

## **Alabama Public Television Natural Gas Engine Generator**

Alabama Public Television (APT) is seeking to install a natural gas engine generator to provide emergency back-up AC power for our Network Operation Center (NOC) and Digital Satellite Up-Link facility located in Birmingham, Alabama. This bid includes all material and labor for complete installation and start-up. The generator shall output a true sine wave and not a modified sine wave. Any AC power interruptions to NOC shall be done on Sunday nights between midnight and six (6) AM.

### **SCOPE OF WORK (NOC)**

The installation at the NOC site shall include one 60KW/75KVA **natural gas engine generator**, Taylor Model TG60 or equivalent. The existing 200 amp automatic transfer switch will be utilized. The generator shall be 208 volt three (3) phase. The generator shall be located on top of a five story building with the transfer switch being located on the 4<sup>th</sup> floor of the building. There is an existing 45KW natural gas generator in place on 5<sup>th</sup> floor that has to be removed prior to installing the 60KW. Natural gas meters already exist but the gas line shall be verified by bidder that it is adequate to supply proper fuel flow to the new 60 KW generator during full load conditions. The contractor shall be responsible for placing the 60 KW generator on top of the building and removal of the existing 45KW, which will be set on a trailer provided by APT.

The AC power from the generator will feed from the top of the building to the fourth floor where the automatic transfer switch is presently located. From the transfer switch the AC feed will connect to the existing 200 amp main circuit breaker box. Contractor is responsible for material and labor to complete the job per National, State and Local codes. See attached specifications for the Packaged Engine Generator. A mandatory site visit is required to bid this project.

### **I. GENERAL**

#### **A. Intent**

It is the intent of these specifications to procure for the owner a generator set, new and to the best industry standard of construction and design. The generator shall be of certified output by the manufacturer. The system shall be built and tested to UL2200 standards and supplied with a sticker either from UL, ETL or any approved OSHA testing lab.

#### **B. Rating: Standby**

The generator shall deliver its rating continuously for the duration for any normal power failure. This rating is applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. The generator set shall be capable of being operated at rated power until the normal power is restored. The rating will be applied where reliable normal power is available. The standby generator set shall be started and accelerated to rated speed immediately upon loss of normal power when equipped with cold starting aids such as a jacket water heater. The generator set shall accept load in one step up to the engine capability to recover to rated speed. Where load conditions are sensitive to voltage and frequency variations, the generator set must be sized accordingly.

### **C. Environment**

**Altitude: 644 feet / 196.29 meters**

**Minimum Temperature: 30 °F / -1.10 °C**

**Maximum Temperature: 100 °F / 37.80 °C**

The engine generator set shall be capable of producing rated kW and kVA when operating at the above stated altitude and temperature range. The generator manufacturer shall provide data to verify the generator set will operate as required in the specified ambient conditions.

### **D. Submittal Information**

1. Current applicable literature completely describing the engine generator set.
2. Current applicable literature describing all accessories.
3. Complete dimensional and electrical drawings locating accessories, anchor bolt and mounting dimensions, fuel, exhaust and cooling piping connections. All information will be coordinated with the installing contractor.
4. Furnish the following information with the bid: Current model specification sheet.

## **II. ENGINE AND COMPONENTS**

### **A. Starting System**

The engine will be equipped with an electric, DC starting motor, positive engagement, of sufficient capacity to crank the engine at starting speed for one minute without overheating.

### **B. Engine Performance**

The 350 cubic-inch-displacement, 4-Cycle, Turbocharged natural gas powered engine shall deliver a minimum of 162 hp at a governed speed of 1800 rpm. The engine shall be equipped with the following:

An electronic isochronous governor capable of .5% steady-state frequency regulation.  
12 Volt positive engagement solenoid shift-starting motor.

70-Ampere minimum automatic battery charging alternator with solid-state voltage regulation.

Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.

Dry-type replaceable air cleaner elements for normal applications.

(2) Electric solenoid fuel shut off valves rigidly mounted to the skid frame and a flexible fuel line to the engine.

The engine shall have a minimum of 8 cylinders, and be liquid-cooled by a unit-mounted radiator, blower fan, water pump, and thermostats. This system shall properly cool the engine with up to 0.5 inches H<sub>2</sub>O static pressure on the fan in an ambient temperature up to 104F/40C.

