Generator Specification
Bulk Order
Various Residences
Abuja, Nigeria

1.1. DESCRIPTION—Provide engine generators, per the attached schedule, in the KVA ratings indicated for each generator. Each generator on the schedule shall conform to the specifications contained herein.

1.1.1 The generator shall be a prime power rated engine generator set, including: prime power, directly coupled shaft, engine generator sets. The unit shall be configured to consist of a liquid cooled engine and a conventional alternator and an electronic governor. The unit shall be manufactured complete with system controls and all necessary accessories to make the generator set (genset) fully operational. Generators provided in pairs shall have the capability to alternate per the requirements of this specification. All equipment shall be as specified but shall not be limited to the items specified herein. Each genset shall be delivered to the residences indicated on the attached schedule, American Embassy, Abuja, Nigeria.

1.1.2 Provide for integral automatic and manual operation from the selector switch:

(1) Automatic transfer switch (ATS) for the generator as described elsewhere in this specification. The system shall come on-line fully automatically, and on restoration of utility automatically re-transfers load to normal power, shuts down the generator and returns to readiness for another operating cycle.

(2) Provision shall be made on the switch for a manual operation using the selector switch in the MANUAL position.

(3) Provide for alternation of gensets when generators are provided in pairs as shown in the attached generator schedule. Alternation shall be accomplished both by automatic and manual means. All equipment and controls for alternation shall be included with each pair of generator sets. All equipments and controls to provide alternation shall be provided in NEMA-3R, weatherproof cabinets.

1.1.3 Prime and overload ratings shall meet requirements herein.

1.1.4 Provide a three-position selector switch, as required in 2.3.2.

1.2. REQUIREMENTS

1.2.1 The electric generating system consists of a prime mover, generator, electronic governor, couplings, and all controls, tested as a complete unit.

1.2.2 Conform to NFPA 70 and applicable inspection authorities.

1.2.3 Transfer switches shall be labeled under UL 1008.

1.3 SUMMARY OF EQUIPMENT

1.3.1 Prime Power Rated Engine Generator, See Attached Schedule.

1.3.2 Automatic Transfer Switch (ATS).

1.3.3 Sound-attenuated, weatherproof enclosure.

Generator output power characteristics shall be 415/240 Volts, 50HZ, 3-phase and neutral, (4-Wire) except were otherwise stated.

2.0 ENGINE-GENERATOR SET

2.1 ENGINE

The prime mover shall be a liquid cooled, diesel fuel, naturally aspirated engine of 4-cycle design, with four cylinders (minimum).

2.1.2 The engine shall be cooled with an integral, unit mounted radiator, fan, water pump, and closed coolant recovery system, which provides visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for satisfactory operation in 122 Degrees Fahrenheit (50 degrees Celsius) ambient temperature.

2.1.3 The intake air filter (with replaceable element) shall be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube-oil pump. The engine shall have a replaceable oil filter with internal bypass and

replaceable elements. Engine coolant and oil drain extension must be provided to outside the mounting base for cleaner and convenient engine servicing. A fan guard shall be installed for personnel safely.

2.1.4 The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire electric starting shall be accomplished by a solenoid shift electric starter.

2.1.5 Engine speed electronic governor shall have a frequency control, adjustable from zero to five percent droop, to maintain alternator frequency within five percent (across the range) from no load to full load. Steady state regulation shall be within plus or minus 0.33 percent.

2.1.6 The engine fuel system shall be designed for operation using No. 2 diesel fuel. A secondary fuel filter, water separator with glass bowl, manual fuel printing pump and fuel shut-off solenoid and all piping shall be installed on the unit.

2.1.7 Sensors shall be located on the engine for: low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, over-speed shutdown, and over-crank shutdown. These sensors shall be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for ease of identification, a molded rubber boot to over the electrical connection on each sensor to prevent corrosion and all wiring to be run in flexible conduit for mechanical protection and environmental protection.

2.1.8 The electric jacket-coolant heater shall be thermostatically controlled to automatically maintain the coolant within plus or minus 3 degrees of the control temperature. The control temperature shall be the temperature recommended by the manufacturer to optimize the starting time.

2.1.9 Definitions - The following definitions apply for the purpose of this procurement and any resulting contract:

Continuous Load - A load in which maximum current is anticipated for three hours or more in accordance with the continuous duty cycle, as defined by NFPA-70.
Continuous Duty Rating - A duty rating, equivalent to a load equal to one hundred percent of the genset nameplate rating for a duration of more than three hours.

Prime Rating - A duty rating, equivalent to seventy percent of the genset nameplate rating, for a continuous period of 12 hours. A prime rated generator is required to safely support the load, in the absence of city power, for an indefinite period. While it is recognized that over a 24 hour, operational load cycle, period the load variation may be considerable, this rating permits the maximum continuous load and duration to be addressed in the genset selection process.

