I. SCOPE OF WORK:

This work shall consist of providing all materials, labor, supervision, tools, equipment and incidentals necessary to furnish, deliver, start, operate, load test, and examine for proper operation and installation by others a 350 KW emergency-standby diesel generator for the

The generator system shall be complete with outside weather housing and all associated equipment including, but not limited to, automatic transfer switch (ATS), starting batteries, battery rack and cables, engine control and instrument panel, under unit mounted fuel tank and anchor bolts for anchoring to concrete foundation pad by others. All equipment and materials shall comply with these specifications and the Virginia OSHA Standards.

II. GENERAL REQUIREMENTS:

It is the intent of these specifications to obtain a generator set and automatic transfer switch of good commercial design with a useable life expectancy of at least 20 years based on an average of 125 hours operating time per year. The equipment supplied shall meet the requirements of the NFPA 110, Level 1, NEC, NEMA, IEEE, and ANSI standards, where applicable, for design, elimination of radio noise (EMI), output filtering and temperature rise. Generator set must conform to EPA Tier 3 non-road emissions regulations, and ISO 8528-5, class G3 requirements for transient performance.

All equipment shall be new and in current production by a nationally recognized firm which manufacturers the engine-generator set as a matched unit. Contractor shall have full responsibility for the performance of the generator set and its accessories. Where no specific kind of quality of material is given, items of good "industrial grade" quality and of a recognized standard manufacturer as approved by the Commonwealth shall be furnished.

III. MATERIAL REQUIREMENTS

The following specifications are based on a Kohler 350 REOZDD and related equipment. They are intended to define the level of performance and quality of the requested equipment and work and not to be restrictive by brand, manufacturer, method of configuring a system, and method of accomplishing required functions, unless otherwise indicated. The word "shall" indicates a mandatory requirement or minimum level of quality required of the Bidder or Contractor. In reference to an agency or department of the Commonwealth, the word "will" indicates an obligation. Bidders shall annotate, explain clearly and thoroughly all similarities and differences, and return these specification pages even if offering the referenced equipment. Bidder shall provide all pertinent information documenting compliance and equivalence with dimensions, functions, performance and quality. Documentation must be provided of all features and specifications of generator set to be provided. The Commonwealth reserves the right to obtain information, to request clarification, and to set a time limit for response. Failure on the part of the Bidder to provide the aforementioned documentation will be cause to reject the bid as non-responsive. All figures are approximate unless stated otherwise. The offered equipment shall provide the following or approved equal:
A. **Continuous Standby Rating:**

1. Generator shall be supplied for 120/240 VAC, three phase, 60 Hz., operation.

2. Generator shall be capable of producing the approximate following output at the specific voltages, for three phase operation, 0.8 pf, 3 or 4 wire:

   a. 120/240 VAC, 350KW/435 KVA, 1052 Amperes (Delta)
   b. 120/208 VAC, 350KW/435 KVA, 1214 Amperes (WYE)
   c. 139/240 VAC, 350KW/435 KVA, 1052 Amperes
   d. 277/480 VAC, 350KW/435 KVA, 526 Amperes (WYE)

3. Motor starting capability: Engine-generator set shall have the capability to properly start a three phase, NEMA Code G, 180 H.P, 0.8 pf, electric motor, approximate voltage dip 30%.

4. Generator set shall be suitable for continuous operation along with all its accessories, for the duration of any failure of the normal utility power source. The above rating shall be based on a minimum intake air temperature of 100°F (38°C).

B. **Derating Factors – Genset must meet or exceed:**

1. Altitude: Engine derating shall be approximately 4.0% H.P. loss per 1000 feet of elevation above 1000 feet.

2. Temperature: Engine derating shall be approximately 1.0% H.P. Loss per 10 deg. F, above 100 deg. F.

C. **Engine Requirements:**

1. The engine shall be diesel, inline or V-type, 6 or 8 cylinders. It shall be directly connected to the generator by a semi-flexible coupling and both shall have sufficient power to produce the specified ratings when operating at generator synchronous speed, full rated load with all accessories required for normal operation including exhaust, fuel pumps, engine cooling fan and pump, generator cooling fan and alternator battery charging system.
2. The engine shall be rated at 1800 rpm. It shall be turbocharged and after cooled as required to develop a minimum of 1.5 horse-power per rated kilowatt of generator set and have an approximate displacement of 12L to 15L (736 cubic inches to 950+cubic inches). Engine shall have a high temperature insulating jacket cover that is easily removable and fully covers exhaust manifold and all required portions of turbocharger, if equipped. The engine shall be of the overall level of quality as Detroit Diesel S60, Cummins NTA855, Caterpillar C15, or approved equivalent.

