

**BID # FY 2016-2017-002 GENERATOR REPLACEMENT ON FOSTER ROAD
EXHIBIT A
SUMMARY OF WORK**

PART 1 – GENERAL

1.01 WORK COVERED BY CONTRACT

It is the intent of this section to provide a brief summary of the work to be performed under this contract. The work shall consist of:

1. Removal of the existing generator and transfer switch at the Foster Road Lift Station No. 9 and to return them to the City Public Works Department located at: 630 NW 2nd Street, Hallandale Beach, Fl. 33009
2. Sizing and installation of a new generator capable of starting each pump **individually**, and has the ability to run both pumps (2-40hp pumps, 240V, 3Ø) simultaneously including the controls and site lighting.
3. The new generator should be installed on the existing generator pad.
4. Installation of the new generator and transfer switch shall meet all applicable codes: Federal, State and Local Codes.
5. Contractor is responsible for pulling all required permits (if applicable).

Any part of the work which is not mentioned in the Specifications but are necessary or normally required to make each installation satisfactory and legally operable, shall be performed by the Contractor as incidental work without extra cost to the Owner and the expense thereof shall be included in the applicable lump sum bid for the work.

1.02 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall maintain traffic movement along all roadways and maintain ingress/egress to all facilities.
- B. Contractor shall assume full responsibility for the protection and safekeeping of products under this contract, stored on the site.
- C. Damage to city properties and other surrounding areas including but not limited to landscaping, trees, parking lot, curbs, fences, paved streets, gutters, etc., shall be restored by the Contractor at his/her sole expense.

1.03 MAINTENANCE OF TRAFFIC

Maintenance of Traffic – Traffic shall be maintained in accordance with Section 102 Maintenance of Traffic of FDOT SSR&BC. The Contractor shall submit (2) copies of a maintenance of traffic plan to the City. No separate payment will be made for maintenance of traffic, the cost of which shall be included in the lump sum bid price. The City may require the Contractor to call for and hire off duty police officers for directing traffic and maintaining

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safety if there is any way that the operations will curtail the use of the nearby streets and roadways.

1.04 MOBILIZATION, INSURANCE AND BONDING

The Lump Sum bid price shall include the cost for mobilization of equipment and personnel to the job site and setting up any required temporary facilities. The price shall also include demobilization from the site and removal and cleanup of temporary facilities. The cost shall include all bonding, insurance, and indemnification costs.

END OF SECTION

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1. Scope of Work

- 1.1. It is the intent of this specification to replace the existing Foster Rd. station generator set, secure and install a new engine-driven generator set that has been prototype tested, factory built, production-tested, and site-tested together with all accessories necessary for a complete installation and functioning system as specified herein.
- 1.2. Any and all exceptions to the published specifications shall be subject to the approval of the owner.
- 1.3. The power system shall be furnished by a single manufacturer who shall be responsible for the design, coordination, and testing of the complete system.
- 1.4. The equipment shall be produced by a manufacturer who has produced this type of equipment for a period of at least 10 years and who maintains a service organization available twenty-four hours a day throughout the year.
- 1.5. The equipment shall be produced by a manufacturer who is ISO 9001 certified for the design, development, production and service of its complete product line.
- 1.6. The existing 200KW generator shall be removed and delivered to the City's Public Works Department located at 630 NW 2nd Street, Hallandale Beach, Fl. 33009
- 1.7. Size and install the generator to start each pump **individually**, and be able to run both pumps simultaneously. (2_40hp pumps, 240V, 3ph and controls)

2. General Requirements

- 2.1. It is the intent of this specification to secure a generator set system that has been tested during design verification, in production, and at the final job site. The generator set will be a commercial design and will be complete with all of the necessary accessories for complete installation as specified herein. The equipment supplied and installed shall meet the requirements of the National Electrical Code and applicable local codes and regulations.
- 2.2. All equipment shall be new and of current production by a national firm that manufactures the generator sets and controls, and assembles the generator sets as a complete and coordinated system. There will be one-source responsibility for warranty, and parts through a local representative.
- 2.3. The contractor shall, before submitting his/her bid, visit the site of the project and become familiar with the existing conditions. No allowance shall be made for existing conditions or failure of the contractor to observe them.