Overload Rating - This is defined as satisfactory operation at a load of 110 percent of the nameplate rating, for a period of two hours.

## 2.2 ALTERNATOR

2.2.1 The alternator shall be a multi-pole revolving field type, wired for 415/240V, 3-phase, 50 HZ, 4- wire, with a brushless, static exciter. Generators shall be prime rated. The stator shall be directly connected to the engine flywheel to ensure permanent alignment. The generator shall meet temperature rise standards for class "F" varnish and conform to MIL-I-24092, Type "M" class 155. All leads shall be extended into the AC connected panel. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker. One step load acceptance shall be 100% of nameplate kW rating and the generator shall return to normal operation within 15 seconds.

2.2.2 The engine-generator set shall be so designed that voltage dip upon application of nameplate full load shall not exceed 30% with recovery to stable operation within 15 seconds.

2.2.3 The solid state voltage regulator shall control output voltage by varying the exciter magnetic field to provide plus or minus 1% regulation during stable load conditions. The regulator shall have a voltage droop characteristic of 4 volts per cycle to maximize motor starting capability in the event an extremely heavy load drops the output frequency. The frequency at which this droop operation begins shall be adjustable allowing the generator set to be properly matched to the load characteristics ensuring optimum system performance.

2.2.4 The voltage regulator shall contain a limiting circuit to prevent output voltage surges in excess of 110% of rated voltage during generator set operation. On a loss of the sensing signal, the voltage regulator shall shutdown to prevent an overvoltage condition from occurring. A voltage regulator that can go into a full field condition is unacceptable. LED indication will be provided on the regulator

to monitor the sensing (yellow), excitation (green), and output circuit (red). A rheostat shall provide a minimum of plus or minus 10% voltage adjustment from the rated value.

2.2.5 The engine generator set shall be mounted with vibration isolators on a welded steel base, which shall permit suitable mounting to any level surface.

2.3 GENERATOR CONTROLS

2.3.1 All engine, alternator controls and instrumentation shall be designed, built, wired, tested and shock mounted in a NEMA 1 enclosure to the engine-generator set by the manufacturer. It shall contain direct current (D.C.) panel lighting and a fused circuit to protect the controls.

2.3.2 The engine-generator set shall contain a complete engine start-stop control, which starts the engine on closing contacts and stops the engine on opening contacts. An automatic preheat circuit that can also be operated in a manual mode shall be provided. A cyclic cranking limiter shall be provided to open the starting circuit, after eight attempts, if the engine has not started. Engine control modules shall be solid state plug-in type for high reliability and easy service. The engine controls shall also include a 3-position selector switch with the following positions: OFF/MANUAL/AUTO. A red annunciator lamp shall be energized when the switch is not in the automatic position.

2.3.3 Safety shutdown monitoring system shall include solid state engine monitor with individual lights and one common external alarm contact indicating the following conditions: Overcrank shutdown, Overspeed shutdown, High Coolant Temperature (Low Coolant Level shutdown), Low Oil Pressure shutdown, and fuel leak. Monitoring system shall included lamp test switch for manual reset of tripped conditions. Engine RPM shall be monitored by an independent permanent magnetic sensor. The engine shall shutdown immediately and energize a LOSS-OF-RPM shutdown light in the event of a failure.

2.3.4 Engine instrumentation shall consist of an oil pressure gauge, coolant temperature gauge, D.C. ammeter and an engine run-hour-meter, located on the unit control panel. Alternator instrumentation shall include analog meters to indicate output voltage per phase; amperage per phase and generator output frequency.

2.3.5 A red light (labeled using silk screened black letters on the control panel), which becomes energized when a low fuel level is sensed in the base mounted tank.

2.3.6 A thermal-magnetic, UL listed, main-line, molded case circuit breaker shall be mounted in the generator terminal panel. Line side connections shall be made at the factory. A system utilizing a manual reset field circuit breaker and current transformers is unacceptable.

2.3.7 A red emergency stop pushbutton shall be provided on the exterior of the enclosure and shall be accessible without the use of a key and without having to open the enclosure.

2.4 MISCELLANEOUS EQUIPMENT

2.4.1 The following miscellaneous equipment shall be provided as a part of this procurement action:

2.4.1.1 A sound-attenuating, weatherproof enclosure: The engine-generator set shall be factory enclosed in a 12 gauge steel enclosure constructed with corner posts, coated with electrostatically applied zinc and finished with baked enamel paint. The installed equipment sound levels shall be no more than that afforded by Hospital muffler standards when the unit is operated at full load, under rated ambient conditions. Muffler and entire installation, including sound-attenuating enclosure, shall be Hospital Rated for sound. The muffler shall be Hospital Rated apart from the enclosure. The enclosure, apart from the muffler, shall be rated no more than 50 dBA sound pressure level when measured at 7 meters. The enclosure shall have large, removable doors to allow complete access to the engine, alternator and control panel. Each door shall be fitted with stainless steel, lockable hardware with two sets of identical keys. The enclosure shall come equipped with a heater for the prevention of condensation within the enclosure. The enclosure shall meet seismic requirements as specified herein.