3. The engine shall be equipped with a fuel system suitable for operation on No. 2 Diesel fuel. Fuel system shall include easily replaceable primary and secondary fuel filters and lift pump. Engine fuel consumption is approximately 25 to 28 gph at full rated load and 14 to 15 gph at 50% load. Vendor must provide fuel consumption data.

4. The engine cooling system shall be designed to provide adequate cooling at full rated load in ambient temperatures of at least 100°F (38°F). The system shall include a unit mounted radiator, blower fan, water pump, and thermostat. Total engine cooling system capacity shall be a minimum of 18 gallons.

5. The engine shall be equipped with an electronic governing system to provide isochronous frequency regulation from 0 to 100% rated load and ± 1.0% steady state regulation, maximum variation.

6. The engine shall have a full pressure lubrication system, an easily replaceable "spin on" cartridge oil filter, and a water-cooled oil cooler. Total engine oil lubrication system capacity shall be 8 gallons minimum.

7. Starting shall be by means of a solenoid operated positive engagement gear driven electric starter for operation of 12 or 24 volts D.C, negative ground system.

8. Engine protective shutdown devices shall include: 1. over cranking protection; 2. low oil pressure; 3. low coolant level; 4. high coolant temperature; and 5. overspeed.
D. Generator (Alternator):

The generator shall be the broad voltage range, 4-pole, stationary armature type. Generator shall have 12 leads brought out to a connection box on side of alternator. Generator shall be easily reconnectible at the jobsite to the common voltages specified in the generator rating section, para. A.2. Generator shall have a revolving field with rotating brushless and permanent magnet type exciter system. It shall have a solid state voltage regulator capable of maintaining voltage within $\pm 1\%$ any purely resistive load up to 100% of the rated KW capacity of the generator, the instantaneous voltage dip shall not exceed 15% and shall recover to $\pm 1\%$ of rated voltage within one second. The generator shall be capable of sustaining, without damage, at least 200% of full rated current for at least 10 seconds under any phase-to-phase or phase-to-neutral short circuit condition. It shall be equipped with a molded case, 3 pole, 600 VAC class, UL listed, manually operable, 1200 Ampere line current sensing circuit breaker to protect fully against any balanced or unbalanced overload condition. It shall be equipped with the necessary time delay so as not to trip within the ten seconds specified above. Generator shall also be equipped with an inverse time delay field type circuit breaker to protect generator in the case of extreme output current or short circuit. Generator shall be of the overall level of quality as Kohler Model 5M4027, or approved equivalent.

E. Controls:

1. The generator set shall be equipped with a microprocessor based mounted control panel which, in conjunction with an automatic transfer switch, shall provide a completely automatic standby system. The controls shall provide remote 2- or 3-wire stop-start control and a unit-mounted 3 position manual switch for "Run-Off-Automatic" functions. In the "Run" position, the engine shall start and run regardless of the position of the remote starting contacts. In the "Automatic" position, the engine shall start when contacts in the remote control circuit close and stop when those contacts open. In the "Off" position, the engine shall not start even though the remote start contacts close. A flashing alarm light shall indicate in "off" position.

2. The controls shall include cyclic cranking to provide alternate crank and rest cycle of 10 seconds each for
up to one minute. If the engine has not started within the time, the control shall lock off and not resume cranking until manually reset. Individual alarm indicating lights shall be provided to show the unit shutdown due to: 1. low oil pressure, 2. low coolant level, 3. coolant high temperature, 4. over speed, 5. over crank. A five-minute unloaded running time cool down delay shall be included either in the engine starting controls or in the automatic transfer switch.

