

ITEM 33

STANDBY POWER GENERATION

1.0 DESCRIPTION. The work under this section includes the requirements for the design, fabrication, testing and furnishing of complete and operable diesel fueled emergency electric generator(s) per plan locations, and automatic transfer switch(es) suitable for outdoor service, including all devices and equipment specified herein, shown on the drawings, or as required for the services. Materials and equipment furnished under this specification shall be delivered to the site completely equipped, wired, tested, and ready for installation.

2.0 SUBMITTALS. Submittals shall include the following:

A. Reference Standards. Latest revisions:

1. National Electrical Manufacturers Association (NEMA) 4X.
2. Underwriters Laboratories (UL) 142, 1008, Class RK1, RK5, J, or L
 - a. Material and equipment built into the work for which examination service is provided shall bear the Underwriters' label.
3. National Electric Code (NEC).
4. General OSHA safety including but not limited to Title 29 Code of Federal Regulations (CFR) 1910.147 - Lockout/Tagout.
5. Ohio Fire code Chapter 34 and requirements of NFPA 30 edition.

B. Shop Drawings.

1. Manufacturers shall submit as part of the pre-bid qualification written proof of the locations and contact personnel for at least three diesel-generator sets similar to that being proposed. These generators must be presently in operation. The generator supplier shall have at least ten years of experience in the manufacture of emergency generating and automatically transferring systems, of the type specified.
2. Bidders shall submit to the Owner a detailed technical proposal for evaluation. This proposal shall be specific and detailed to fully demonstrate that the offered system and its application meet the requirements of this specification. Statements that the manufacturer understands the specification, statements that the manufacturer can comply with all specifications, and statements that paraphrase the specifications will be considered insufficient.
 - a. The proposal shall follow the same general format as the specifications and shall include a paragraph-by-paragraph review of the complete specification.
 - b. Where exception is taken, the proposal shall state in detail what the exception is and how the bidder's intended offering differs from the specified equipment or services.

- c. The proposal shall also include a detailed list of all hardware, standard & special equipment, recommended spare parts, supporting equipment, documentation and services that the bidder would include to meet the specifications. A collection of standard catalog sheets or sales literature by itself will not be acceptable. Any catalog sheets provided shall have all non-pertinent information neatly crossed out.
- d. Drawings, diagrams and tabulations to be furnished by the Contractor shall meet the following requirements:
 - i. Load profile and generator set sizing documentation in the Kohler Quicksite or approved equal format shall be provided as part of Contractor's submittal to the Engineer.
 - ii. The Contractor shall provide drawings on 24 inch by 36-inch overall size paper, to a scale of not less than 3/8" equals 1'-0", showing the equipment arrangement he proposes for the equipment proposed. Drawings will be produced in accordance with acceptable drafting practice, and shall identify the location of each component, using wherever practicable the terms and identification numbers employed in the specification.
 - iii. The drawings shall additionally stipulate the size and number of floor and/or slab penetrations required for all necessary conduits and shall indicate the routing of all inter-component cabling.
- 3. The manufacturer shall furnish schematic and wiring diagrams for control panel, emergency generating set, and an interconnection wiring diagram showing all connections to each individual piece of equipment which constitutes the emergency generator set. The manufacturer shall have published literature or verifiable web content describing the standard series specified (not a one-of-a-kind fabrication).
- 4. The Contractor shall provide one set of systems manuals necessary for system maintenance & operation. Manuals shall include not less than the following information as applicable, for each major item of equipment:
 - a. General, introduction and overall description, purpose, functions, simplified theory of operation, etc.; specifications; installation, instruction, procedures, sequences, tolerances and precautions; operational procedures; shut-down procedures; maintenance, and service instructions; parts list and spare parts recommendations.
 - b. Use drawings and pictorials to illustrate the text to the extent necessary to insure a clear, concise presentation. If manuals have been written to cover a family of similar equipment, strike out non-applicable information in a neat fashion.
 - c. Bind the manual in a cover, which indicates the system to which it applies, manufacturer's name, local address and telephone number, and year of purchase. Punch manuals less than one-inch thick for standard three-ring binders. Bind larger manuals in hard covers and include system name and manufacturer's name on binding.

5. Instruction and Drawings. Complete instructions consisting of operating and maintenance manuals, part books, dimensional drawings, separate unit wiring diagrams and schematics, and interconnection wiring diagrams shall be provided.
6. Parts and Operation Information. Four (4) copies of the complete parts and operation information shall be included in the service manuals. Material shall be in booklet form and shall include all major components supplied under this section. The engine-generator supplier shall provide four (4) copies of the recommended operation, maintenance and service practices for the engine-generator supplied. This shall be bound in a labeled hard cover notebook. Four (4) sets of generator keys shall also be provided to the Owner.