The engine shall be EPA certified

### **C. Cooling System: Unit Mounted**

A unit mounted radiator will be furnished complete with a blower fan and a 50/50 water/glycol coolant. The maximum radiator airflow restriction of 0.5 inches WC must be taken in account when sizing the cooling system. The cooling system will be sized to maintain a safe engine temperature at the appropriate ambient conditions. Proper ducting must be used to prevent overheating.

#### **D. Exhaust System: Critical**

The silencer shall attenuate exhaust noise to a Critical level. An Exhaust silencer shall be furnished of industrial standard construction, all welded, for stationary engine application. A seamless, stainless, convoluted flexible exhaust connector shall be provided. The entire exhaust system and silencer shall be supported independently of the generator set to prevent transmission of vibration and allow for thermal expansion. Long radius, low restriction fittings will be used throughout, and pipe size will be sufficiently large to handle the engine exhaust flow at full load without causing back pressure in excess of that allowed by the engine manufacturer. The silencer must be mounted internally to the unit enclosure.

#### **E. Engine Lubrication System**

The engine shall be furnished with a gear type lube pump that will furnish oil under pressure to moving parts. Full flow lube oil filters shall be provided in addition to a bypass valve that will allow lube oil circulation in the event of a failure of the filtering system.

#### **F. Governing System: Isochronous Governing System**

The engine generator set shall be provided with a precision electronic governor of the constant speed type. The governor shall be capable of maintaining a steady state bandwidth of not more than  $\pm 0.25\%$ , at any constant load, from no load to full load. The governor shall maintain governed speed at 60 Hertz at any load, from no load to full load.

#### **G. Battery: Lead Acid**

A lead-acid, heavy duty battery(s) shall be furnished of sufficient capacity to provide a minimum of five full cycle starts for ten seconds crank with ten second rest periods between cranks. The lead acid battery system will be 12 volt or 24 volt as required by the engine specification.

#### **H. Battery Charger**

##### **Battery Charger Design Guidelines:**

Charger shall be designed for heavy-duty industrial service and capable of full-rated output indefinitely at temperatures between 0° C and +50° C. Charger shall be capable of recharging a fully discharged battery of the maintenance-free lead acid, conventional (wet) lead acid or nickel-cadmium type. Charger shall maintain the battery automatically and minimize the need for battery electrolyte replenishment. Conservatively rated SCRs and diodes in full-wave bridge shall be used. Charger shall be unit mounted and natural convection cooled. The housing shall be constructed of rustproof metal (e.g. stainless steel).

##### **Battery Charger Standards:**

Where required, the charger shall be listed by UL, ETL or another recognized testing authority to the most recent revision of UL specification 1236. The manufacturer shall maintain a comprehensive quality control system and shall be ISO 9001 or ISO 9002 registered.

##### **Battery Charger Input:**

Charger shall operate at 60 Hz (57 to 63 range) and nominal input voltage shall be 120V, 208V, 240V, or 480V. The charger shall be internally regulated and protected. Input protection shall consist of fuses or circuit breakers. Proven surge suppression devices shall be fitted as required by contract drawings.

##### **Battery Charger Output:**

General Characteristics: Output voltage shall be (12 or 24) volts nominal as required by the unit. Float voltage shall be approximately 2.16 VPC for lead acid batteries. Equalize voltage shall be approximately 2.33 VPC for lead acid batteries. Charger shall be current limited to approximately 135% with a rectangular current limit characteristic.

Regulation and Temperature Compensation: Voltage regulation shall be within +1 of the correct temperature-compensated value from no load to full load with simultaneous variations of +10% input voltage and +5% input frequency. The DC output shall be constant voltage and current limited. The charger's current limit shall be fixed between 100% and 110%. Input transient protection shall be provided. The charger shall be protected against damage by reverse connection of the battery.

The charger shall be equipped with an automatic high rate (equalize) charge facility operating in response to the battery's state of charge. Charger shall operate at the high rate until the battery is fully charged, then revert to float voltage to prevent overcharging. High rate operation shall be governed by the requirement of the battery. Mechanical or electronic timers shall not be used. Float/equalize control: charger shall include an automatic equalize feature that is activated when the battery's state of charge is reduced. Indicators and Optional Alarms: Meters for output amperes and voltage shall be provided where required.

### **I. Engine Block Heater**

A jacket water heater shall be provided which will be thermostatically controlled to maintain the engine block at a suitable temperature to assure rapid starting under the specified ambient temperature. The heater will be of the industrial tank type with thermo-siphon circulation.