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- 2.4. The contractor shall adequately size the generator to power the **miscellaneous and a maximum of 2 of the motor loads** which will start sequentially.
- 2.5. The owner reserves the first right of refusal on any existing equipment to be disposed of.
- 2.6. The contractor shall provide all materials and labor for a complete and functioning system. Items not specified herein but obviously necessary for completion of the work shall be included at no additional cost to the owner.

3. Submittal

- 3.1. The submittal shall include prototype test certification and specification sheets showing all standard and optional accessories to be supplied; schematic wiring diagrams, dimension drawings, and interconnection diagrams identifying by terminal number each required interconnection between the generator set and the existing the transfer switches.

4. Codes and Standards

- 4.1. The generator set shall be listed to UL 2200 or submitted to an independent third party certification process to verify compliance as installed.
- 4.2. The generator set shall conform to the requirements of the following codes and standards:
 - 4.2.1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 4.2.2. EN50082-2, Electromagnetic Compatibility-Generic Immunity Requirements, Part 2: Industrial.
 - 4.2.3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 - 4.2.4. IEC8528 part 4, Control Systems for Generator Sets.
 - 4.2.5. IEC Std 61000-2 and 61000-3 for susceptibility, 61000-6 radiated and conducted electromagnetic emissions.
 - 4.2.6. IEEE446 Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
 - 4.2.7. NFPA 70, National Electrical Code, Equipment shall be suitable for use

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in systems in compliance to Article 700, 701, and 702.

- 4.2.8. NFPA 99, Essential Electrical Systems for Health Care Facilities.
- 4.2.9. NFPA 110, Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit. Component level type tests will not substitute for this requirement.

5. Testing

- 5.1. To ensure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and/or local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.
- 5.2. **Design Prototype Tests.** Components of the emergency system, such as the engine/generator set, transfer switch, and accessories, shall not be subjected to prototype tests because the tests are potentially damaging. Rather, similar design prototypes and preproduction models shall be subject to the following tests:
 - 5.2.1. Maximum power (kW).
 - 5.2.2. Maximum motor starting (kVA) at 35% instantaneous voltage dip.
 - 5.2.3. Alternator temperature rise by embedded thermocouple and/or by resistance method per NEMA MG1-32.6.
 - 5.2.4. Governor speed regulation under steady-state and transient conditions.
 - 5.2.5. Voltage regulation and generator transient response.
 - 5.2.6. Harmonic analysis, voltage waveform deviation, and telephone influence factor.
 - 5.2.7. Three-phase short circuit tests.
 - 5.2.8. Alternator cooling air flow.
 - 5.2.9. Torsional analysis to verify that the generator set is free of harmful torsional stresses.

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- 5.2.10. Endurance testing.
- 5.3. **Final Production Tests.** Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - 5.3.1. Single-step load pickup
 - 5.3.2. Safety shutdown device testing
 - 5.3.3. Rated Power @ 0.8 PF
 - 5.3.4. Maximum power
 - 5.3.5. Upon request, a witness test, or a certified test record sent prior to shipment.
- 5.4. **Site Tests.** The manufacturer's distribution representative shall perform an installation check, startup, and load test. The owner shall be notified of the time and date of the site test. The tests shall include:
 - 5.4.1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - 5.4.2. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery chargers, alternator strip heaters, etc.
 - 5.4.3. Generator set startup under test mode to check for exhaust leaks, path of exhaust gases outside the building, cooling air flow, movement during starting and stopping, vibration during operation, normal and emergency line-to-line voltage and frequency, and phase rotation.
 - 5.4.4. Automatic start by means of a simulated power outage to test automatic starting, transfer of the load, and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator set voltage, amperes, and frequency shall be monitored throughout the test.