C. Calculations.

1. A torsional analysis shall be calculated by the manufacturer of the engine-generator to verify freedom from torsional stresses within +10% of rated speed, with result submitted to the Engineer for inspection with the shop drawing submittal.

D. Certifications.

1. Engine shall be certified by the engine manufacturer as capable of developing sufficient brake horsepower to drive a generator yielding electrical power as specified on a continuous standby basis with the electrical loads listed.
2. Engine power performance shall conform with ISO 8528 and 3046 for ambient conditions of 85 degrees Fahrenheit (29.7 degrees Celsius) 29.92 inches Hg (101 kPa) barometric pressure and sea level elevation.

3.0 MATERIALS. Only materials approved by the SCMSD may be incorporated into the work.

A. Rating. The complete diesel emergency electrical generating system(s) shall be rated at a minimum to match required electrical outputs shown and performance characteristics as follows:

1. Diesel engine-generator sets rated (kW) per the contract drawings, 277Y/480 volt 3- phase, 0.8 PF, Kohler, Cummins, or pre-approved equal manufacturer.
2. Electrical Load: The generator shall be capable of SkVA rating per project plans with an instantaneous voltage dip not to exceed 35% and a running voltage within 2% of nominal voltage.
3. One (1) automatic transfer switch with a NEMA 4X stainless steel enclosure rated for amperage and voltage specified on electrical plans, 3-phase, 3-pole, solid neutral 60 Hertz service, Kohler Series KSS, or equal. Transfer switch shall be tested and warranted by the manufacturer of the emergency generator.
4. Contractor to provide a 480/120 Volt, 1 phase transformer for pump station control.

B. Primary Components.

1. The diesel emergency electrical generating system shall include, but not necessarily be limited to, the following: 12VDC Battery with a float/equalize battery charger for starting of engine as outlined. Provide 120 VAC battery blanket style heater and thermostat for outdoor mounted battery. Provide battery heater for each battery. A 120 VAC thermostat adjustable, in-line engine block heater shall also be provided. Engine-generator control, and automatic transfer to emergency distribution equipment.
2. Engine-generator shall be supplied with a UL 142 Listed double lined leakage-containing sub-base mounted fuel tank. Contractor shall provide full tank of high-grade diesel fuel, prior to unit field testing. Tank shall be sized to hold the minimum fuel needed to supply the generator for 24 hours when it is running at 100% load or minimum tank size of 87 gallons whichever is larger.
3. Automatic transfer switch, manual transfer switch and main circuit breaker as indicated on the contract drawings.
4. All necessary control devices to provide a complete, operable system.
5. The emergency system described herein, including the engine-generator set, automatic transfer switch, engine auxiliaries and engine-generator control panel shall be furnished by a single supplier who is regularly engaged in the production of diesel engine-generators and control. The responsibility for performance to this specification in its entirety cannot be split up among individual suppliers of components comprising the system, but must be assumed solely by the supplier of the system.
6. The emergency system shall be provided by the manufacturer's designated distributor. Companies offering products private labeled or "third-party" as manufactured by companies other than those as listed on their published standard literature shall not be acceptable.
7. Materials and equipment installed under this Contract shall be new and of the quality herein specified.
8. The diesel emergency electric generator shall be provided and labeled Kohler Power Systems, Cummins Power Systems, or *pre-approved* equal.

C. Engine Generator Set. The following standard features and accessories shall be supplied as a minimum:

1. Standard features:
 - a. Battery rack and cables.
 - b. Engine shutdown for High engine temperature, Low coolant level, and Low oil Pressure.
 - c. Oil drain extension.
 - d. Operation and installation literature.
2. Accessories:
 - a. Enclosed Unit – level #1 sound attenuated enclosure.
 - b. Cooling system - Block heater.
 - c. Fuel system – Flexible fuel lines.
 - d. Electrical system – Battery.