## **III. GENERATOR AND COMPONENTS**

### **A. Generator Performance Rating**

60kW  
75.00 kVA  
130°C Temperature Rise  
208 Volts  
3 Phase  
0.8 Power Factor  
60 Hertz  
1800 RPM

### **B. Mainline Circuit Breaker: Thermal Magnetic 100% rated**

A molded case circuit breaker shall be provided for the protection of the generator.

All circuit breakers shall be listed by UL, ETL or equivalent approved testing laboratory to conform to applicable requirements of NEMA Standard Publication No. AB1 and meet appropriate classifications of Federal Specifications W C 37511/Gen.

All circuit breakers shall have a quick-make, quick-break over center toggle-type mechanism and the handle mechanism shall be trip-free to prevent holding contacts closed against a short circuit or sustained overload. All circuit breaker handles shall assume a position between on and off when tripped automatically. Multi-pole circuit breakers shall be common-trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously. Arc extinction is to be accomplished by magnetic arc chutes. All ratings are to be clearly visible.

Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Circuit breakers shall be calibrated to carry 100% rated current in an ambient of 40°C. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40°C the circuit breaker automatically derates itself so as to better protect its associated conductor. The instantaneous magnetic trip shall be adjustable and accessible from the front. The interrupting rating of the circuit breakers shall be at least equal to the available short circuit current at the line terminals of the circuit breaker and correspond to the UL listed integrated short circuit current rating specified.

The circuit breaker shall be sized to comply with UL2200.

### **C. Voltage Regulator: DVR (Digital Voltage Regulator)**

The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage waveform. The insulation shall meet the NEMA standard - MG1-22.40 and 16.40 - for Class H and be insulated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class H ratings and based upon temperature rises measured by the resistance method as defined by MIL-STD-705C and IEEE Std 115, Method 6.4.4.

The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/- 2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.

The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2.

The generator, having a single maintenance-free bearing, shall be directly connected to the flywheel housing with a semi-flexible coupling between the rotor and the flywheel.

The generator shall be inherently capable of sustaining at least 250% of rated current for at least 10 seconds under a 3-phase symmetrical short circuit without the addition of separate current support devices.

#### **PMG Excitation System**

The generator shall be equipped with a 300/250 Hz permanent magnet generator excitation system. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds; or 250% for 50 hertz operation for 10 seconds. The rotating exciter shall use a three phase full wave rectifier assembly with hermetically sealed silicon diodes protected against abnormal transient conditions by a multi-plate selenium surge protector. The diodes shall be designed for safety factors of 5 times voltage and 3 times current.

#### **VOLTAGE REGULATOR**

The voltage regulator shall be a digital, microprocessor design with solid state voltage build-up.

No voltage build-up relay or other relays are acceptable. The unit shall be encapsulated for humidity and abrasion protection. The regulator shall include 1/4% regulation, true volts per hertz operation with adjustable cut in, loss of sensing continuity shutdown, over excitation shutdown, three phase RMS sensing, over voltage protection, and provisions for parallel operation.

#### **PERFORMANCE**

The voltage regulation shall be 1/4% from no load to full load and 5% frequency variation. Regulator drift shall be less than 1/2% per 72°F /40°C ambient temperature change. The voltage regulator shall be a static-type using non-aging silicon controlled rectifiers, with electromagnetic interference suppression to MIL-STD-461 C, part 9, when mounted in the generator conduit box. The waveform harmonic distortion shall not exceed 5% total RMS measured line to line at full-rated load. The TIF factor shall not exceed 50. Construction will allow connection to the load through the top, bottom or either side of the conduit box. The conduit box shall be constructed of heavy gauge sheet steel, capable of supporting up to 240 pounds of accessory control equipment. The conduit box shall contain two compartments; one housing the rotating rectifier and PMG; and the other the connection area and regulator. This is to separate the rotating elements from the load connection and voltage regulator adjustments. The regulator shall be mounted on the inside of the conduit box panel allowing access to adjust the regulator through a swinging dust cover.

from the outside of the conduit box, therefore avoiding the higher voltage generator terminals on the inside of the conduit box.

#### VERIFICATION OF PERFORMANCE

All certified performance and temperature rise test data submitted by the generator manufacturer are to be the result of the actual test of the same or duplicate generators. Temperature rise data shall be the result of loaded, rated power factor heat runs at the rated voltage and hertz. All performance testing shall be done in accordance with MIL-STD-705 and/or IEEE Standard-115.

