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MILITARY SPECIFICATION

GENERATOR SET, GAS TURBINE ENGINE, 60 KW 400 HERTZ, GENERAL PURPOSE

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for a general purpose, tactical generator set (herein after called "set"), 60 kilowatts (kw), 400 Hertz (Hz), alternating current (ac), wheel-mounted, towable/self propelled, gas turbine engine-driven (g t e d), Model MEP-365A (Air Force Model A/M32A-60A).

1.2 Rated output. The generator set shall have rated outputs of the type and description as specified herein.

TYPE	DESCRIPTION
Pneumatic power (bleed air)	147 pounds per minute (lb/min) at 48 pounds per square inch (p s i)
Alternating current	3 phase, 4-wire, 120 volt line-to-neutral and 208 volt line-to-line (120/208V), 60 kw, 0.8 power factor (pf) (lagging)
Direct current	200 amperes at 28 volts

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-T-60 -Tape, Packaging, Waterproof.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: AFLC CASO/LODS, Federal Center, Battle Creek, MI 49016 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter

FSC 6115

MILITARY

MIL-L-2105	-Lubricating Oil, Gear, Multi-purpose.
MIL-G-5572	-Gasoline, Aviation, Grades 80/87, 100/130, 115/145.
MIL-T-5624	-Turbine Fuel Aviation, Grades JP-4 and JP-5.
MIL-L-7808	-Lubrication Oil, Aircraft Turbine Engine, Synthetic Base.
MIL-M-8090	-Mobility, Towed, Aerospace Ground Equipment, General Requirements For.
MIL-A-8421	-Air Transportability Requirements, General Specification For.
MIL-P-8686	-Power Units, Aircraft Auxiliary, Gas Turbine-type, General Specification For.
MIL-L-23699	-Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.
MIL-G-28554	-Generator Sets, Mobile Electric Power, Packing of.
MIL-V-38398	-Valve, Starter Control Pneumatic, Aircraft Engine, General Specification For.

STANDARDS

MILITARY

MIL-STD-105	-Sampling Procedures and Table for Inspection by Attributes.
MIL-STD-130	-Identification Marking of US Military Property.
MIL-STD-143	-Standards and Specifications, Order of Precedence for the Selection of.
MIL-STD-454	-Standard General Requirements for Electronic Equipment.
MIL-STD-461	-Electromagnetic Interference Characteristics Requirements for Equipment.
MIL-STD-471	-Maintainability Demonstration.
MIL-STD-705	-Generator Sets, Engine-Driven, Methods of Tests and Instructions.
MIL-STD-781	-Reliability Tests Expontial Distribution.
MIL-STD-831	-Test Reports, Preparation of.
MIL-STD-1473	-Standard General Requirements for Color and Marking of Army Material.
MIL-STD-1474	-Noise Limits for Army Material.
MS-24498	-Battery, Aircraft Storage, Nickel-Cadmium 24 Volts, 34 Ampere Hour, 27°C (80°F).
MS-90328	-Cable Assembly, External Electric Power.

DRAWINGS (Air Force)

69E39110	-General Arrangement, Generator Set A/M32A-60A.
69E39122	-Engine, Gas Turbine.
69B39145	-Installation Kit, Engine Gas Turbine.

(Copies of specifications, standards, and drawings required by the contractor in connection with specific procurement funcitons should be obtained from the procuring activity or as directed by the contracting officer).

2.2 Other Publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issues in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

NEMA-MG-1-97 -Motor and Generator

(Application for copies should be addressed to the National Electrical Manufacturers Association, Industrial Laminate Section, 155 East 44th Street, New York, NY 10017).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Power Test Code 19.5:4 -Supplement on Instruments and Apparatus: Part 5, Chapter 4, Flow Measurement by Means of Standardized Nozzles and Orifice Plates

(Copies of the ASME power test code may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017).

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI S1.4a-1985 -Sound Level Meters.
ANSI S1.11-1986 (R-1993) -Specification for Octave and Third-Octave Band Filter sets
ANSI S1.13-1971 -Methods for Measurement of Sound Pressure Levels

(Application for copies should be addressed to the American National Standards Institute, 11 East 42th Street, New York, NY 10016).

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT

National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic, Traffic Order Section, 1616 P Street, N.W., Washington, DC 20036).

UNIFORM CLASSIFICATION COMMITTE, AGENT

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committe, Room 1130, 22 [illegible] Riverside Plaza, Chicago, IL 60606).

