

## ATTACHMENT A

### LEE COUNTY UTILITIES TECHNICAL SPECIFICATIONS DIESEL ENGINE DRIVEN GENERATOR SETS SECTION 26 32 13

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required for a complete unit, and field test of the diesel engine driven generator unit, and controls as shown on the specifications herein. The equipment installation is to be performed by the County.
- B. Testing and startup of the system shall be provided by the vendor.
- C. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, and delivery of a complete unit, and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these Specifications or not.
- D. The genset supplier is responsible for field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.
- E. Provide per the project scope all equipment as specified including but is not limited to supplying engine generator sets complete, Automatic transfer switch complete, sub-base fuel tank, sound attenuated enclosure, muffler, line circuit breakers, etc.
- F. The generator Unit shall be as manufactured by Cummins-Onan, or equal, with a standby rating of \_\_\_kW, \_\_\_kVA, 1800RPM, 0.8 power factor, 277/480Volt, 3 phase, 60 Hertz, 4 wire including radiator fan and all parasitic loads.
- G. The generator unit shall bear a UL2200 label.

##### 1.02 RELATED SECTIONS

- A. Section 26 36 00-Automatic Transfer Switches
- B. Section 26 05 02-Basic Materials and Methods
- C. Section 26 05 19-Low Voltage Wire and Cables
- D. Section 26 05 26-Grounding and Bonding for Electrical Systems

### 1.03 DESCRIPTION OF SYSTEMS

- A. A complete package shall be provided by the generator set distributor, maintaining single source responsibility. The complete package shall include the automatic transfer switch specified in other sections.
- B. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein.

### 1.04 SUBMITTALS

- A. Submit to the Engineer for review in accordance with division 26 Sections of the specifications, complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other Sections, including foundation drawing showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment. Drawings must be created specific the project, manufacturers standard drawings are not acceptable.
- B. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects. Approval by the Engineer is required.
- C. The submittal data for each unit shall include, but not necessarily be limited to, the following:
  - 1. Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; fuel tank; and all other items requiring space for installation. Layout and stub-up locations of electrical and fuel systems.
  - 2. Interconnect wiring diagram of complete emergency system, including generator, switchgear, fuel tank level monitor/transmitter, battery charger, remote alarm indications.
  - 3. 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.
  - 4. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.
  - 5. Engine Data:
    - a. Manufacturer
    - b. Model
    - c. Number of cylinders
    - d. RPM
    - e. Bore x stroke
    - f. Piston speed, RPM
    - g. Make and model and descriptive literature of electric governor
    - h. Fuel consumption rate curves at 25,50,75,100% loads

- i. Engine continuous pump drive duty rating
  - j. Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads).
  - k. Manufacturer's and dealer's written warranty.
  - l. Emissions data
6. Generator Data:
- a. Manufacturer
  - b. Model
  - c. Rated KVA
  - d. Rated kw
  - e. Voltage
  - f. Temperature rise above 40 degree C ambient
  - g. Generator efficiency including excitation losses and at 80 percent power factor
  - h. Generator resistances, reactances and time constants.
  - i. Generator current decrement curve.
  - j. Generator motor starting capability.
  - k. Generator thermal damage curve.
  - l. Line circuit breaker.
7. Generator Unit Control Data:
- a. Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Control panel schematics
  - b. Legends for all devices on all diagrams
  - c. Sequence of operation explanations for all portions of all schematic wiring diagrams
8. Generator Unit and Accessories:
- a. Weight of skid mounted unit
  - b. Overall length
  - c. Overall width
  - d. Overall height
  - e. Exhaust pipe size
  - f. CFM of air required for combustion and ventilation
  - g. Heat rejected to jacket water and lubricating oil...BTU/hr
  - h. Heat rejected to room by engine and generator...BTU/hr
  - i. Jacket water heater connection diagram.
  - j. Automatic load transfer switch(es).
- D. Submit to the Engineer operating and maintenance data as specified in 26 05 02 Basic Electrical Materials and Methods of this specification. Submit to the Engineer the equipment Manufacturer's Certificate of Installation, Testing and Startup Report.

#### 1.05 SPARE PARTS

- A. The Manufacturer shall furnish one (1) complete spare replacement sets of all filter elements required for the generator unit.