### **D. Control Panel: Digital Controller**

The Digital Genset Controller shall be a highly advanced integrated genset control system. The Controller shall be perfectly focused, combining rugged construction and microprocessor technology to offer a product that will hold up to almost any environment and flexible enough to meet your application's needs. This device provides genset control, transfer switch control, metering, paralleling, protection and programmable logic in a simple, easy to use, reliable, rugged package. All software for programming, remote monitoring and data recovery shall be NON-PROPRIATARY and furnish with the system or be downloadable free of charge.

#### **Standard Features**

- Generator Metering
- Engine Monitoring
- Genset Control
- Emergency Stop
- Engine Protection
- Windows-Based Software, NON-Proprietary
- Automatic Transfer Switch Control
- Event Recording
- Suitable for use on rental gensets with Hi/Lo line sensing or single or three phase sensing override
- SAE J1939 Engine ECU Communications (Expandable I/O Capability)
- Modbus Communications via RS-485
- Multilingual Capability (English, Spanish, Chinese)
- Extremely Rugged, Fully Encapsulated Design
- 16 Programmable Contact Inputs
- 10 Programmable 2 Adc Form A Rated Contacts
- Wide Ambient Temperature Range
- NFPA110 Compatible
- HALT (Highly Accelerated Life Tests) Tested
- IP 54 Front Panel Rating with Integrated Gasket
- LCD Heater
- UL-508 Compatible
- UL Recognized, CSA Certified, CE Approved
- Current Sensing (5A CT Inputs)
- Generator Frequency - 50/60 Hz
- Battery Backup for Real Time Clock
- Generator Protection (27, 32, 40Q, 59, 81O, 81U)

#### **Genset Protection**

- Undervoltage (27)
- Reverse Power (32)
- Loss of Excitation (40Q)

- Overvoltage (59)
- Overfrequency (81O)
- Underfrequency (81U)

All Generator Protection features are programmable as alarms, pre-alarms, status or not used.

## **Engine:**

### **Alarms (Shutdown)**

- Low Oil Pressure
- High Coolant Temperature
- Low Coolant Level
- Low Fuel Level
- Overspeed
- Overcrank
- Engine Sender Unit Failure
- Fuel Leak/Fuel Sender Failure
- Emergency Stop
- Battery Charger Failure

### **Pre-Alarms (Warnings)**

- Low Oil Pressure
- High Coolant Temperature
- Low Coolant Temperature
- Battery Overvoltage
- Weak Battery
- Battery Charger Failure
- Engine Sender Unit Failure
- Engine kW Overload (3 levels)
- Maintenance Interval Timer
- Low Coolant Level
- Low Fuel Level
- Fuel Leak Detect
- High Fuel Level
- Critical Low Fuel Shutdown

All alarms and pre-alarms can be enabled or disabled via the PC software or the front panel.

### **Genset Metering:**

- Generator parameters consist of 8 standard parameters including, but not limited to voltage, current, Hz, real power (watts), apparent power (VA), and power factor. The view can be programmed to display up to 20 parameters using the scrolling and time delay feature.
- Engine parameters include oil pressure, coolant temperature, RPM, battery voltage, fuel level, engine runtime, and various J1939 supported parameters.

### **Engine Control:**

- Cranking Control: Cycle or Continuous (Quantity and Duration Fully Programmable)
- Engine Cooldown: Smart Cooldown function saves fuel and engine life.

- Successful Start Counter: Counts and records successful engine starts
- Timers including, but not limited to:
  - Engine Cooldown Timer
  - Engine Maintenance Timer
  - Pre-Alarm Time Delays for Weak/Low Battery Voltage
  - Alarm Time Delay for Overspeed
  - Pre-Crank Delay
  - Continuous or Cycle Cranking Time Delay
  - Arming Time Delays after Crank Disconnect:
    - Low Oil Pressure
    - High Coolant Temperature

**Event Recording:**

The controller shall have an event recorder that provides a record of alarms, pre-alarms, engine starts, engine runtime loaded, engine runtime unloaded, last run date, and many other events that are all date and time stamped to help the user determine the cause and effect of issues related to the generator set. Contains 30 event records each retaining up to 99 occurrences in memory. Time, date and engine hour detail is available for the most current 30 occurrences within each event record.