6. Warranty and Maintenance

- 6.1. The generator set shall include a standard one year warranty to guarantee against defective material and workmanship in accordance with the manufacturer's

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published warranty from date of startup. Optional warranties shall be available upon request.

- 6.2. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall regularly engage in maintenance contract programs to perform preventive maintenance and service on equipment similar to the one installed. An O&M manual shall be available.

7. Equipment

- 7.1. The generator set shall be able to provide enough kW/kVA to handle the loads when operating at 120/240 (3ph) volts, 60 Hz, .8 power factor. It shall be capable of a Standby 130°C rating while operating in an ambient condition of less than or equal to 77° F and a maximum elevation of 3300 feet above sea level.
- 7.2. Motor starting performance and voltage dip determinations shall be based on the complete generator set. The generator set shall be capable of supplying enough LRKVA for starting motor loads with a maximum instantaneous voltage dip of 35%, as measured by a digital RMS transient recorder in accordance with IEEE standard 115. Motor starting performance and voltage dip determination that does not account for all components affecting total voltage dip i.e. engine, alternator, voltage regulator and governor will not be acceptable. As such, the generator set shall be prototype tested to optimize and determine performance as a generator set system.
- 7.3. Vibration isolators shall be provided between the engine-alternator and heavy-duty steel base.

8. Engine

- 8.1. The displacement engine shall be equipped with the following:
- 8.1.1. Electronic isochronous governor capable of 0.25% steady-state frequency regulation.
- 8.1.2. 12-volt positive-engagement solenoid shift-starting motor.
- 8.1.3. Automatic battery charging alternator with a solid-state voltage regulation.
- 8.1.4. Positive displacement, full-pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
- 8.1.5. Dry-type replaceable air cleaner elements for normal applications.

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- 8.1.6. Engine-driven or electric fuel-transfer pump including fuel filter and electric solenoid fuel shutoff valve capable of lifting fuel.
- 8.2. The turbocharged, intercooled engine shall be fueled by diesel.
- 8.3. The engine shall have a minimum of 6 cylinders and be liquid-cooled by Unit Mounted Radiator 122°F/50°C.
- 8.4. The engine shall be EPA certified from the factory.

9. Alternator

- 9.1. The alternator shall be salient-pole, brushless, 2/3-pitch, 12 lead, self-ventilated with drip-proof construction and amortisseur rotor windings and skewed for smooth voltage waveform. The ratings shall meet the NEMA standard (MG1-32.40) temperature rise limits. The insulation shall be class H per UL1446 and the varnish shall be a fungus resistant epoxy. Temperature rise of the rotor and stator shall be limited to Standby 130°C. The excitation system shall be of brushless construction controlled by a solid- state voltage regulator capable of maintaining voltage within $\pm 2.5\%$ at any constant load from 0% to 100% of rating. The AVR shall be capable of proper operation under severe nonlinear loads and provide individual adjustments for voltage range, stability and volts-per-hertz operations. The AVR shall be protected from the environment by conformal coating. The waveform harmonic distortion shall not exceed 5% total RMS measured line-to-line at full rated load. The TIF factor shall not exceed 50.
- 9.2. The alternator shall have a single maintenance-free bearing, designed for a minimum of 40000 hour B10 life. The alternator shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.
- 9.3. The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current-support devices.

10. Controller

10.1. Controller Requirements

- 10.1.1. The generator set controller shall meet NFPA 110 Level 1 requirements (latest version) and shall include an integral alarm horn as required by NFPA.
- 10.1.2. The controller shall meet NFPA 99 and NEC requirements.
- 10.1.3. The controller shall be UL 508 listed.

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10.2. Applicability

- 10.2.1. The controller shall support 12-volt starting systems.
- 10.2.2. The controller's environmental specification shall be: -40°C to 70°C operating temperature range and 5-95% humidity, non-condensing.
- 10.2.3. The controller shall be mounted on the generator.