## PART 2 - PRODUCTS

### 2.01 RATINGS

- A. The rating of the generator set shall not exceed the Manufacturer's published standby rating. The gross engine horsepower required to produce the standby rating shall not exceed the Manufacturer's published continuous duty rating by more than 150 percent. Continuous duty rating shall be as defined in BS5514 or DIN6271 but in no case shall it exceed the Manufacturer's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, radiator fan (for fan cooled models) and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1800 rpm.
- B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the Manufacturer for the actual unit supplied.
- C. The generator set shall operate at 1800 rpm and at a voltage of: 277/480, 3-Phase, 4-wire, 60 hertz. The complete generator set shall be rated per ISO8528 standby rating, based on site conditions of: Altitude 100 meters, ambient temperatures of 50 degrees C, based on temperature measured at the alternator inlet. The generator set rating shall be based on stationary emergency/standby service and marked as applicable per NFPA110.
- D. Performance:
  1. Voltage regulation shall not exceed one percent for any constant load between no load and rated load for both parallel and non-parallel applications. 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 0.25%.
  3. Generator sets shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition.
  4. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
  5. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set.
  6. 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.
  7. 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.
  8. The generator set shall share real and reactive load proportionally within plus or minus 3% with all other generator sets in the system.

9. The time required to automatically start, accelerate to rated speed and voltage, synchronize and parallel all generator sets to the system bus on a normal power failure shall not exceed 15 seconds, assuming that the water jacket heaters are operating properly.
10. The generator set and complete sound attenuated enclosure sound levels shall be tested by the manufacturer per ANSI S1.13. Data documenting performance shall be provided with submittal documentation.

## 2.02 CONSTRUCTION

- A. 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.
- B. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.
- C. All outdoor equipment shall be enclosed with corrosion-protected materials. Steel components used in enclosures shall be powder coated and baked, and shall provide fade and corrosion resistance in compliance to Dry film thickness shall be SHD3363 of 2H+ all a minimum of 1.8 Mils, gloss at 60degrees per ASTMD523 of 80+/- 10, pencil hardness per ASTM D3363

## 2.03 CONNECTIONS

- A. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept two hole 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.
- B. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

## 2.04 ENGINES

- A. The engine shall be full compression ignition, four cycle, single acting, solid injection engines, either vertical or "V" type. Speed shall not exceed 1800 revolutions per minute at normal full load operation. The engine governor shall be +/- 0.25 percent accuracy electronic type governor.
- B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM Designation D396). Diesel engines requiring a premium fuel will not be considered.
- C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.

- D. The engine shall be equipped with spin on fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, engine driven water pump, and unit mounted instruments. The engine shall be provided with low oil pressure, high water temperature and overspeed safety shutdowns.
- E. Injection pumps shall be pressure time common rail type. The system shall be self bleeding and self priming in design. The fuel system shall provide redundant overspeed protection with one governor having a dual flywheel fuel limiting mechanical control and the other fail safe electric control. The governors shall be located within the fuel pump body without external linkages or adjustments. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing. Digital Electronic fuel injection systems shall be considered equal to common rail type pressure injection systems.
- F. The fuel system shall be equipped with spin on fuel filters having replaceable elements. Filter elements shall be spin on canister elements, easily accessible and removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure. The engine shall be provided with a Racor type fuel water separator, sized as determined by engine manufacturer, to filter fuel continuously while unit is in operation.
- G. The engine shall be provided with removable wet-type cylinder liners of close grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one piece stress relieved grey iron casting.
- H. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be spin on canister elements, easily accessible, easily removed and cleaned and shall be equipped with a spring-loaded by-pass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water cooled lubricating oil cooler and dipstick oil level indicator.
- I. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit. The air cleaner shall be replaceable, easily accessible with restriction indicators.
- J. Provide fuel ramping control to limit black smoke and frequency overshoot.
- K. The engine shall be radiator and fan cooled. 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.

- L. Provide fuel cooler, suitable for operation of the generator set at full rated load in ambient temperature.
- M. Provide Racor, or approved equal, Crankcase Ventilation System.
- N. A digital 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, and operating in various isochronous states. The governor control logic shall be based in the engine ECM and must communicate with the alternator and set control. Third party and private labeled governors are not acceptable.