3. An engine and generator information display shall be installed on the unit. Display may be digital or analog, and to include the following functions, but not limited to:
   a. AC Voltmeter
   b. AC Ammeter
   c. Frequency meter, 45-65 Hz., 0.5% Accuracy
   d. Voltage adjusting rheostat (+5% range)
   e. Oil pressure, 2% Accuracy.
   f. Coolant Temperature, 2% Accuracy
   g. Running time meter, digital, 2% Accuracy
   h. Battery charging ammeter or voltmeter, 2%

Accuracy
   i. Panel lights.
   j. AC Voltmeter and Ammeter phase selector

Provide complete detailed information on functions and features of control system offered.

4. The instrument and control panels(s) shall be isolated from engine vibration.

F: Automatic Transfer Switch:

1. An automatic transfer switch with electronic control shall be furnished. It shall meet NEMA standard ICS10-1993 “Alternating Current Automatic Transfer Switches”. It shall be of microprocessor control design and rated at 1200 Ampere, 600 VAC Class, 60 Hz., 3 poles, 4 wire. It shall be mechanically and electrically inter-locked, electrically operated by power from both normal and emergency positions. It shall be listed by Underwriters Laboratories under UL Std. 1008 for emergency systems, and meet current NEMA standard ICS10 – AC Automatic Transfer Switches. It shall be rated for continuous duty and all classes of load. It shall be furnished in an outdoor, weatherproof, NEMA 3R cabinet. It shall be furnished with three phase logic boards for
operation on existing utility supplied, three phase current.

2. When the voltage of any phase of the normal source drop below 70% of nominal voltage for more than three seconds, contract shall close to initiate engine starting. When the generator set reaches at least 90% or rated voltage and frequency, the switch shall transfer to the emergency source after a 0-10 second adjustable time delay.

3. When all phases of the normal source have been restored to 90% or more of rated voltage for an adjustable time of 0-30 minutes, the switch shall retransfer the load to the normal source and signal the engine to stop. A five minute unloaded running time delay shall be provided in the transfer switch or the engine starting controls.

4. In the event of failure of the automatic transfer mechanism, means for manual operation shall be provided.

5. Automatic transfer switch shall incorporate a 7-14 day exerciser time clock with selector switch, standby battery charger and the following standard accessories:
   a. Time delay, normal to emergency, adjustable 0 seconds to 60 minutes, in 1 second increments.
   b. Time delay on engine start, adjustable, 0 to 10 seconds in 1 second increments.
   c. Time delay emergency to normal, adjustable 0 seconds to 60 minutes in 1 second increments.
   d. Frequency voltage relay for emergency source, non-adjustable.
   e. Test button, key operated. Shall simulate a power failure to start generator and to transfer load.
   f. Disconnect plug, for testing, circuit check and repair, and to prevent automatic operation.
   g. Main shaft auxiliary contact, closed on normal.
   h. The 7-14 day plant exerciser time clock shall be capable of running the plant for a minimum of 15 minutes during any 24 hour period. Selector switch shall simulate or not simulate a power failure.

6. Automatic transfer switch shall be of the overall level of quality as Kohler KCS series with MPAC1500 controller, or approved equal.
G. Accessories

All accessories necessary for proper outside mounting and operations shall be provided, including starting batteries, battery cables and connectors, acid resisting battery rack, flexible fuel connector, and vibration isolators, as follows:

1. Critical type exhaust silencer with rain cap.
2. Engine block heater, 2500 Watt, 120/240 vac.
3. Outside weather proof housing.
4. Charging alternator, 12 or 24 Volt, 30 Amp. minimum capacity.
5. Engine air cleaner, dry type, with replaceable element.
6. Secondary fuel filter shall be water and trash sediment type.
7. Fuel pump, lift suction capability shall operate properly with installed tank under unit.
8. Flexible fuel line connectors.
9. Heavy duty automotive type maintenance free batteries, minimum of 900 cold cranking Amps. at 0°F and 430 minutes reserve capacity at 80°F for a 24 volt system. (four each 12 volt batteries), SAE 24.
10. Fuel solenoid valve, compatible with engine electrical system.