**Specifications:**

**Metering:**

- Generator Voltage (rms)
- Generator Current (rms)
- Generator Frequency
- Apparent Power
- Power Factor
- Real Power
- Oil Pressure
- Coolant Temperature
- Fuel Level
- Battery Voltage
- Engine RPM
- Engine Run Time
- Maintenance Timer

**Operating Power:**

- Nominal: 12 or 24 Vdc
- Range: 6 to 32 Vdc
- Power Consumption: - Sleep Mode: 5W with all relays non-energized
- Power Consumption: - Typical Operational Mode: 14.2W - Run mode, LCD heater on, 6 relays energize
- Battery Ride Through: Withstands cranking ride-through down to 0 V for 50 ms (typical)

**Current Sensing: \_\_\_\_\_ 5 Amps AC Current Sensing**

Continuous Rating .....0.1 to 5.0 Amps AC  
 1 Second Rating.....10 Amps AC  
 Burden .....1 VA

**Voltage Sensing:**

- Range: 12 to 576 V rms, line-to-line
- Frequency Range: 10 to 72 Hz for 50/60 style
- Burden: 1 VA
- 1 Second Rating: 720 V rms

**Contact Sensing/Input Contacts:**

- Contact sensing inputs include 1 emergency stop input and 16 programmable inputs. The factory utilizes up to (3) of these inputs. The emergency stop input accepts normally closed, dry contacts. The remote emergency stop is limited to 75 ft. standard. Extended runs are available with optional relay. All programmable inputs accept normally open, dry contacts.

**Engine System Inputs:**

- Fuel Level Sensing Resistance Range: 33 to 240  $\Omega$  nominal
- Coolant Temperature Sensing Resistance Range: 62.6 to 637.5  $\Omega$  nominal
- Oil Pressure Sensing Resistance Range: 34 to 240  $\Omega$  nominal
- Engine Speed Sensing: Magnetic Pickup Voltage Range: 3 to 35 V peak (6 to 70 V peak-peak)  
Frequency Range: 32 to 10,000 Hz Generator Voltage Range: 12 to 576 V rms

**Output Contacts:**

- 15 Form A Total Programmable Outputs: (3) 30 Adc and (12) 2 Adc
  - The factory typically utilizes (5) on each gen-set which can be reprogrammed as needed:
    - (3) 30 Adc for Run, Start and Pre-Start
    - (2) 2 Adc for Audible Alarm and Alarm Output
  - (10) 2 Adc remain as user-defined outputs

**Generator Protection Functions:**

**Overvoltage (59) and Undervoltage (27)**

Pickup Range: 70 to 576 Vac  
Activation Delay Range: 0 to 30 s

**Underfrequency (81U) and Overfrequency (81O)**

Pickup Range: 45 to 66 Hz (50/60 Hz nominal), 360 to 440 Hz (400 Hz nominal)  
Pickup Increment: 0.1 Hz (50/60 Hz nominal), 0.1 Hz (400 Hz nominal)  
Activation Delay Range: 0 to 30 s

**Reverse Power (32)**

Pickup Range: -50 to 5%  
Pickup Increment: 0.1%  
Hysteresis Range: 1 to 10%  
Hysteresis Increment: 0.1%  
Activation Delay Range: 0 to 30 s  
Activation Delay Increment: 0.1 s

**Loss of Excitation (40Q)**

Pickup Range: -150 to 0%  
Pickup Increment: 0.1%  
Hysteresis Range: 1 to 10%  
Hysteresis Increment: 0.1%  
Activation Delay Range: 0 to 30 s

Activation Delay Increment: 0.1 s

**Environmental:**

Temperature: Operating: -40 to 70°C (-40 to 158°F), Storage: -40 to 85°C (-40 to 185°F)

Humidity: IEC 68-2-38

Salt Fog: ASTM B 17-73, IEC 68-2-11 (tested while operational)

Ingress Protection: IEC IP54 for front panel

Vibration:

5 to 29 to 5 Hz: 1.5 G peak for 5 min.

29 to 52 to 29 Hz: 0.036" DECS-A for 2.5 min.

52 to 500 to 52 Hz: 5 G peak for 7.5 min.

Swept over the above ranges for 12 sweeps in each of 3 mutually perpendicular planes with each 15-minute sweep.

**Agency Approvals:**

- UL/CSA Approvals: "cURus" approved to UL 508 R and CSA C22.2 No.14
- NFPA Compliance: Complies with NFPA Standard 110, Standard for Emergency and Standby Power.