## 2.05 COOLING SYSTEMS

- A. The engine shall be furnished with a unit mounted radiator type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature of 122 degrees F. The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions.
- B. Radiator shall be sized based on a core temperature which is 10 degrees C 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 cooling system shall be filled with a 50/50-ethylene glycol/water mixture by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
- C. Closed circuit jacket water systems shall be treated with a rust inhibitor as recommended by the engine Manufacturer.
- D. A unit mounted thermal circulation type water heater incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 70 degrees F. The heater shall be rated as shown on the drawings.
  - 1. Heater shall be UL499 listed and labeled.
  - 2. Install on the engine with SAEJ20 compliant materials. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches.
  - 3. Installation shall be specifically designed to provide proper venting of the system.
  - 4. Install using isolation valves to isolate the heater for replacement of the heater element. The design shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
  - 5. Provide a thermostat, installed at the engine thermostat housing. Provide for a single AC power connection to the coolant heater system.

## 2.06 EXHAUST SYSTEMS

- A. The engine exhaust silencer shall be a critical grade and provided by the genset manufacturer. Silencer shall be sized and approved by the engine manufacture and supported by acoustical and pressure loss calculation not to exceed 55db max at the property line.
- B. All exhaust equipment must be rated to withstand temperatures of approximately 1,000 degrees F. A flexible stainless steel pipe connection shall be provided between the engine exhaust stack and exhaust piping. One silencer raincap with counter weight shall be provided for each silencer. The exhaust system shall be mounted inside genset enclosure.

## 2.07 AUTOMATIC STARTING SYSTEM

- A. A DC electric starting system with positive engagement shall be furnished. The starting motor voltage shall be as recommended by the engine Manufacturer.
- B. An engine control shall be furnished as an integral part of the electric set to start and stop the engine as signaled by the automatic transfer controls on the generator control unit. The control shall start the engine by adjustable timed cranking cycles for a total period of not less than one minute. The crank and rest cycles shall be individually adjustable. The starting circuit shall open, and the control shall activate an alarm circuit if the engine does not start. The control shall be equipped with automatic safety shutdowns so that upon signal of a low oil pressure, high water temperature, or overspeed condition of the engine, the control shall immediately stop the engine. The control shall be equipped with digital display to indicate any of the engine failures and also with a 3-position control switch identified for "automatic-off-manual" externally mounted.
- C. Engine Cranking Batteries: The batteries shall be of the lead acid type, and shall be of domestic manufacture. The battery shall be rated S.A.E. type "D", diesel engine starting type and of sufficient size and capacity in a fully charged condition to crank start the engine generator for the maximum allowed crank cycle, (minimum 20-second cranking periods) six consecutive times at 20 degrees F without recharging between cranks. The batteries shall be mounted in suitable covered racks. Battery rack location will be as shown on the Shop Drawings. The electrical Contractor shall provide the required lengths of all interconnecting battery cables. Minimum wire size and type shall be 2/0 welding cable.
- D. Battery Chargers:
  - 1. Provide a 10amp battery charger. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications. The charger shall be compliant with UL991 requirements for vibration resistance.
  - 2. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours.
  - 3. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the



- battery to 100 percent of charge, and a float stage to maintain a fully charged battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.
4. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.
  5. The charger shall include the following features:
    - a. Two line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;
    - b. LED indicating lamp(s) indicating normal charging condition (green), equalize charge state (amber), and fault condition (red);
    - c. AC input overcurrent, over voltage, and undervoltage protection;
    - d. DC output overcurrent protection;
    - e. Alarm output relay;
  6. Locate Charger in the automatic transfer switch.