- i. Battery heater.
 - ii. Battery charger, Float/Equalize type.
- e. Engine and generator.
 - i. Line Circuit Breaker (NEMA Type 1 Enclosure).
 - ii. Rodent guards.
 - iii. Safeguard breaker.
 - iv. Skid end caps.
 - v. Dry contact kit (Isolated Alarm).
 - vi. Run Relay Kit.
- 3. Maintenance – General maintenance literature kit.
- 4. The outdoor service type engine-generator set shall be rated as specified. The engine-generator set shall be mounted on a suitable structural steel base capable of maintaining proper alignment between components during shipment, installation, and operation. Unit shall incorporate spring-type isolators of the design, size, and quantity specified by the manufacturer.
- 5. Engine shall be stationary, liquid-cooled, to be powered with number 2 diesel fuel oil. Design shall be four-cycle, three (3) cylinder minimum. Engine shall be arranged for direct connection to an alternating current generator. Fuel injection and valves shall not require adjustment while in service. Engine shall be capable of driving the generator at this rating for the duration of utility source interruptions.
- 6. Engine equipment shall include the following:
 - a. An electronic speed sensing engine governor and frequency regulation within $\pm .25$ percent of rated frequency during steady state conditions, and frequency dip during full load application shall not be greater than six cycles from rated frequency. Governor shall be Barber-Coleman (Woodward), or approved equal.
 - b. Electric starting motors shall be for operation at 12 volt D.C. The starter pinion shall disengage automatically when the engine starts. Independent systems shall be provided to disconnect the starting circuit when the engine starts.
- 7. Engine Cooling System - Engine shall be cooled by engine mounted radiator system including belt-driven pusher fan, coolant pump, thermostat temperature control, and coolant corrosion resistant filters with replaceable elements.
- 8. Provide 50% propylene glycol antifreeze solution to fill engine cooling system.
- 9. Provide water jacket heating systems for the engine.
 - a. The heating elements shall operate on 120 volt, single phase, 60 Hz power.
 - b. A thermostat shall control the temperature of the jacket heater within the range from 120 degrees Fahrenheit (48.8 degrees Celsius) to 140 degrees Fahrenheit (60.5 degrees Celsius).
 - c. Heater shall be disconnected whenever the engine starts by an oil pressure switch mounted on the engine.
- 10. Provide a positive displacement, mechanical lubrication oil pump, lubricating oil cooler, full flow lubrication oil filters, and dipstick oil level indicator.

11. Provide primary and secondary fuel filters with replaceable elements, and an engine driven, mechanical, positive displacement fuel pump, all mounted on the engine.
12. Provide a replaceable dry element air cleaner.
13. Provide sensing elements, located on the engine to initiate the following preliminary alarms and engine shutdowns:
 - a. Low coolant temperatures alarm.
 - b. Low lubrication oil pressure alarm.
 - c. High coolant temperature alarm.
 - d. Low lubrication oil pressure shutdown.
 - e. High coolant temperature shutdown.
 - f. Overspeed shutdown.
 - g. Over-crank lockout.
 - h. Overvoltage shutdown.
 - i. All alarm contacts shall be open under normal conditions, and closed under abnormal or alarm conditions. Shutdown actions shall not rely on the energization of relay coils.
 - j. Provide engine gauges, including water temperature and oil pressure gauges and battery charging ammeter, engine running time meter, and frequency meter.
14. Generator shall be engine-driven single bearing, and self-aligning with brushless excitation; revolving field and amortisseur windings. Generator shall be directly connected to the engine housing and driven through a flexible coupling. Insulation for generator and exciter shall be Class H 130 Degrees Celsius as defined by NEMA MG1-1-65.
 - a. The generator shall be rated for 480Y/277 volt, 3-phase, 4-wire 60 Hz. operation at 1800 RPM.
 - b. Voltage regulator shall be solid-state design providing no load to full load regulation within +/- 2% of rated voltage during steady state conditions.
 - c. Instantaneous voltage dip shall not be greater than 20% of rated voltage upon applications of full load at rated power factor to the generator. Recovery time shall not exceed three seconds for restoration of stable voltage within +2% of rated load.
 - d. The generator characteristic must be matched to the torque characteristics of the engine in such a manner that with full load connected to the generator terminal, the generator can utilize all the available engine power without exceeding it at all speeds.
15. Auxiliary Equipment:
 - a. Starting Batteries - A battery set shall be supplied for engine and shall be mounted as recommended by generator set manufacturer; provide battery racks as required. Provide 150 Watt, 120 VAC Battery blanket with NEMA 4 thermostat adjustable from 40°F-100°F. (Type WCRT).
 - b. Battery set shall be 12 volt DC and composed of one 12 volt, 800 CCA, heavy-duty diesel starting lead-acid battery. All necessary intercell connecting and battery cables, stranded copper and properly sized, shall be provided. The

battery shall be supplied by system supplier and cabled during unit commissioning.