2.4.1.2 An automatic dual rate battery charger mounted inside the genset enclosure, in its own cabinet, shall be provided. The charger shall have 240 volt, single phase input. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The output voltage is to be determined by the charge current rate. The charger shall have a maximum open circuit voltage of 35 volts and be protected against a reverse polarity connection.

2.4.1.3 A heavy duty, lead acid battery set shall be provided by the generator set manufacturer of adequate voltage and amperage capacity to start and operate the engine. Provide all intercell and connecting battery cables as required for complete installation. The battery shall be shipped in place fully charged with electrolyte.

2.4.1.4 The genset, parts shall be warranted by the offeror in accordance with the terms of this contract.

2.4.1.5 An integral skid type fuel tank shall be provided with the generator set to permit 18-24 hours of operation at full rated load. The fuel tank shall be a dual wall tank with a retention capacity of 110% of the internal tank. The integral fuel tank shall include an interstitial leak detector to provide notification of the presence of fuel in the interstitial space. The leak detector shall be able to be wired to the safety shutdown monitoring system and shall have a dedicated indicator light.

## 3.0 AUTOMATIC TRANSFER SWITCH (ATS)

### 3.1 GENERAL

3.1.1 The automatic transfer switch shall be industrial (NOT residential) grade and furnished so as to maintain system compatibility and local service responsibility for the complete emergency power system. It shall be listed by Underwriter's Laboratory, Standard 1008, with circuit breaker protection afforded by the generator breaker. Representative production samples of the transfer switch, which have been demonstrated through tests, shall withstand 10,000 mechanical operation cycles (minimum) without failure. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring shall comply with NEC table 373-6. The manufacturer shall furnish complete schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system showing all components, relays and part numbers. This ATS shall be an integral part of the generator set and be secured to the weather-proof enclosure. All wiring and connections to integrate the ATS into the generator output shall be made by the vendor before acceptance by the Government.

### 3.2 ATS RATINGS & PERFORMANCE

3.2.1 The automatic transfer switch (ATS) shall be a minimum 4-pole design (3-pole + neutral), rated for full load, continuous operation. The ATS rating shall be ambient temperatures of -15 Degrees Celsius to +50 Degrees Celsius. Main power switch contact shall be rated to operate at 415/240 volts unless otherwise specified herein. The transfer switch shall have a minimum withstand and closing rating of 42,000 amperes. The RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch.

3.3 ATS CONSTRUCTION

3.3.1 The transfer switch shall be open transition type, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. Independent break before make action shall be used as protection to prevent dangerous source to source connections. The transfer switch shall be approved for manual operation. The electrical operating means shall be approved for manual operation. The electrical operating means shall be by electric solenoid. Every portion of the contactor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. This transfer switch shall not contain integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.

3.3.2 The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy contacts to resist burning and pitting for long life operation.

3.3.3 There shall be one Single Pole Double Throw, 10 ampere, 250 volt auxiliary contact on both normal and emergency sides, operated by the transfer switch. Full rated neutral bar with lugs for normal, emergency and load conductors shall be provided inside the cabinet.

3.4 CONTROL EQUIPMENT

3.4.1 All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet

lockable door is open, but prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.

3.4.2 A solid state under-voltage sensor shall monitor each phase of the normal source and provide adjustable ranges for field adjustments for specific applications needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. The utility input voltage shall be stepped down to 24VAC for safety and reliability.

3.4.3 Signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. An adjustable, solid state time delay start (1 to 180 seconds) shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.

3.4.4 Transfer the load to the engine-generator set after it reaches proper voltage (80%) and frequency (80%). A solid state time delay (30 seconds) shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.

3.4.5 Retransfer the load to the line after normal power restoration. A return to utility timer (5-10 minutes) shall delay this transfer to avoid short term normal power restoration.

3.4.6 The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.

3.4.7 Signal the engine-generator to stop after the load re-transfers to normal. An adjustable, solid state engine cool-down timer (3-10 minutes) shall permit the engine to run unloaded to cool-down before shutdown.

3.4.8 Provide an engine minimum run timer (10 minutes) to ensure an adequate engine run period.

3.4.9 Provide a solid state plant exercise clock to set the day and time of generator set exercise period. Clock shall have a seven days, 24 hour programmable clock powered from the load side of the transfer switch. A 150 hour internal battery shall be supplied to maintain the circuit board settings when the load side of the transfer switch is de-energized. Include a switch to select if the load will transfer to the engine-generator set during the exercise period.