10.3. Hardware Requirements

- 10.3.1. Control Panel shall include:
 - 1. The control shall have a run-off/reset-auto three-position selector switch.
 - 2. A controller-mounted, latch-type emergency stop pushbutton.
 - 3. Five indicating lights: System Ready - green Not in Auto - yellow Programming Mode - yellow System Warning - yellow System Shutdown - red
 - 4. Display with two lines of 20-alphanumeric characters, viewable in all light conditions.
 - 5. Snap action sealed keypad for menu selection and data entry.
 - 6. For ease of use, an operating guide shall be printed on the controller faceplate.
 - 7. Panel lights shall be supplied as standard.

10.4. Control Functional Requirements

- 10.4.1. Field-programmable time delay for engine start. Adjustment range 0-5 minutes in 1 second increments.
- 10.4.2. Field-programmable time delay engine cool down. Adjustment range 0-10 minutes in 1 second increments.
- 10.4.3. Capability to start and run at user-adjustable idle speed during warm-up for a selectable time period (0-10 minutes), until engine reaches preprogrammed temperature, or as supported by ECM-equipped engine.
- 10.4.4. The idle function including engine cool down at idle speed.
- 10.4.5. Real-time clock and calendar for time stamping of events.
- 10.4.6. Output with adjustable timer for an ether injection starting system. Adjustment range, 0-10 seconds.

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- 10.4.7. Output for shedding of loads if the generator set reaches a user programmable percentage of its kW rating. Load shed shall also be enabled if the generator set output frequency falls below 59 Hz.
- 10.4.8. Programmable cyclic cranking that allows up to six crank cycles and up to 35 seconds of crank time per crank cycle.
- 10.4.9. The capability to reduce controller current battery draw, for applications where no continuous battery charging is available. The controller vacuum fluorescent display should turn off automatically after the controller is inactive for 5 minutes.
- 10.4.10. Control logic with alternator protection for overload and short circuit matched to each individual alternator and duty cycle.
- 10.4.11. Control logic with RMS digital voltage regulation. A separate voltage regulator is not acceptable. The digital voltage regulator shall be applicable to single- or three-phase systems.
- 10.4.12. The capability to exercise the generator set by programming a running time into the controller. This feature shall also be programmable through the PC software.
- 10.4.13. Control function shall include output voltage adjustment.
- 10.4.14. Battle switch function selection to override normal fault shutdowns, except emergency stop and over speed shutdown.
- 10.4.15. The control shall detect the following conditions and display on control panel:
 - 1. Customer programmed digital auxiliary inputs
 - 2. Customer programmed analog auxiliary input out of bounds (any inputs for ECM equipped engines and non-ECM engines)
 - 3. Emergency stop
 - 4. High coolant temperature
 - 5. High oil temperature
 - 6. Controller internal fault
 - 7. Locked rotor - fail to rotate
 - 8. Low coolant level
 - 9. Low oil pressure
 - 10. Master switch error
 - 11. NFPA common alarm
 - 12. Over crank
 - 13. Over speed with user-adjustable level, range 60-70 Hz.

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14. Overvoltage with user adjustable level, range 105% to 135%
15. Over frequency with user adjustable level, range 102% to 140%
16. Under frequency with user adjustable level, range 80% to 90%
17. Under voltage with user adjustable level, range 70% to 95%
18. Coolant temperature signal loss
19. Oil pressure gauge signal loss

Conditions resulting in generator warning (generator will continue to operate):

1. Battery charger failure
2. Customer programmed digital auxiliary inputs.
3. Customer programmed analog auxiliary input on (any inputs available on ECM engines and non-ECM engines)
4. Power system supplying load
5. Ground fault detected - detection by others
6. High battery voltage - Level shall be user adjustable.
7. Range 29-33 volts for 24-volt systems.
8. High coolant temperature
9. Load shed
10. Loss of AC sensing
11. Under frequency
12. Low battery voltage - level shall be user adjustable, range 20-25 volts for 24-volt systems.
13. Low coolant temperature
14. Low fuel level or pressure
15. Low oil pressure
16. NFPA common alarms
17. Over current
18. Speed sensor fault
19. Weak battery
20. Alternator protection activated