## 2.08 ALTERNATOR, EXCITER AND ACCESSORIES

- A. Rating: The alternator shall be rated \_\_\_KW, \_\_\_KVA at 0.8 p.f., 1800 RPM 3 phase, 60 Hertz, 277/480 volts, at a maximum temperature rise of 80 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The alternator shall be wound for 2/3rds pitch for harmonic mitigation. The alternator shall conform to NEMA Standard MG-1. As an alternate to the 80 degree C rise alternator (if not a standard option), the manufacturer shall upsize the diesel generator such that at the derated capacity of \_\_\_kw, the heat rise on the alternator will be 80 degree C rise or better.
- B. Performance: The instantaneous voltage dip shall not exceed 25 percent of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 1 second. Steady state modulation shall not exceed +/- 1/2 percent. Provide documentation of submitted unit meeting performance criteria with shop drawing submittals.
- C. The alternator shall be capable of starting across the line, \_\_\_ HP motors that are 85% efficient with a power factor of 0.8 in \_\_\_ equal steps with no more than 10% instantaneous voltage dip and 2% frequency dip. Provide documentation of submitted unit meeting performance criteria with shop drawing submittals.
- D. Construction:
  1. The alternator and exciter shall be drip proof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.

2. The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.
3. Alternator stator and exciter stator windings shall be a full Class H insulated system (generator rated for class B temperature rise of 80 degrees) vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air.
4. Alternator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Alternator windings shall be braced for full line to ground fault currents, on a solid grounded neutral system.
5. Provide an anti-condensation heater for the alternator for generator sets installed outdoors or in unheated environments.

## 2.09 ACCESSORIES AND ATTACHMENTS

- A. Terminal boxes: The unit shall contain a controls terminal box properly sized and provided with terminal strips and interposing relays and devices to properly interface genset controls with remote controls and instrumentation. The generator shall have separate AC and DC low voltage terminal boxes with suitably marked terminal strip for required connections.
- B. All required P.T.'s, C.T.'s and protective relays shall be supplied by the engine-generator Manufacturer.
- C. Vibration isolation: Provide spring type vibration isolation.
- D. Provide a molded case line circuit breaker. Provide breaker with solid state adjustable functions for long time, and instantaneous trip. Instantaneous adjustment trip setting range 2-10 or greater. Provide line circuit breaker with a 100% continuous current rating.

## 2.10 GENERATOR ASSOCIATED CONTROLS

- A. Voltage Regulator: The generator Manufacturer shall furnish a hermetically sealed, silicon controlled rectifier type voltage regulator employing a zener reference with a plus or minus one percent regulation for the generator. The regulator shall include 3 phase voltage sensing, automatic short circuit protection and shall include automatic underfrequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures. Switches and/or fuses shall not be used to provide this protection. An over-voltage sensing module with manual reset shall be furnished with the regulator. A volts per Hz., sensing module shall be provided as part of the regulation system. A voltage adjustment rheostat for 5 percent voltage adjustment on the unit shall be provided.

- B. 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 300% of rated current for not more than 10 seconds.

## 2.11 GENERATOR SET INSTRUMENTATION

- A. The generator set shall be provided with a microprocessor-based control system which is designed to provide automatic starting, monitoring, and control functions, both local and remote, for the generator set. The control shall be mounted on the generator set. Controls shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The control shall be UL508 listed, and meet IEC8528 part 4. All switches, lamps, and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. The entire control shall be tested and meet the requirements of IEEE-587 for voltage surge resistance.
- B. The front display of the genset control panel unit shall include the following:
  - 1. 1% accuracy generator set AC output instruments; Ammeter, Voltmeter, Frequency Meter, Wattmeter, KW-hour meter, Power Factor Meter. Selector switches to allow viewing of voltage and amperes for each phase shall be provided. For 3-phase/4-wire systems the voltmeter shall indicate line to line and line to neutral conditions. Running Time Meter and Start Counter.
  - 2. Generator Set Mode Selector Switch: Switch shall provide hand, off, and automatic functions for control of the generator set.
  - 3. Control Reset push-button switch with indicating lamp. Lamp shall flash to indicate that generator set is locked out due to a fault condition.
  - 4. Lamp test push-button switch. Operation of this switch shall cause all lamps on the panel to be simultaneously tested.
  - 5. Emergency Stop switch. The emergency stop switch shall be a red, mushroom head switch which maintains it's position until manually reset.
  - 6. Precision voltage and frequency adjust raise/lower switches. Switches shall allow the generator set frequency and voltage to be adjusted plus or minus 5% when the generator set is operating independently of the system bus. Voltage and frequency adjustment switches shall be located adjacent to the generator set and bus metering, for ease of use by the operator.
  - 7. Provide an alarm and status indicating panel to indicate the genset conditions to the operator via LED display; provide the following alarm condition indicators:
    - Low DC Voltage
    - High DC Voltage
    - Weak Battery
    - Low Oil Pressure Alarm
    - Low Fuel - main tank
    - Fuel tank leak
    - High Engine Temp Alarm Amber
    - Ground Fault
    - Overcurrent Alarm
  - 8. The alarm and status indicating panel shall indicate the following shutdown conditions to the operator:
    - Breaker Failure
    - Not in Auto
    - High Engine Temp