3.4.10 The transfer switch shall have a time delay neutral feature to provide a time delay (5 seconds) during the transfer in either direction during which time the load is isolated from both power sources. This allows residual voltage components of motors or other conductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass this feature when immediate transfer is required.

3.4.11 Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.

3.4.12 Provide colored indicator lamps to be energized when the transfer switch position is in either UTILITY (white) or EMERGENCY (red). A third lamp shall be provided to indicate STANDBY OPERATING (amber). These lights shall be energized from utility or the engine-generator set.

3.4.13 Provide manual operating handle to allow for manual transfer. This handle shall be mounted inside the lockable enclosure so accessible only by authorized personnel.

3.4.14 Provide a safety disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.

3.4.15 Provide LED status lights to give a visual readout of the operating sequence. This shall include: utility on, engine warm up, engine warm up bypass, standby voltage "ready", standby frequency "ready", standby on, transfer to standby, return to utility, engine cool-down, engine minimum run and fast test mode.

3.4.16 Provide for alternation of paired generator sets when indicated in the attached generator schedule and as required elsewhere in this specification.

3.5 MISCELLANEOUS ATS EQUIPMENT

3.5.1 The transfer switch mechanism and controls shall be mounted in a NEMA 4X enclosure for outdoor, weatherproof, dustproof and corrosion resistant installation.

4.0 MISCELLANEOUS

4.1 FACTORY TESTING

4.1.1 Before shipment of the equipment, the engine-generator set shall be tested under rated load and power factor for performance and proper fronting of control and interfacing circuits. Tests shall include:

4.1.1.1 Verifying all safety shutdowns and components are functioning properly.

4.1.1.2 Single step load pick-up per NFPA 110-1985, Paragraph 5-13.2.6.

4.1.1.3 Transient and voltage dip responses and steady state voltage and speed (frequency) checks.

4.1.1.4 The factory test data sheet shall identify all tests (PASSED or FAILED) and accompany each generator set. This will be reviewed by the Department of State Representative (DOSREP) before written acceptance is provided.

4.2 Not Applicable

4.3 OWNERS MANUALS

4.3.1 Two (2) hard copy sets of owner's manuals specific to the genset and products supplied shall be located inside each unit and accompany the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model shall be included. A PDF version of the owner’s manuals shall also be provided on a compact disc and shipped with each generator.

4.4 SUBMITTALS

4.4.1 Provide two complete sets (for each rating of machine) of Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine, generator and automatic transfer switch. Submittals shall include complete system interconnection wiring diagrams and manufacturer's warranty form indicating compliance with these specifications.

## 4.5 SPARES

General parts: Provide one set of maintenance (spare) parts for each genset ordered under this contract. An order of maintenance parts is defined as all items necessary to perform scheduled maintenance functions for 2000 operating hours plus replacement bulbs for indicators, replacement fuses for each fuse used on the genset and any other like items that the manufacturer deems desirable. Package these maintenance parts in polyethylene bag, and pack inside the genset for which they are intended. Should there be insufficient room inside genset, enclose parts bag in protective package and attach to shipping skid. This group of parts shall include a complete list of all vendors recommended spares, including, but not limited to, the items listed below:

1. Engine lubricating oil filters and filter gaskets, if separate from filter.
2. Fuel filters and filter gaskets, if separate from filter.
3. Engine intake air filters and filter gaskets, if separate from filter.
4. A minimum of five light bulbs of each size light bulb used in the genset.
5. A minimum of five electrical fuses of each size fuse used in the genset.
6. One engine lubrication oil system drain plug.

For the 2000-hour requirement for replacement parts, one replacement cycle for all filters and associated gaskets shall be 250 hours. The offer shall include a complete list of all vendors recommended spares. The offer shall explicitly identify each Table I line item by packaged dimensions, weight and price.

## 4.6 WARRANTY

The offeror shall provide a one-year warranty on parts, which starts from the date the equipment is commissioned on-site. This requirement shall not modify or change the standard contract warranty agreement.

## 4.7 DELIVERY

The generator sets, transfer switches, spare parts and trailers are being imported duty free under the diplomatic duty free status of the American Embassy, the goods will be considered delivered once received and inspected by the Receiving Officer at the United States Embassy, Abuja, Nigeria.

GENERATOR SCHEDULE
Abuja, Nigeria

| **Property#** | **Minimum Prime Rating, KVA** |
|---|---|
| 1. CMR—00223 | 260 |
| 2. DCR-- 00214 | 80 |
| 3. Newport – 00115 | 140 |
| 4. MSGQ—00224 | 145 |
| 5. Dartmouth—00226 | 250 |
| 6. Utah—00213 | 170 |
| 7. Hyattsville—00274 | 200 |
| 8. Seattle—00116 | 165 |