3. REQUIREMENTS

3.1 First article. The contractor shall furnish two complete assembled sets for examination and testing within the time frame specified (see 6.2) to prove that his production methods will produce sets that comply with the requirements of this specification. Examination and tests shall be as specified in Section 4; and unless otherwise specified herein, all examination and tests shall be conducted by the contractor subject to surveillance and approval by the Government (see 6.4). When specified (see 4.7.1, 4.8.1, and 6.2), the Government may conduct any of the First Article tests.

3.2 Materials shall be as specified in Air Force drawings unless otherwise specified herein. Materials not definitely specified shall be selected in accordance with MIL-STD-143. Parts and materials selected shall be of a quality and reliability suitable for the intended purpose and capable of meeting the test and service life requirements specified herein.

3.2.1 Reclaimed materials shall be required to the maximum extent possible without jeopardizing the intended use of the item.

3.3 Design and construction. The set shall be in accordance with Air Force Drawings 69E39110, 69E39122, 69B39145 and as specified herein.

3.3.1 Drawings. The drawings forming a part of this specification are end product drawings. No deviation from the prescribed drawing requirements are permissible without prior approval of the contracting officer. Where tolerances could cumulatively result in incorrect fits, the contractor shall provide tolerances within those prescribed on the drawings to insure correct fit, assembly and operation of the set. Any data (e.g. shop drawings, layouts, flow sheets, processing procedures, etc.) prepared by the contractor or obtained from a vendor to support fabrication and manufacture of the production item shall be made available upon request, for inspection by the contracting officer or his designated representative.

3.3.2 Reliability. The set shall have a reliability of 425 hours (minimum acceptable) Mean-Time-Between-Failures (MTBF).

3.3.3 Endurance. The set shall pass an endurance test of 1000 hours of operation at the prevailing sea-level atmospheric conditions (see 4.8.9).

3.4 Operational enviorment for starting, operating, handling, and storage.

3.4.1 Starting. The set shall start (see 6.3.1) within 30 seconds as specified:

a. At ambient temperatures for +125°F (51.7°C) to -20°F (-28.9°C) at any possible relative humidity.

b. At ambient temperatures from -20°F (-28.9C) to -65°F (-53.9°C) after set battery has been short-circuited for not more than 10 minutes.

c. With 4 inches of rain per hour impinging on the set at angles from the vertical up to 45 degrees, from all compass-point directions.

d. With base of the set in planes from level to 15 degrees from level, in all 4 directions.

e. At any altitude up to an including 10,000 feet above sea level at an ambient temperature of 77°F (25°C).

3.4.2 Operation. Within 20 seconds after starting, the set shall accept full load without surging or creating an engine over-temperature condition.

3.4.2.1 Operating speed. The operating speed of the generator set shall withstand 5 minutes of continous operation at no-load and 105 percent of rated speed without mechanical or thermal damage.

3.4.2.2 Critical speed. The turbine-generator combination shall be free from injurious flexural vibrations and dangerous torsional critical speeds (see 6.3.4 and 6.3.7) between 5 percent below normal operating speed and overspeed shutdown.

3.4.2.3 Stopping. Within 60 seconds (from idle rpm) after activation of any device intended to stop the set, the rpm shall go to zero.

3.4.3 Handling. Fork-lift provisions shall be required to permit the set to be lifted and transported, at the center of balance axis, without deformation or damage to the set.

3.4.3.1 Rough handling. The set shall not be damaged (see 6.3.8) by rough handling which could be encountered during rail, truck, aircraft and helicopter transportation (see 6.3.9, 6.3.10 and 6.3.11).

3.4.4 Storage temperature and humidity. The set shall not be damaged (see 6.3.3) by storage in temperatures from +155 Deg F (68.3 DegC) to -65 Deg F (-53.9 Deg C) at any relative humidity possible within that range and shall not be damaged by exposure to five consecutive 48-hour cycles as specified in MIL-STD-705, Method 711.1.

3.5 Initial production. When specified (see 6.2) the contractor shall furnish to the Government one or more sets for inspection as specified in 4.5.

3.6 Performance.

3.6.1 Electrical performance (no pneumatic output).

3.6.1.1 Normal rating. The rated electrical output of the set shall be as follows:

a. 60 KW at 0.8 pf, 3 phase, 4 wire, 120/208V, 400 Hertz (measured at load end of power cable).

b. 200 amps at 28 VDC (measured at DC output receptacle).

c. 60 KW, any combination of alternating and direct current.

3.6.1.2 Overload rating. The overload rating of the electrical output of the set shall be as follows:

a. 75 KW at 0.8 pf, 3 phase, 4 wire, 120/208V, 400 Hz for 5 minutes.

b. 300 amps, at 28 VDC for 5 minutes (current limits at 300 amps for 20 seconds minimum).

c. 75 KW, any combination of alternating and direct current for 5 minutes.