- c. Battery Charger: An SCR voltage regulated charger with a maximum charge rate of 10 amps shall be provided for the engine/generator set battery. The battery charger shall contain a voltmeter, ammeter, 12 hour equalizing timer, circuit protection (output) and calibrated to charge the battery supplied. Charger shall be equipped with alarms as required by NFPA 110.
- d. Exhaust Silencer: A critical Exhaust Silencer shall be supplied for the engine. The silencer shall be of multi-chambered construction and shall provide critical silencing suitable for residential installation. The engine exhaust silencer shall be coated to be temperature and rust resistant, rated for residential application. The silencer will reduce total engine exhaust noise by 25-35 dB(A). The silencer shall be sized to assure operation without excessive backpressure when installed as shown on the drawings. A seamless, stainless steel flexible bellows connector shall be provided for installation between the engine and the silencer. The silencer shall be provided with two condensate drains, one at front and one at rear.
- e. Contractor to install 120 VAC, 20-amp. GFI receptacle with cast box and waterproof "in use" cover.
- f. Double-lined, Leakage-contained Fuel Tank (Sub Base Mounted): Minimum 125 gallon fuel tank shall be furnished and installed by the Contractor as part of the generator set unit; provide complete with 125 gallons of diesel fuel. Increase fuel tank size as necessary to allow 100% full load operation for a continuous 27-hours. An underground storage tank will NOT be permitted. Low Fuel and Fuel Leak Detectors shall be provided, with normally-closed auxiliary contacts that open on Low Fuel or Fuel Leak Detection for transmitting alarms to the Telemetry System.
- g. Weatherproof Sound Shield Enclosure: A sound attenuated weather housing shall be provided. The housing shall be constructed of 14-gauge pre-painted aluminum to resist corrosion. The maximum sound level shall not exceed 69 dB(A) at 7 meters (23 feet). Steel enclosures do not meet this specification and will not be accepted. Silencer shall be mounted INSIDE generator enclosure.
- h. Per the State of Ohio Fire Marshall requirements, generator supplier shall include a 5-gallon spill containment, 12 foot fuel vent, combustible liquids decal, and low & high fuel switch.

D. Automatic Transfer Switch. General: The transfer switch shall be suitable for outdoor service, tested and warranted by the manufacturer of the emergency generator to ensure one source of responsibility and compatibility for the complete emergency power system. To be approved as a transfer switch by manufacturer, the manufacturer shall have been regularly engaged in the production of UL 1008 listed transfer switches (that are brand names, documented and offered for sale on the open market) for a minimum of five (5) years, and shall provide factory trained

service support and parts through a factory authorized distributor or service center that is regularly doing business in the geographical area of this installation site.

1. The Automatic Transfer Switch shall be the programmed open transition type suitable for 480 volt, 100-ampere, 3-phase, 60 Hertz service. Transfer switch shall be NEMA 4X stainless steel gasketed construction and shall have an adjustable time-delay not to exceed 20-minutes before re-transfer to "NORMAL" service.
2. Transfer switch shall be double-throw construction, positively electrically and mechanically interlocked by a simple mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both "NORMAL" and "EMERGENCY" positions. Transfer switch operation shall be quick-break, quick-make so that the speed of opening and closing is not controlled by the operating personnel during manual operation. The transfer switch shall provide a center "programmed transition" position for manual switching.
3. The electrical-operating means shall be by a direct-acting, constant force in both directions, provided by a bi-directional, linear-induction motor to provide a minimum friction, straight-line switching action. The motor output shall be applied directly to the switching mechanism without the use of gears, cams, or other complex mechanical linkage methods. A switch using solenoid operations, and/or relying upon gravity, weight, or momentum for closing in either position, does not meet this specification. A switch using magnetically operated contactors does not meet this specification. The transfer switch shall not contain any integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
4. The manufacturer shall supply printed literature containing diagrams, parts lists and descriptions sufficient for the Owner's personnel or subcontract supplier to install, operate and perform normal service on the equipment. Each transfer switch component shall have the manufacturer's own drawings and part number with specifications to provide alternate sources of supply for future service and maintenance.
5. Prototype Model Tests: Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from the "NORMAL" position to the "EMERGENCY" position, and return to the "NORMAL" position.
6. The transfer switch supplied for this project shall have minimum withstand and closing ratings (amperes) as listed below; these ratings shall be obtained without contact welding. These RMS symmetrical fault current ratings shall be verified by UL witnessed tests on representative test samples and shall be the ratings listed in the UL listing or component recognition procedures for the transfer switch supplied. All withstand tests shall be performed with any overcurrent protective devices located externally to the transfer switch. Tests conducted with overcurrent protective devices internal to the switch, in such a