10.5. Control Monitoring Requirements

- 10.5.1. All monitored functions must be viewable on the control panel display.
- 10.5.2. The following generator set functions shall be monitored:
 1. All output voltages - single phase, three phase, line to line, and line to neutral, 0.25% accuracy
 2. All single phase and three phase currents, 0.25% accuracy
 3. Output frequency, 0.25% accuracy
 4. Power factor by phase with leading/lagging indication
 5. Total instantaneous kilowatt loading and kilowatts per phase, 0.5% accuracy
 6. kVARS total and per phase, 0.5% accuracy
 7. kVA total and per phase, 0.5% accuracy
 8. kW hours
 9. A display of percent generator set duty level (actual kW loading

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divided by the kW rating)

- 10.5.3. Engine parameters listed below shall be monitored: (*available with ECM equipped engines)
1. Coolant temperature both in English and metric units
 2. Oil pressure in English and metric units
 3. Battery voltage
 4. RPM
 5. Lube oil temperature*
 6. Lube oil level*
 7. Crankcase pressure*
 8. Coolant level*
 9. Coolant pressure*
 10. Fuel pressure*
 11. Fuel temperature*
 12. Fuel rate*
 13. Fuel used during the last run*
 14. Ambient temperature*
- 10.5.4. Operational records shall be stored in the control beginning at system startup.
1. Run time hours
 2. Run time loaded hours
 3. Run time unloaded hours
 4. Number of starts
 5. Factory test date
 6. Last run data including date, duration, and whether loaded or unloaded
 7. Run time kilowatt hours
- 10.5.5. The following operational records shall be a resettable for maintenance purposes:
1. Run time hours
 2. Run time loaded hours
 3. Run time unloaded hours
 4. Run time kilowatt hours
 5. Days of operation
 6. Number of starts
 7. Start date after reset
- 10.5.6. The controller shall store the last one hundred generator set system events with date and time of the event.
- 10.5.7. For maintenance and service purposes, the controller shall store and display on demand the following information:
1. Manufacturer's model and serial number
 2. Battery voltage

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3. Generator set kilowatt rating
4. Rated current
5. System voltage
6. System frequency
7. Number of phases

10.6. Inputs and Outputs

10.6.1. Inputs

1. There shall be dry contact inputs that can be user-configured to shut down the generator set or provide a warning.
2. There shall be user-programmable analog inputs for ECM-equipped engines and non-ECM engines for monitoring and control.
3. Each analog input can accept 0-5 volt analog signals
4. Resolution shall be 1:10,000
5. Each input shall include range settings for 2 warnings and 2 shutdowns.
6. All values shall be on the control panel display.
7. Shall be user-assigned.
8. Additional standard inputs required:
 - Input for an external ground fault detector. Digital display shall show "ground fault" upon detection of a ground fault.
 - Reset of system faults.
 - Remote two-wire start.
 - Remote emergency stop.
9. Idle mode enable.

10.6.2. Outputs

1. All NFPA 110 Level 1 outputs shall be available.
2. Thirty outputs shall be available for interfacing to other equipment:
 - All outputs shall be user-configurable from a list of 25 functions and faults.
 - These outputs shall drive optional dry contacts.
3. A programmable user-defined common fault output with over 40 selections shall be available.

10.7. Communications

- 10.7.1. If the generator set engine is equipped with an ECM (engine control module), the controller shall communicate with the ECM for control, monitoring, diagnosis, and meet SAE J1939 standards.

- 10.7.2. Industry standard Modbus communication shall be available.

- 10.7.3. A Modbus master shall be able to monitor and alter parameters, and start or stop a generator.

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- 10.7.4. The controller shall have the capability to communicate to a personal computer (IBM or compatible) running Windows '9X or Windows NT.
- 10.7.5. Communications shall be available for serial, CAN, and Ethernet bus networks.
- 10.7.6. A variety of connections shall be available based on requirements:
 - 1. A single control connection to a PC.
 - 2. Multiple controls on an intranet network connected to a PC.
 - 3. A single control connection to a PC via phone line.
 - 4. Multiple controls to a PC via phone line.
- 10.7.7. Generator controls shall be equipped with communications modules capable of connecting to the same communication network.
- 10.7.8. Network shall be self-powered.