Low Oil Pressure  
Overcurrent  
Short Circuit  
Loss of Excitation  
Reverse Power  
Overcrank  
Overspeed  
Under Frequency  
Under Voltage  
Over Voltage  
Low Coolant Level  
Emergency Stop

9. The alarm and status indicating panel shall indicate the following genset status conditions to the operator:  
Genset Ready (in auto and ready)  
Generator Running (ready to load)
10. In addition, provisions shall be made for indication of three (3) customer-specified alarm or shutdown conditions.
11. Provide controller with optional run relay package to enable direct hardwired connection to SCADA system. Provide the following status and alarms conditions to the PLC:  
Generator Common Warning(parameter 1540)  
Generator Common Fault(parameter 1541)  
Generator Not in Auto  
Low Fuel - main tank  
Fuel tank leak

## 2.12 GENERATOR ENCLOSURE

- A. Provide an Outdoor Weather-Protective Sound Attenuating Generator Housing. The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 72 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.
- B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.
- C. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a raincap and rainshield.
- D. The entire enclosure shall be sheathed in aluminum. Provide aluminum enclosure finish painted with the manufacturer's standard color.
- E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be stainless steel or non-metallic corrosion resistant,

and designed to minimize marring of the painted surface when removed for normal installation or service work.

- F. The Generator enclosure shall be designed accordance with ASCE 7-10 “minimum design for building and other structure” and shall conform to the latest edition of the Florida Building Code. The enclosure shall be designed for the following parameters: Basic wind speed = 170 mph; Risk Category =III; Exposure category = C.
- G. Generator enclosure/tank anchorages to concrete foundation shall be designed for the wind conditions specified above and designed by a professional engineer registered in the State of Florida. All anchors shall be Type 316 stainless steel. Enclosure manufacturer shall provide shop drawings for the enclosure, components and anchorages. Generator enclosure/building complements and cladding shall be designed for the conditions specified in ASCE 7-10, Florida Building Code (FBC) and Lee County Building Department Requirements. Components and cladding shall be designed for the following parameters for internal wind pressure coefficients in accordance with ASCE 7-98 provision for “components and cladding”, Condition I, ( $G C_{pi} = +0.18, -0.118$ )

## 2.13 SUB-BASE FUEL TANK

- A. Provide where shown on the drawings, a UL listed Double Wall diesel fuel storage tank. The fuel tank shall be an integral part of the enclosure/generator mounting frame. Fuel tank shall have a capacity of no less than 1100 gallons usable to provide 48 hours of run time under 100% generator full load conditions. Fuel tank provided shall comply with and be constructed in accordance with the requirements of Underwriters Laboratories UL-142 “Special Purpose Protected Secondary Containment Generator Base Tank”; N.F.P.A. 30, 37 & 110; Florida Department of Environmental Protection (FDEP) and the Steel Tank Institute. Fuel tank venting in compliance with NFPA and UL
- B. Complete assembly shall be manufactured using minimum 3/16” sheet steel for the inner tank and 3/16” 304 Stainless Steel for outer tanks. Fuel tank and containment basin are to be leak tested at 3-PSI air as outlined in UL-142 standards. The interstitial space shall be monitored using a float type level switch and shall indicate the presences of fuel in the annular space by use of normally open contacts that are to be wired back to the generator set control panel for visual/audible indication.
- C. Fuel tank provided shall have the following devices but by no means be limited to those as specified. A 2” Manual fuel fill cap, with means to padlock fill cap, mechanical fuel level gauge, low level alarm set at 40% of tank capacity, rupture basin alarm with normally open contacts, fuel supply and return ports with full length pick-up tubes. A foot or check valve shall be installed on the generator supply to prevent loss of prime during idle conditions. A rectangular double-walled electrical stub-up area is to be provided and located directly under the generator circuit breaker to provide a pass-through for field installation of electrical load conductors. Tank color shall match the generator enclosure.
- D. The tank shall be elevated off the concrete pad with integral tank supports that provide a 2 inch air space to control moisture accumulation. The tank supports shall be arranged so that moisture is not trapped in the channel of the supports. Provide 3/8”TH x 6”W continuous neoprene pads between the tank supports and the concrete pad. The tank shall include the hurricane tie down restraint points and drillings for grounding attachments.