H. Fuel Tank:

Generator set shall incorporate an under-skid mounted fuel tank of gallons capacity to be determined by operating time required and fuel consumption at 100% load.

Minimum requirement is 24 hour operation at 100% load (i.e. 675 gallons at 27 gallons per hour).

*Show additional pricing for optional tank requirements:*

- 36 hours operation at 100% load
- 48 hours operation at 100% load
- 72 hours operation at 100% load

$_________________________

$_________________________

$_________________________

Tank shall meet UL142 requirements, and installation shall meet NFPA30 and NFPA37 standards. The sub-base fuel tank must be compatible for installation of a weatherproof housing, and shall meet the following minimum requirements:

- Tank shall be rectangular in shape, and shall provide overall length, width, and height as needed for fuel capacity requirement.
- Double wall construction, fabricated from structural channel or plate, ASTM A-36, 0.280" thickness, or other equivalent acceptable type. Steel angle shall form all four sides of tank. Top and bottom of tank shall be of 10 gauge sheet steel, ASTM A-366 or other equivalent acceptable type. Tank shall have at least one 1/8" thick internal baffle.

- Leak detector system
- Low fuel warning system for controller arm
- Mechanical float type fuel gauge
- Normal vent with riser and mushroom cap
- Emergency pressure relief vent for inner tank
- Basin drain
- Overflow opening
- Tank shall provide access porting to allow conduit to pass from generator through mounting pad.
- 2" NPT minimum lockable fill cap with riser and vent that is secured when weather housing is locked
- Minimum 3/8" fuel supply and fuel return stubs that are connected to the engine.
- 4 mounting lugs to bolt tank and generator set to concrete pad with 1/2" diameter, 2000 lb. pullout strength, foundation bolts.
- Each tank mounting lug shall rest on a suitable vibration attenuating pad and shall properly support the weight of generator set and tank. Vibration pad shall allow an approximate clearance of 1" between bottom of tank and concrete mounting base.
- Generator set side rails shall bolt to 1" steel mounting blocks on top of tank. Generator skid rails shall not be welded to tank.
- Tank shall be internally coated with a good grade of epoxy. All exterior sides of tank shall be painted with two coats of industrial grade primer and two coats of industrial grade finish enamel (total of 4 coats of paint). Paint shall match generator color and otherwise present a uniform neat appearance.
- Tank shall be of correct design and sufficient construction to properly support full weight of engine-generator set for the life of the unit (20 years) with no cracking or distortion. Engine-generator set shall be properly centered on top of fuel tank.
- Tank shall be of the overall level of quality as
Kohler Company or Chillicothe Metal Company, 4507 East Rome Road, Chillicothe, IL 61523-9071, Tel (309) 274-5421, or approved equal.

I. Enclosure:

Engine-generator set shall be furnished with a weather protective and sound attenuating housing fabricated of minimum 16 gauge sheet steel or equivalent strength aluminum and properly reinforced to protect engine-generator set for the life of the unit (20 years) with no cracking or distortion. Steel shall be baked powder coated or epoxy/polyurethane painted inside and outside with rust inhibitor treatment prior to factory applied finish. Aluminum may have a natural finish, free of blemishes, scars and scratches, with a protective clear coat, or finished same as steel. Enclosure shall have sufficient air inlet louvers and damper as required to provide ample air circulation through generator and radiator, and reduce rain and snow entry. Enclosure shall include a critical silencer with flexible exhaust connector, and rain cap. Interior shall be lined with acoustic insulation material meeting UL94 HF1 flammability classification. Enclosure shall have hinged or lift out type doors or access panels on both sides that provide full rain protection and full access to engine and generator and instrument panel. All doors and access panels shall be secured with keyed locks. Enclosure shall also provide easy top access to engine radiator fill cap and shall provide protection with key lock access for fuel tank gauge, vent, and fill pipe. Enclosure shall install to fit with a sub base fuel tank located under the generator set. Battery racks shall also be accommodated within the enclosure. Any scars, scratches or dents resulting from handling and shipping shall be repaired or painted to exactly match contiguous area.