11. Accessories

- 11.1. **Air Restriction Indicator.** The air cleaner restriction indicator shall indicate the need for maintenance of the air cleaners.
- 11.2. **Battery Charger.** A 10-ampere automatic float to equalize battery charger with the following features:
 - 1. 12 or 24 VDC output
 - 2. Voltage regulation of 1% from no to full load over 10% AC input line voltage variations
 - 3. Ammeter and voltmeter with 5% full-scale accuracy
 - 4. LED lamp for power indication
 - 5. Current limited during engine cranking, short circuit, and reverse polarity conditions
 - 6. Temperature compensated for ambient temperatures for -40°C to 60°C
 - 7. UL Listed
- 11.3. **Battery Rack and Cables.** Battery rack and battery cables capable of holding the manufacturer's recommended batteries shall be supplied.
- 11.4. **Block Heater.** The block heater shall be thermostatically controlled and sized to maintain manufacturers recommended engine coolant temperature to meet the start-up requirements of NFPA 99 and NFPA 110, Level 1.
- 11.5. **Critical Silencer.** The engine exhaust silencer shall be temperature and rust resistant, and rated for critical applications. The silencer will reduce total engine exhaust noise by 25-35 db (A).

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- 11.6. **Circuit Breaker.** The generator shall come with a primary, factory installed, 100% rated line circuit breaker that is UL2200 listed. Line circuit breakers shall be sized for the rated ampacity of the genset. Load side lugs shall be provided from the factory. The line circuit breaker shall include auxiliary contacts, shunt trip, under voltage trip, and over current switch functionality. Load side breaker connections made at the factory shall be separated from field connections. When GFI breakers are required, additional neutrals shall be factory installed.
- 11.7. **Crankcase Emission Canister.** The engine shall have a crankcase emission canister. The emission canister prevents crankcase oil vapor from escaping into the air to prevent environmental pollution and fouling of the radiator.
- 11.9. **Duct Flanges.** A radiator duct flange to provide a convenient connection to duct work for the radiator discharge air shall be included.
- 11.10. **Failure Relay.**
- 11.10.1. The common failure relay shall remotely signal auxiliary faults, emergency stop, high engine temperature, low oil pressure, over crank, and over speed via one single-pole, double-throw relay with 10 amps at 120 VAC contacts.
 - 11.10.2. The relay contacts shall be gold flashed to allow use of low current draw devices (100ma @ 28VDC min.).
 - 11.10.3. Once energized the relay shall remain latched until the system is reset by the main controller switch.
- 11.11. **Flex Exhaust Tube.** The exhaust piping shall be gas proof, seamless, stainless steel, flexible exhaust bellows with threaded NPT connection.
- 11.12. **Flexible Fuel Lines.** The two fuel lines shall have fittings for the engine inlet/return and threaded pipe fittings for connection to the sub-base fuel tank (or stationary piping).
- 11.13. **Pre-alarm Senders.** The generator pre-alarm senders shall provide signals for local and/or remote annunciation for engine conditions approaching critical/shutdown parameters required in NFPA 110. Pre-alarms warn of low water (engine) temperature, approaching low oil pressure, and approaching high engine temperature.
- 11.14. **Run Relay.** The run relay shall provide a three-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The relay provides three sets of dry contacts for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)

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- 11.15. **Standard Air Cleaner.** The air cleaner shall provide engine air filtration which meets the engine manufacturer's specifications under typical operating conditions.

12. Double Wall Secondary Containment Sub Base Fuel Tank

- 12.1. A sub-base fuel tank used in conjunction with the diesel powered generator set will contain a minimum of 1000 gallons of fuel to support the generator set for a period of 96 hours at 100% of rated load and 120 hours at 75% of rated load.
- 12.2. The sub-base fuel system is listed under UL 142, sub-section entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.
- 12.3. The above ground steel secondary containment rectangular tank for use as a sub base for diesel generators is manufactured and intended to be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.
- 12.4. **Primary Tank.** It will be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.