- manner that the transfer switch interrupts the current rather than withstanding the current, are not acceptable under this definition of withstand.
7. Where the line side overcurrent protection is provided by circuit breakers at 480 VAC or less, the short circuit withstand and closing ratings shall be as follows:
 - a. Transfer Switch Continuous Current Ratings: 100 A
 - b. Withstand and Closed Ratings: 35,000 Amp-RMS
 8. Where the line side overcurrent protection is provided by current-limiting fuses, the fuses shall be UL Class RK1, RK5, J, or L (with the fuse sizes being no larger than the maximum ratings listed in the UL listing or component recognition procedures for the transfer switch supplied), and the transfer switch closing rating shall be suitable for 200,000 amperes available fault current, as verified by UL witnessed tests on representative test samples.
 9. Ratings: The transfer switch shall be UL listed per Standard 1008. The transfer switch supplied shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-CI and NFPA 76A, rated for total system load (including motor loads, electric discharge lamps, resistive loads, and tungsten lamp loads as described in Section 1 of UL Standard 1008).
 10. The transfer switch shall be suitable for use on a 60 hertz system. Refer to drawings for the location of the switch, number of phases, number of poles, voltages and ampere ratings.
 11. The transfer switch shall be rated for continuous operation in ambient temperatures of -40 degrees Celsius to +67 degrees Celsius (-40 degrees Fahrenheit to +152 degrees Fahrenheit). The main power switch contacts shall be rated for 600 VAC minimum.
 12. The switch shall have transparent protective covers to protect personnel during manual operation, and to allow operating personnel to visually determine whether the main contacts are "open" or "closed".
 13. The main switch contacts shall be high-pressure silver alloy contacts to resist burning and pitting for long life operation. The switch shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs quickly and effectively; arc chutes shall have insulating covers to prevent interphase flashover.
 14. The transfer switch shall have one 3-pole D.T., 10A, 480V auxiliary switch on both normal and emergency sides, operated by the transfer switch. These switches shall be factory-wired to an easy access terminal block and shall be used to monitor the transfer switch position for controlling indicator lights or other peripheral equipment. (Provide additional auxiliary relays as required to provide proper functioning system.)
 15. Complete AL-CU lugs, UL listed and CSA approved, shall be provided for the "NORMAL", "EMERGENCY", and "LOAD" power connections. For 150A and larger switches top or bottom feed for load connections shall be provided for slimmer design requiring less wall space. Load connections shall be designed for field relocation, either from top to bottom or vice-versa.

4.0 EXECUTION. The engine generating set, control panel and emergency transfer switch shall be supplied by the engine generator manufacturer and installed by the Contractor on an appropriately sized and constructed (per plan) concrete pad/foundation. The entire system responsibility shall be with the Engine Generator Company.

A. Transfer Controls. Control accessories shall be mounted in a separate smaller relay compartment mounted adjacent to the transfer switch power compartment.

1. Provide solid-state under-voltage sensors to simultaneously monitor all phases of the normal source and all phases (all 3-phase for 3-phase system) of the emergency source. Provide adjustable range sensors for field adjustment for specific application needs. Pick-up settings shall be adjustable from a minimum of 85% to a maximum of 100% of nominal voltage.
2. Dropout settings shall be adjustable from a minimum of 74% to a maximum of 98% of pick-up setting with fixed dropout time delay of 0.5 seconds. The voltage sensors shall have an operating temperature range rating of -25 degrees Fahrenheit (-32 degrees Celsius) to +175 degrees Fahrenheit (+79 degrees Celsius). The voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of normal or emergency source, even where motor feedback voltages exist.
3. The controls shall signal the emergency power system generator to start upon signal from normal source voltage sensors. Solid-state time delay start, adjustable from 0 to 6 seconds (factory set at 2 seconds) shall be provided to avoid nuisance start-ups on momentary voltage dips or momentary interruptions.
4. The switch shall transfer the load to the emergency power system after the generator set reaches proper voltage and frequency. Provide solid-state time delay transfer, adjustable from 0 to 120 seconds to allow the engine-generator set to stabilize before application of load.
5. The transfer switch shall control the generator set to allow the generator set to start and transfer load within 10 seconds after a normal source power failure. It shall be the responsibility of the supplier of the transfer switch to ensure that this requirement is met.
6. The switch shall transfer the load back to the normal source after normal power restoration. Provide solid-state time delay retransfer, adjustable from 0 to 32 minutes to allow normal power to stabilize before transfer back to the normal power source.
7. The controls shall signal the engine-generator set to stop after load transfer back to the normal source. Provide solid-state time delay stop, adjustable from 0 to 8 minutes to maintain availability of the emergency source in the event that the normal source fails shortly after transfer of the load back to the normal source, and to permit the engine to run unloaded for cool down before shutdown.
8. The operating power for load transfer shall be obtained from the source to which the load is being transferred. The controls shall provide an automatic transfer of the load from the emergency source to the normal source if the emergency source fails when the normal source is available. The controls shall be provided with two sets of contacts to provide remote signaling of an "Automatic Transfer Switch

Failure” alarm, in the event of a switch failure to transfer in either transfer direction. Provide one normally open and one normally closed isolated 10A contacts.