- E. Provide a level gauge near the fill location. Provide a drop tube and leak alarm switch located in the interstitial space area of the tank indicating inner tank failure and wire to genset control panel.
- F. Provide DEP approved Fuel management system, Omar-Vega or approved equal. The system shall include an audible and visual high level alarm station at the fill location set to alarm at 90% of tank capacity. System shall include Omar-Vega manufacturer level transmitter, or approved equal. The alarm station shall be housed in a NEMA 4X SS powder coated white enclosure. Provide a high level alarm float switch in the tank and wire to the generator controller and remote annunciation alarm console. Fuel level transmitter (4-20ma) output wired to the Pump Station PLC. Provide 6-channel optional analog output card.
- G. All tanks shall be labeled by product, capacity and manufacturer per NFPA requirements.

### **PART 3 - EXECUTION**

#### **3.01 SERVICES**

- A. Furnish the services of a competent and experienced Manufacturer's field service technician who has complete knowledge of proper operation and maintenance of the equipment to inspect the installed equipment, supervise the initial test run, coordinate checkout of the interlocks between ATS and the Genset and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed.
- B. Provide instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled at least ten days in advance with the Owner and shall take place prior to final acceptance and after substantial completion by the Owner.
- C. The final copies of operation and maintenance manuals specified in division 1 Sections must be delivered to the Engineer prior to scheduling the instruction period with the Owner.
- D. The distributor of the Genset shall provide installation coordination services to insure a properly installed and coordinated system including all coordination with the electrical and instrumentation contractor for proper interfacing. As a minimum the Genset Distributor shall coordinate the installation with factory trained technicians with weekly site visits from the time the genset arrives on site to the time it is fully operational. Also the technician shall provide on site coordination of all conduit stub ups, fuel line stub-ups, pad dimensions, embedment etc prior to slab pour. It is the intent of these specifications that the Distributor of the Genset provide complete system coordination including but not limited to; fuel system with venting and filling requirements; exhaust system requirements; cooling and ducting system; power; control, battery and grounding systems, switchgear system; testing and acceptance certification. The site technician shall submit written reports of the coordination efforts weekly to the engineer and meet with the engineer as requested. The technician shall certify the units installed per manufacturers recommendation prior to test runs or functional testing.

3.02 INSTALLATION

- A. Not Applicable

3.03 TESTING

- A. The engine-generator set shall be given the Manufacturer's standard load bank test at full rated load and power factor at the factory.
- B. Prior to final acceptance of the generator set, all equipment furnished under this Section shall be field tested to show it is free of any defects and that the generator set can operate satisfactorily under full load test using resistance type load banks. The genset testing shall be for four (4) continuous hours. Any defects which become evident at this time shall be corrected before acceptance.
- C. During the field tests, readings will be taken at thirty (30) minute intervals of the following: oil temperature, exhaust temperature, water temperature, volts, amps, frequency, fuel pressure, manifold pressure, and oil pressure, KW, KWH.
- D. The owner shall provide fuel for start-up and testing of the generator system.

3.04 WARRANTY

- A. The complete electrical standby power system; generator set, controls, and associated switches, and accessories, as provided by the factory distributor including the ancillary equipment shall be warranted by the manufacturer against defects in materials and workmanship for a period of five years or 1500 genset run hours, whichever occurs first from the date of system startup. Coverage shall include parts, labor, travel expenses and labor to remove reinstall defective equipment under terms of the Manufacturer's comprehensive standard warranty. No deductibles shall be applied to the warranty except for starting batteries and water jacket heater being warranted for one year.

**END OF SECTION**