Steel Channel Support System. Provide reinforced steel box channel for generator support, with a load rating of 5,000 pounds per generator mounting hole location. Full height gussets at either end of channel and at generator mounting holes shall be utilized.

Exterior Finish. The exterior coating has been tested to withstand continuous salt spray testing at 100 percent exposure for 244 hours to a 5 percent salt solution at 92-97° F. The coating has been subjected to full exposure humidity testing to 100 percent humidity at 100° F for 24 hours. Tests are to be conducted in accordance with The American Standard Testing Methods Society.

- 12.5. **Venting.** Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.
- 12.6. **Emergency Venting.** The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated on the basis of 100 percent of the primary tank. The vent is spring-pressure operated: opening pressure is 0.5/psig and full opening pressure is 2.5 psig. The emergency relief vent is sized to accommodate the total venting capacity of both normal and emergency vents.

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- 12.7. **Fuel Fill.** There shall be a 2" NPT opening within the primary tank and lockable manual fill cap.
- 12.8. **Fuel Level.** A direct reading, UL listed, magnetic fuel level gauge with a hermetically sealed vacuum tested dial shall be provided to eliminate fogging.
- 12.9. **Low Fuel Level Switch.** Consists of a 30 watt float switch for remote or local annunciation of a (50% standard) low fuel level condition.

13. Enclosure

The enclosure must be a sound-attenuated and weather-protective enclosure. It should be constructed of steel or aluminum to address environmental (high humidity and/or high salt/coastal regions) concerns such as corrosion and abrasion. The level of sound attenuation should be a Level III: 68dB to 70 db. The enclosure should have a compact footprint, low profile design with easy access to all major generator and engine control components for servicing.

The enclosure must:

- 1. Be equipped with an exhaust silencer to ensure safety and protect against rust.
- 2. Be of steel or aluminum construction with stainless steel hardware to offer durability.
- 3. Be mounted directly to a sub-base fuel tank.
- 4. Have exterior oil and coolant drains with interior valves for ease of service.
- 5. Have overhead 2-point lifting brackets (some models).
- 6. Be painted with advanced powder coating paint finish.
- 7. Have single piece main roof.
- 8. Have side hinged doors on both sides of the enclosure incorporating lift-off hinges at 45 degrees.
- 9. Have secure, lockable doors to prevent unauthorized access to control panel, fuel fill and battery.
- 10. Have doors positioned for optimum access of frequently service items.
- 11. Have lockable, flush-mounted door latches.
- 12. Have vertical air inlet and outlet discharge to redirect air and reduce noise.
- 13. Have cooling fan and battery charging alternator fully guarded.
- 14. Be wind-rated to 150 mph minimum (per ASCE 7-05 exposure D, category 1 importance factor).
- 15. Be UL2200-listed, CSA approved and have IBC Seismic Certification.

END OF SECTION

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EXHIBIT A
AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.01 Scope

- A.** Furnish and install an automatic transfer switch (ATS) with appropriate number of poles, amperage, and voltage and withstand current ratings. The automatic transfer shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation. The transfer switch and control module(s) shall be the product of the same manufacturer.

1.02 Codes and Standards

The automatic transfer switch and accessories shall conform to the requirements of:

- A.** UL 1008 - Standard for Automatic Transfer Switch
- B.** NFPA 70 - National Electrical Code
- C.** NFPA 99 - Essential Electrical Systems for Health Care Facilities
- D.** NFPA 110 - Emergency and Standby Power Systems
- E.** IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- F.** NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switch

1.03 Acceptable Manufacturers

Automatic transfer switch shall be ASCO 940 or approved equal.