B. Generator Control Panel. Provide a lighted, unit mounted control console suitable for outdoor service that is factory built, wired, tested and shock-mounted by the generator manufacturer. The control console shall be a rigid metal enclosure, mounted on the generator end of the set, and shall contain the main circuit breaker and all devices as specified herein, shown on the drawings, and as required for described functions. The control console shall include a control section, control panel and cable termination box. Hinged, front-opening doors shall provide required access to all components; removable top and side panels shall provide required access to cable entry and terminations.

1. Control wire shall have termination identification on each wire for ease of tracing. Terminal blocks for control wires which run between generator set controls shall have identical terminations on both ends. Nameplates shall be provided to identify each device or function and shall be silk-screened white on a black background. Metal enclosures shall be chemically treated and painted manufacturer's standard color with black control panels. Engine-generator control shall include the following for each unit:
2. Two wire, 12-volt DC engine controls including oil pressure gauge, coolant temperature gauge, and charge rate ammeter.
3. A manual selector switch providing three (3) control positions, RUN-STOP-REMOTE, shall be included on the console. The RUN position shall permit the engine to be started locally at the set and run unloaded; the STOP position shall inhibit engine operation. REMOTE position allows starting from transfer switch equipment.
4. The control console shall contain complete start-stop controls, which start the engine on closing contact, and stop the engine on opening contact.
5. Two independent systems shall be provided to disconnect the starting circuit upon the engine starting. The design shall provide for proper operation if either of these systems malfunctions.
6. The Control shall provide for automatic engine shutdown for the following fault conditions:
 - a. Overcrank.
 - b. Overspeed.
 - c. Low oil pressure.
 - d. High engine temperature.
 - e. Low coolant level.
7. Indicator Lamps shall be provided to signal the following functions:
 - a. SYSTEM READY – Indicates system is ready for start signal and has no current fault conditions, and that switch is in the “auto” position.
 - b. AUXILIARY FAULT - Indicates a user-defined fault condition from user-provided input contacts.
 - c. PRE-ALARM LOW OIL PRESSURE - Indicates oil pressure is marginally low.

- d. PRE-ALARM HIGH ENGINE TEMPERATURE - Indicates engine temperature is marginally high.
 - e. LOW OIL PRESSURE - Indicates engine has shutdown because of critically low oil pressure.
 - f. HIGH ENGINE TEMPERATURE - Indicates engine has shutdown because of critically high temperature.
 - g. OVERSPEED - Indicates engine has shut down because of excessive RPM.
 - h. OVERCRANK - Indicates the starter has been locked out because cranking time was excessive.
 - i. FUEL LEAK
 - j. LOW WATER TEMPERATURE - Indicates engine temperature is marginally low for starting
 - k. LOW FUEL - Indicates fuel supply is marginally low
 - l. GENERATOR SWITCH NOT IN AUTO - Indicates control switch is in the "OFF/RESET" position.
 - m. HIGH BATTERY VOLTAGE
 - n. LOW BATTERY VOLTAGE
 - o. EMERGENCY STOP
8. Fault Reset Switch - shall be provided to clear fault indications and allow restarting of the engine after shutdown faults. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either AC or DC voltage and shall retain the fault status memory even through complete removal and replacement of the starting battery. The fault reset function shall operate only when the run switch is in the "Off/Reset" position.
 9. Cycle Cranking Control Circuit - shall be provided which shall provide for a 15 second cranking period followed by a 15 second reset period followed by a 15 second crank cycle and reset, etc., for a total of three cranking tries, after which the starting control shall be locked out.
 10. A potentiometer shall be provided to adjust the voltage $\pm 5\%$ from rated value.
 11. Provide a three-pole, mainline circuit breaker, fully rated at 600 V, 30 amp, 25,000 AIC.
 12. Running time meter shall be 0-99,999.9 hours non-reset type
 13. Provide relay contacts for remote indication alarms and shutdowns. Alarm contacts shall be open under normal conditions, and closed on abnormal or alarm conditions. Energization of relay coils to indicate alarm conditions shall not be accepted
 14. Provide AC meters with phase selector switch for the following functions:
 15. Voltmeter - 2-1/2", 2% accuracy.
 16. Ammeter - 2-1/2", 2% accuracy.
 17. Frequency - 2-1/2", 2% accuracy
 18. Contractor shall check for proper phasing of the AC Generator output which shall be follow the same phase rotation as the NORMAL POWER. Phase A-B-C shall be maintained at all times on all bus-work, incoming power cables, cable

feeders, panel board bus-work and switchgear as follows when facing the front of the unit.

- a. Left to Right A-B-C.
- b. Front to Rear A-B-C.
- c. Top to Bottom A-B-C.

