    c. The coolant/block heater assembly shall be installed in/on the generator system such that it can be readily isolated from the engine coolant sub-system by closing "ball-cock" type valves so that field service personnel may easily replace the heater and associated hoses without draining the coolant sub-system or taking the generator out of service.
    d. The generator system shall be equipped with a battery charger-maintainer SENS Model NRG22-10-RC mounted inside the generator enclosure such that it is readily accessible for service activities and/or operator viewing of read-outs. The charger shall be equipped with a six (6) foot long AC power cord configured with a NEMA 5-20P male plug. No substitutions permitted.
    e. The engine-generator shall be equipped with the manufacturer recommended lead-acid starting battery(s) and associated cables. Provide battery straps and heater per NFPA 110.

f. The engine-generator shall be equipped with the manufacturer recommended. EPA compliant exhaust system.

2.02 TESTING AND COMMISSIONING

On-site start-up, testing, and system commissioning shall be accomplished by a manufacturer's certified representative. City of Savannah personnel shall be present as witness to these procedures and to assist with equipment operation for all testing, commissioning, and acceptance activity. The below listed activities and demonstrations shall be required as a minimum:

A. Install starting battery(s) and associated cabling. Connect/adjust the battery charger-maintainer as necessary.

B. Install flexible fuel lines, fittings, and loss-of-prime prevention devices. Inspect any feeder fuel piping and verify that it is correctly installed, (notify City of Savannah of incorrect installation). Prime the generator set fuel system.

C. Inspect and verify that all electrical load and control wiring to/from the generator and ATS are properly sized, installed, and terminated.

D. Inspect and verify that all of the various sub-assemblies (housing, fuel tank, etc.) are correctly assembled.

E. Start and run the generator unit under no-load conditions and verify the correct voltage, frequency, and phase rotation is present at the generator load breaker output terminals. Allow the unit to run for a sufficient time to achieve normal operating temperature and verify the correct operation of the engine thermostat.

F. Verify that the phase rotation and High Leg (240VAC units) at the emergency terminals of the ATS match the normal (utility) terminals as applicable. Correct as necessary.

G. Verify the correct operation of the ATS in response to both power-fail and system-test conditions with no load applied.

H. Verify correct system operation under simulated power failure and restoration conditions with the site load applied:
   1. The system shall automatically respond to a power failure condition by starting the generator and correctly transferring the load to the emergency power source. Verify that all applicable time delay functions operate correctly.

2. The system shall automatically respond to normal power restoration by re-transferring the load to the normal power source and returning to a standby condition. Verify that all applicable time delay functions operate correctly.
3. With the site load(s) operating on emergency power, start and run all load devices and verify that there is no relay drop-out or degradation of function of any sub-system at the site while operating on emergency power due to motor starting in-rush effects or other anomalies of the station load(s). Programmed start of the station loads shall be permissible under the conditions listed below:
    a. All single-phase loads and at least one main load device shall be supplied power at step A.
    b. The remaining station loads may be applied one at a time providing that there is no more than 10 seconds delay between each application until 100% of the station load is applied.
4. Verify the correct operation of ALL engine safety and alternator protection shut-down and warning functions by simulating the applicable fault.
5. Adjust all time delay functions to end user requirements and set the exerciser function and time period to end user requirements.
6. Load test the system at 100% of rated load for two consecutive hours in compliance with NFPA 110 Level I using a resistive load bank.
7. Demonstrate a successful single-step pick-up of a 100% rated load.

2.03 ADDITIONAL REQUIREMENTS

A. The generator shall be sized such that when 100% of the site KW load is applied, the generator shall not be loaded less than 35% of its nameplate capacity nor more than 87% of its nameplate rating capacity.

B. The ATS unit shall be rated to equal or exceed the main utility service to the station.

C. All Emergency Power System assemblies shall be warranted for five (5) years or 1,500 hours of operation whichever comes first with a comprehensive factory warranty that includes all parts, labor, and travel.

D. Provide a minimum of one complete set of operator instruction and maintenance manuals to the end user department representative in printed form.

E. Provide familiarization and operator training to the end user department personnel as requested. Provide 4 hours of training.

2.04 FINAL ACCEPTANCE

Final acceptance of the Emergency Standby Power System shall be upon of all the requirements of this specification and Specification 11100 being certified acceptable by the City of Savannah Inspector and the Wastewater Conveyance Maintenance Department office of the City of Savannah.

END OF SECTION 16620