PART 2 PRODUCTS

2.1 Mechanically Held Transfer Switch

- A.** The transfer switch unit shall be electrically operated and mechanically held. The electrical operator shall be a single-solenoid mechanism, momentarily energized. Main operators which include overcurrent disconnect devices will not be accepted. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
- B.** The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

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- C.** All main contacts shall be silver composition. Switch rated 600 amperes and above shall have segmented, blow-on construction for high withstand current capability and be protected by separate arcing contacts.
- D.** Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The handle shall permit the operator to manually stop the contacts at any point throughout their entire travel to inspect and service the contacts when required.
- E.** Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching or transfer between two active power sources are not acceptable.
- F.** Where neutral conductors must be switched, the ATS shall be provided with fully-rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which are not overlapping are not acceptable.
- G.** Where neutral conductors are to be solidly connected, a neutral conductor terminal plate with fully-rated AL-CU pressure connectors shall be provided.

2.2 Microprocessor Control Panel

- A.** The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent serial communications capability. The control panel shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance.
- B.** The control panel shall be enclosed with a protective cover. Sensing and control logic shall be provided on printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
- C.** The control panel shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
 - 1.** IEEE472 (ANSI C37.90A) Ring wave test.
 - 2.** ENC55011 1991 Class A Conducted and radiated emission.
 - 3.** IEC801-2 1991 (EN61000-4-2) Electrostatic discharge immunity, direct contact & air discharge.
 - 4.** IEC801-3 1984 (ENV50140) Radiated electromagnetic field immunity.
 - 5.** IEC801-4 1988 (EN61000-4-4) Electrical fast transient immunity.
 - 6.** ENV50142 (EN61000-4-5) Surge immunity.

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- 7. ENV50141 HF Conducted disturbances immunity.
- 8. EN61000-4-11 Voltage dips and interruptions immunity.
- 9. Mil Std 461, Class 3C, Group 1 Test UM05 Radiated & conducted electromagnetic emissions.

2.3 Enclosure

- A. The ATS shall be furnished in a NEMA type 4X enclosure.

PART 3 OPERATION

3.1 Voltage and Frequency Sensing

- A. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal and dropout adjustable from 75% to 98% of pickup setting.
- B. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.
- C. Repetitive accuracy of all settings shall be within $\pm 2\%$ over an operating temperature range of -20°C to 70°C .
- D. Voltage and frequency settings shall be field adjustable in 1% increments without the use of tools, meters or power supplies. Actual settings shall be clearly defined in the operator's manual.

3.2 Time Delays

- A. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds.
- B. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
- C. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
- D. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.
- E. All time delays shall be fully field adjustable without the use of tools.

3.3 Additional Features

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- A.** A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred. Also, provide a "commit/no commit to transfer" selector switch to select whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
- B.** A momentary-type test switch shall be provided to simulate a normal source failure.
- C.** Terminals shall be provided for a remote contact which opens to signal the ATS to transfer to emergency and for remote contacts which open to inhibit transfer to emergency and/or retransfer to normal.
- D.** Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.
- E.** Indicating lights shall be provided, one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
- F.** Terminals shall be provided to indicate actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.
- G. Engine Exerciser** - An engine generator exercising timer shall be provided, including a selector switch to select exercise with or without load transfer. The exerciser shall be programmable to enable exercise for 1 minute to 24 hours per day in 1 minute increments for 1 to 7 days per week. The exercising timer shall be equal to ASCO Accessory 11C.
- H. In-phase Monitor** - An In-phase monitor shall be inherently built into the controls. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The in-phase monitor shall be specifically designed for and be the product of the ATS manufacturer. The in-phase monitor shall be equal to ASCO Accessory 27.
- I. Communications Networks** - A full duplex RS485 interface shall be installed in the ATS control panel to enable serial communications with remotely located annunciators and/or network supervisors. The serial communication interface shall be equal to ASCO Accessory 72A.

PART 4 ADDITIONAL REQUIREMENTS

4.01 Withstand and Closing Ratings

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- A.** The ATS shall be rated to close on and withstand the available rms symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans.
- B.** The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATSs which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

4.02 Tests and Certification

- A.** The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.
- B.** Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.
- C.** The ATS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, and installation and servicing in accordance with ISO 9001.

END OF SECTION