C. Concrete Generator Pad & Sub-base. A concrete generator pad and sub-base shall be provided under Item 4.

5.0 ELECTRICAL. The generator(s) shall be installed in accordance with all electrical codes and provisions herein and also SCMSD Item 29.

6.0 QUALITY ASSURANCE.

A. Testing. The complete installation shall be tested for compliance with the specification following completion of all on-site work. Testing shall be conducted by representatives of the manufacturer, with required fuel, test equipment, etc., with the Owner notified one week before the tests are to be conducted. The Owner shall have the option to witness the tests. Certified copies of the test procedures and results shall be forwarded to the engineer. Tests to be conducted on-site shall include

1. Simulated power failure tests - The engine generator shall be made ready for automatic operation and started by means of the test switch control. Unit shall run for the duration of all time delays and then automatically shut down:
2. Load test of the engine generator - On-site load testing shall utilize resistive load banks of the proper size and rating. Actual plant equipment load will not be available for test purposes.
 - a. One-hour operation at half rated load
 - b. One-hour operation at three quarters of rated load
 - c. Two-hour operation at full load
 - d. Records shall be maintained throughout this period on water temperature, oil pressure, ambient air temperature, phase-to-phase and phase-to-neutral voltages for all three phases, all three phase currents, frequency, kilowatts, fuel consumption, and power factor.
 - e. Once the generator load test is complete, and all other equipment and systems are tested, a simulated power failure is to be employed.
 - f. Once the generator has come on line, each pump shall be tested under load (water may have to be supplied), individually and simultaneously.
 - g. All ancillary equipment and alarms shall also be examined for proper operation.
 - h. When all equipment and alarms have successfully passed the test, line power shall be restored. Once the generator cools and the equipment has been

- under line power for the amount of time for generator cool down, all equipment shall be examined for proper operation.
3. Control demonstration -The following control features shall be demonstrated:
 - a. Preliminary alarm and safety shutdown verification.
 4. The system shall be exercised by the manufacturer or his authorized service technician between the date of initial startup and Owner's acceptance date. The system shall also be exercised a minimum of once every six weeks under available load for two hours.
 5. Before acceptance by Engineer, the system shall be completely serviced. The oil and anti-freeze shall be changed and new filters shall be installed on the generator.
 6. Owners final acceptance test shall be as follows:
 - a. Full load test of engine generator by means of a resistive load bank. Fuel tank shall be filled by installing contractor on completion of test.
 - i. Engine shutdown test with time delays.
 - ii. Standby mode test (no load).
 - iii. Simulated power failure test.
 - iv. Peak mode sequence test - no load.
 - v. Peak mode sequence test - full load.
 - vi. Peak mode overload test - functional.
 - vii. Peak mode loss of engine test
 - viii. Peak Mode normal fail test.
 7. After acceptance by the Owner, a representative of the supplier shall meet with representatives of the Owner and review the operation, correct starting and control methods of the system. This review shall make the Owner aware of all recommended preventative maintenance procedures and operational procedures. A minimum of 2 separate 4-hour sessions shall be provided.
 8. Performance. The performance tests of the generating set shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered. These tests shall have included:
 - a. Maximum power level.
 - b. Maximum motor starting capacity.
 - c. Structural soundness.
 - d. Torsigraph Analysis per MIL-STD 705B, Method 504.2.
 - e. Fuel consumption.
 - f. Engine-alternator cooling air flow.
 - g. Transient response and steady state governing.
 - h. Alternator temperature rise per NEMA MG1-22.40.
 - i. Harmonic analysis and voltage waveform deviation per MIL STD-705B, Method 601.4.
 - j. Three Phase short circuit test for mechanical and electric strength.
 - k. The complete standby electric power generator shall be warranted as outlined in the warranty section of the specifications.

- l. The manufacturer shall maintain facilities at his place of business to adequately provide technical support for simulation and diagnostic purposes.

B. Observation.

1. Electrical contractor shall obtain a permit for new fuel tank installation and arrange for State fire Marshall to be onsite for final tank inspection.