J. Certified Test Report and Load Test:

1. The automatic transfer switch and engine-generator set shall be tested by the manufacturer prior to shipment. A certified copy of the factory full-load test of the unit supplied shall be submitted to the Agency. The Certified Test Report shall show both the Commonwealth’s Purchase Order Number and Agency ______.
Requisition number. The Certified test report shall verify the current (Amperage) and wattage output, voltage and frequency regulation, at the following minimum specified loads and operating time:

- a. No load, maximum voltage test, 30 minutes
- b. 25% load, 30 minutes
- c. 50% load, 30 minutes
- d. 75% load, 30 minutes
- e. 100% load, 30 minutes
- f. 110% load, 10 minutes

2. The generator shall be tested at the above loads through the use of pure resistive load banks at 1.0 pf. The test shall be performed at the manufacturer's or supplier's facility and shall prove that the generator set is free of any defects and shall perform to all specifications.

3. Transient responses, including voltage dips, frequency dips and recovery time period, shall be measured and agree with the data submitted with the bid. Also, the generator set shall be full load tested by the Contractor in the field at start-up prior to acceptance. Any deficiencies shall be permanently corrected by the Contractor at the sole cost of the Contractor.

IV. INSTALLATION: Unit will be installed by other parties.

V. DELIVERY:

A. The Contractor shall plan and coordinate the delivery of the equipment with the Agency's Representative, ____________________________, so as to cause minimal disturbance to facilities. The Contractor shall notify the Agency's Representative at least 3 working days prior to delivery.

B. Contractor shall deliver generator set to Agency and unload in the storage area as directed. If unit is to be stored outside, Contractor shall provide, install and properly secure a suitable waterproof, UV resistant tarpaulin to protect engine, generator and fuel tank from the effects of the weather. Lightweight tarpaulins will not be accepted.

C. Important - If engine-generator set, fuel tank and automatic transfer switch cannot be delivered to Agency for storage by ________________, Contractor shall provide in writing, to the Agency's Business Manager, ____________________________, manufacturers certification of the serial numbers for the: 1. Engine, 2. Generator, 3. Automatic Transfer Switch and 4. Fuel Tank.

D. Contractor shall furnish and install the engine manufacturer's recommended engine lubricants and fill the cooling system with a 50% solution of automotive type ethylene glycol
antifreeze and shall be supplemented with corrosion protection inhibitors. An acceptable corrosion protection inhibitor for conventional coolants is six pints of BTE by Baldwin Filters of Kearney, Nebraska or equivalent. If extended life coolant is installed in the generator system, do not install BTE in the coolant.

VI. Inspection of Installation Work by others and Start-Up by Contractor:

1. After installation (by others), Contractor shall inspect that all aspects of the installation is made in accordance to the generator-set manufacturers recommendations, this specification, good trade practices, Virginia OSHA requirements and unit is suitable to start, test and operate.

2. The initial startup of the engine-generator set and operation of automatic transfer switch under load shall be performed by a factory trained or certified representative of the engine-generator set manufacturer. This person may also be the Contractor. The Agency Buildings and Grounds Superintendent, Farm Manager, Dairy Manager and Electrician will be present.

3. Factory representative or certified Contractor shall instruct the Agency personnel in the proper operating and maintenance procedures for all components of the standby power system.

4. After start-up, operating, examining and load testing, the Contractor and the Agency Representative shall conduct a final inspection of the equipment to verify compliance with these specifications. Any deficiencies shall be promptly and permanently corrected. After final inspection, Manufacturer’s Representative or certified Contractor shall certify that all installation work, equipment and materials supplied appears proper and the commencement of the warranty will begin.

Any damage to existing utilities, equipment or finished surfaces resulting from this work shall be repaired to the Agency's satisfaction at the Contractor's sole expense.

At the conclusion of the work, the Contractor shall demonstrate to the Agency's Representative that the equipment and installation work is fully operational and in compliance with these Specifications and Codes. Any supplied equipment deficiencies shall be promptly and permanently corrected by the Contractor at the Contractor's sole expense prior to final acceptance of the work.