**CE Compliance:**

This product complies with the requirements of the following EC Directives:

- Low Voltage Directive (LVD) - 73/23/EEC as amended by 93/68/EEC
- Electromagnetic Compatibility (EMC) - 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
- EN 50178:1997 - Electronic Equipment for use in Power Installations
- EN 61000-6-4:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Emission  
Standard for Industrial Environments
- EN 61000-6-2:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments

**Battery Backup for Real Time Clock**

A ten-year (typical life) lithium battery is used to provide long-term maintenance of the real time clock setting. This battery is serviceable by removing the rear cover. The settings, programming, and event records are saved in nonvolatile memory and do not require battery backup.

## **E. Manual Keyed By-Pass Control Panel**

Provide manual keyed by-pass control panel to crank and run the system in the event the Genset controller has a problem. The control panel shall be located on the side of the engine.

## **F. Base Design**

The base shall be constructed of steel. The base shall be designed to rigidly support the engine-generator set, ensure permanent alignment of rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment is maintained during shipping and normal operation. The base shall permit skidding in any direction during installation and shall withstand and mitigate the effects of synchronous vibration of the engine and generator. The base shall be provided with suitable holes for anchor bolts.

## **G. Enclosure: Sound Attenuated Weather Enclosure**

The enclosure will be supplied and built with lockable and keyed alike hinged doors and flush mounted latches. The air intake consists of multiple baffles which help in reducing sound levels. There is a sound insulated air exhaust chamber for absorbing and redirecting noise and air flow upward. Sound attenuated foam will be installed on the baffles, enclosure walls, and air exhaust chamber. Included is a critical grade silencer mounted in the air exhaust chamber.

## IV. OPERATION AND MAINTENANCE

### A. Factory Testing

The generator set shall be tested and performance assurance certification shall be completed at the factory on the unit. The test metering shall have an accuracy of 1% or better, and the metering used in testing shall be regularly calibrated and traceable to the National Bureau of Standards. All tests shall be performed in accordance with the following test methods: IEEE 115 or MIL-STD-705.

Factory tests shall include but not be limited to the following:

- Full load at rated power factor will be applied;
- Full load at unity, 1.0 PF;
- Recordings of the maximum load carrying capabilities of the engine generator set;
- Maximum single block load pickup capability;
- Kilowatts;
- Amperes;
- Voltage;
- Kilovolt amperes;
- Resistance of exciter field and stator;
- Insulation test, generator field, exciter armature, exciter field, generator armature;
- Dielectric test, generator armature, generator field, exciter armature, exciter field;
- Lube oil pressure, if applicable;
- Time;
- Water temperature, if applicable;
- Battery charge rate, if applicable;
- Heaters, jacket water and/or lube oil;
- Safety shutdowns and automatic controls;
- Accessories - annunciator panel, charger, pumps as supplied;
- Phase sequence on three phase;
- Full load and .4PF to verify the motor starting capability of the engine generator set - optional; Frequency; Full rated load at rated PF and maximum load, to verify engine power, overload and maximum capability; kVA, kilowatts, amperes, voltage, frequency and voltage transients at ½ and rated load frequency at: no load, full load rated and maximum output; Regulator range - adjust, phase sequence, phase voltage balance;
- Stator and exciter field resistance; Insulation test, generator field, exciter armature, exciter field, generator armature or stator; Dielectric test, generator field, exciter armature, exciter field, generator armature or stator; All safety shutdown and automatic controls.

Standard testing includes portions of MIL-STD-705:

- 301.1b: Insulation Resistance Test;
- 302.1a: High Potential Test;
- 401.1a: Winding Resistance Test;

410.1a: Open Circuit Saturation Curve Test;  
503.1b: Start and Stop Test;  
505.2a: Overspeed Protective Device Test;  
507.1c: Phase Sequence Test - Rotation;  
508.1c: Phase Balance Test - Voltage;  
510.1c: Rheostat Range Test;  
511.1c: Regulator Range Test;  
511.2b: Frequency Adjustment Range Test;  
515.1a: Low Oil Pressure Protective Device Test;  
515.2a: Overtemperature Protective Device Test;  
516.1: Controls, Direction of Rotation;  
508.1c: Phase Balance Test - Voltage;  
640.1c: Maximum Power Test.

### **B. Startup and Warranty Validation**

The start-up of engine generator set and Automatic Transfer Switch (if applicable) will be performed by an authorized service station of the manufacturer. The test will include instruction to personnel of normal maintenance and operation under existing load available.

### **C. Manufacturer's Product Period of Warranty: 2 Yr - 1500 Hr Basic Limited**

The standby electric generating system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. The warranty period shall commence when the standby system is invoiced by the factory. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.