C. Warranty.

1. The complete standby power system shall be covered by an extended five-year or three thousand (3000) hour warranty. Failures which occur due to equipment, component, control, programming etc. failures/malfunctions shall be covered 100% by the five (5) year comprehensive warranty.
 - a. The "system" shall include the generator, engine and all appurtenances necessary for proper functionality as designed. Other components include but are not limited to the ATS, controls, heaters, wiring, battery, fluids etc.
2. A startup Notification Form must be completed by the Seller and received by manufacturer within 60 days after the initial startup, copy to the Engineer.
3. The seller of the system shall also, within one year of supervised startup, send into the manufacturer a properly filled out warranty registration form and warranty fee. Copy of warranty form shall be supplied to the Engineer. Warranty Fee shall be included in the cost of the generator.
4. On or about the anniversary date of the placement of the generator into service for each of the five (5) years of the comprehensive Manufacturer's warranty, the contractor shall supply an authorized manufacturer's technician to provide an annual service inspection. The annual inspection shall include:
 - a. Performing an actual load testing and technical evaluation of the entire emergency generator system performance (all components).
 - b. Any deficiencies or problems discovered during either the annual service inspection, excluding routine oil and filter changes, shall be corrected under the warranty.
 - c. The technician shall provide a written report and USB flash drive containing digital photographs pertaining to the generator system to the County indicating:
 - i. The condition of the generator system and all component systems.
 - ii. All repairs and/or adjustments.
 - iii. All components or parts utilized for any repairs.
 - iv. Any potential future concerns or recommendations.
5. All labor, transportation, equipment and material costs shall be chargeable to the warranty and NO costs shall be borne by the County throughout the duration of the comprehensive five (5) year warranty.
6. The Contractor shall be responsible for provision of an annual written report, at no additional cost to the county, during the warranty period which includes but is not be limited to:
 - a. Detailing service under the comprehensive warranty.
 - b. Detailing service not part of the comprehensive warranty.

- c. USB flash drive complete with photographs.
- 7. Manufacturer's technician shall be on site within twenty four (24) hours of notification of a generator system failure at any period throughout the five (5) year warranty.
 - a. Failure to comply with the twenty four (24) hour on-site requirement will result in the Manufacturer reimbursing the County for any and all COSTS associated with obtaining, making emergency repairs to the generator system and or any of its components.
- 8. Failures which occur due to equipment, component, control, programming etc. failures/malfunctions shall be covered 100% by the five (5) year comprehensive warranty.
 - a. All labor, transportation, equipment and material costs shall be chargeable to the warranty and NO costs shall be borne by the County throughout the duration of the comprehensive five (5) year warranty.
 - b. The technician shall provide a written report and USB flash drive containing digital photographs detailing the problem and corrective actions taken as described above.
- 9. Failures which occur within the five (5) year comprehensive warranty which are a result of system abuse or negligence on the owner's behalf, shall not be covered by the comprehensive warranty and all costs (inclusive) shall be borne by the owner.

D. Owner Orientation. A representative of the supplier shall meet with a representative of the Owner at the time of final acceptance tests and shall review the operation and parts books, correct starting and control methods, and recommend preventive maintenance procedures.

E. Special Provisions. In order to properly evaluate the vendor's equipment, it is necessary to fully understand the capability of each system. Therefore, the Owner requests that the following questionnaire be answered (in triplicate) to allow a fair and equitable comparison to be made. Should the Bidder have any questions relative to this questionnaire, submit them in writing at least two weeks before Bid Opening.

7.0 MEASUREMENT. The number of generators installed, complete, tested and approved shall be measured for payment.

8.0 PAYMENT. The price for this item shall be included under Item 33 and shall include all material, labor, equipment, and appurtenances required to accomplish this work.

<u>Item</u>	<u>Unit</u>	<u>Description</u>
33	EA.	Standby Generator
SCMSD P-[XXX] [PROJ NAME]	33.16	Standby Power Rev 11/18/25

END OF SECTION

QUESTIONNAIRE

These questions are applicable to engine-generator set. This questionnaire may be provided during submittal process for the pre-approved manufacturers but must be provided during time of bid for alternates or substitutions to the named manufacturers.

- 1) Does your equipment meet all applicable codes? Yes No
- 2) Has your equipment been through prototype tests at the factory? Yes No
- 3) Do you have adequate facilities to perform testing & provide technical support? Yes No
- 4) Is engine 4-cycle, 6-cylinder, full-diesel- turbocharged, and fuel injected? Yes No
- 5) Who manufactures the governor? _____
- 6) What is engine heat rejection to coolant? _____
- 7) How many water jacket heaters will be provided for each engine? _____
- 8) Are primary and secondary fuel filters provided? Yes No
 - a. Do they have replacement elements? Yes No
- 9) Who manufactures the generator? _____
- 10) What type of spring isolators are to be used? _____
- 11) Who manufactures the prime mover? _____
 - a. What is the overall size? _____
 - b. Weight? _____
 - c. What are CFM requirements? _____
- 12) Who manufactures and what type of regulator is to be used? _____
- 13) Who manufactures the battery charger? _____
- 14) What type and who manufactures the batteries? _____
- 15) What is the exhaust pipe size? _____
- 16) Muffler size (dimension)? _____

- a. Quantity of mufflers per engine? _____
- b. Weight? _____

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[SPEC NAME]