V. Product Documentation and Information: Bidder shall state the following for each model and item:

1. Bid price for all equipment & materials only (do not include installation)
   $____________________________.

2. Rated capacity at:
   120/240 VAC, 3 Phase, 0.8 pf, ________AMPS, ________KW, ________KVA
   120/208 VAC, 3 Phase, 0.8 pf, ________AMPS, ________KW, ________KVA
   139/240 VAC, 3 Phase, 0.8 pf, ________AMPS, ________KW, ________KVA
277/480 VAC, 3 Phase, 0.8 pf, ______ AMPS, ______ KW, ______ KVA

3. Engine original Manufacturer & Model No. ________________________________.

4. Engine displacement in cubic inches ________________________________.

5. Engine horsepower and torque at 1800 rpm: ________________/ ____________.
   HP TQ

6. Generator original Manufacturer & Model No. ________________________________.

7. Automatic transfer switch initial Manufacturer & Model No., number of poles and wires, Voltages Class Rating, Amperage rating, Type of Logic, and type of cabinet:
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

8. Engine deration factors:
   a. **Altitude**: Maximum percent (state) _____% H.P. Loss per 1000 ft. elevation to approx. __________ ft.
   b. **Temperature**: Maximum percent (state) _____% H.P. Loss per 10 deg. F. above 100 deg. F.

9. Maximum electric motor horsepower that engine-generator set and complete system, with automatic transfer switch and generator circuit breakers, can properly start (Maximum voltage dip 30%):
   KVA/KW __________________, H.P. __________________ - three phase, 0.8 pf

10. Generator field circuit breaker manufacturer, model, voltage class, and complete rating
   ________________________________________________________________

11. Generator load circuit breaker manufacturer, model and complete rating
    ________________________________________________________________

12. Two **independent** electric apparatus repair facilities that are capable of all repairs to generator (full names, addresses, telephone numbers.)
13. Two factory authorized, independent, diesel engine, repair parts sources (full names, addresses, telephone numbers.)

14. Type of battery used for cranking, include full information and shall include SAE type number, cold cranking capacity @ 0°F. and reserve capacity @ 80°F., etc.

15. Generator is capable of sustaining, without damage, at least ___ % of full rated output for _______ seconds under any phase-to-phase to neutral short circuit. Include proof with bid.

16. Upon an instantaneous one-step application of any purely resistive load up to _______ % of the rated KW capacity of the generator, the instantaneous voltage dip shall not exceed _______ % and shall recover to + or - _______ % of rated voltage within ______ seconds. Include proof with bid.

17. Additional Standards for Service
   
   A. Generator shall be designed and constructed so that, after warranty, should major repairs or rewind become necessary, all work may be successfully accomplished by an electric apparatus repair facility, independently of generator set manufacturer and supplier, that repairs to the Standards of the Electrical Apparatus Service Association (EASA).

   B. Diesel engine repair parts shall be readily available from a factory authorized diesel engine dealer, independently of generator set manufacturer and supplier, such as Detroit Diesel, Caterpillar, White-Hercules, John Deere or Cummings.

   C. Important: Bidder shall submit, with bid, as shown on the product information pages, a listing of two (2) independent electric apparatus repair facilities and factory authorized engine part dealers that are within 100 miles of the jobsite. The award of any resulting contract may be based on complete and verifiable information furnished with bid.

   D. Instruction, Maintenance and Repair Manuals:

   The Contractor shall submit three copies to Construction and Engineering Department, COR, and one copy each to the Superintendent of Buildings and Grounds and Power Plant, loose-leaf bound instruction manuals with copy of all warranties, parts lists, lubrication instructions, electrical schematic diagrams and applicable data which will
provide guidance and reference material on the operation, adjustment, maintenance and repair of the various pieces of equipment. All instructions shall be bound together in 3-ring hard back binder with information indexed. Contractor shall also furnish manufacturer's recommended spare parts list. This shall include the manufacturer's estimate or experience based on mean time before failure (MTBF) for each item listed.