3.6.2 Pneumatic performance. The continuous, automatically controlled, rated pneumatic output of the set at the bleed air outlet flange shall meet the minimum condition in Table I. Airflow measurements shall be made in accordance with the procedures specified in ASME Power Test Code 19.5; 5-1949, Part 5, Chapter 4, or by method acceptable to the procuring activity.

TABLE I

Min Pressure (PSIA)	Min Flow (Lb/MIN)	Ambient Temperature	Output Air Temp
45 ± 2	94 ± 4	130°F (54°C)	450°F (232°C)
49 ± 2	120 ± 4	60°F (15.6°C)	355°F (179.5°C)
51 ± 2	174 ± 4	-65°F (-54°C)	205°F (96°C)

NOTE: At altitudes up to 10,000 feet, the rated output pressure shall be that of a constant pressure ratio machine for a given ambient operating temperature.

3.6.3 Combined pneumatic and electrical output. The set shall be rated for continous duty at full speed and rated turbine temperature. The unit shall continuously supply the air output, as specified elsewhere in this specification without exceeding rated turbine temperature.

3.6.4 Fuel consumption. At the horsepower required to produce rated load at standard sea level conditions, the specific fuel consumption of the set shall not exceed 1.5 pounds per shaft horsepower per hour.

3.6.5 Audio noise. The audio noise eminating from the generator set, when it is operating at any load up to and including maximum rated speed and load, at a distance of not more than twenty-five (25) feet in any direction from the perimeter of the set shall not exceed the values as specified:

a. Eighty-five decibels as measured on the A-scale of a standard sound level meter at slow response (85 Dba), reference 0.0002 microbar, or

b. The sound pressure level in any octave band center frequency given below as measured with an octave band filter set at slow response:

Octave Band Center Frequency (Hz)							
63	125	250	500	1000	2000	4000	8000
Sound Pressure Level (dB, reference 0.0002 microbar)							
101	91	84	79	76	74	74	75

3.6.5.1 Measurement of the sound pressure levels emanating from the set shall be measured with the sound level meter microphone or the octave band filter set microphone located sixty-eight (68) inches above ground level at the following positions:

a. The position normally occupied by the generator set operator: and

b. On concentric circles of 5 feet, 15 feet and 25 feet from the perimeter of the set at the center of each side of the set and at each corner of the set (8 measurement locations for each distance): and

c. Other locations as deemed appropriate (see 4.8.2).

3.6.5.2 Sound level meter. The sound level meter used shall conform to ANSI S1.4-1971, Type 2. The octave band filter set used shall conform to ANSI S1.11-1966 (R-1971) Type E, Class II.

3.6.5.3 Measurement Procedure. The sound measurement procedures used shall conform to ANSI S1.13-1971, except that the microphone height shall be as specified in 3.6.5.1.

3.6.5.4 Pressure level. If the sound pressure level at any measurement location specified in 3.6.5.1 exceeds the limits of 3.6.5.1 a, b or c, a caution sign, in accordance with MIL-STD 1473, shall be placed on each of the four vertical sides of the set stating:

"CAUTION - NOISE HAZARD
HEARING PROTECTION REQUIRED WITHIN __ X __ FEET"

The distance (X) to be placed on this sign shall be the maximum distance from the generator set at which the sound pressure level does not exceed the limits of 3.6.5.1 a, b, or c.

3.7 Transportability. The set shall meet the air transportability requirements of MIL-A-8421 when the set is loaded into the aircraft with longitudinal axis of the set parallel to the longitudinal axis of the aircraft.

3.8 Mobility. The set shall meet the general and Type II, Group C, mobility requirements of MIL-M-8090 except that the cramping angle of the trailer shall be sufficient to obtain 17 1/2 feet or less turning radius. The trailer shall have four wheels with 6:00 by 9, 6-ply pneumatic tires.

3.8.1 Self-propulsion. A variable-speed drive unit shall drive the two rear wheels of the trailer. The drive unit shall propel the set either forward or in reverse direction at speeds ranging from 0 to 4 mph on paved level surfaces and shall also propel the set up hard-surfaced, 8-percent grades. The drive unit shall be fully controlled by the operation from the towbar. Adequate deadman protection shall be incorporated to prevent injury to the operator. The towbar shall be spring-loaded to the up position. The drive unit speed controller shall include the following special features:

a. Sudden reversal protection.

b. Entire circuit shall be electrically open until forward or reverse switch is activated.

c. Controller shall be moisture-resistant.

3.9 Lubricating oils and fuels. Lubrication and fuels shall be as specified herein.

3.9.1 Oils. The engine lubricating oil shall conform to MIL-L-7808 or MIL-L-23699 (CAUTION - Do not mix). The drive unit lubricating oil shall conform to MIL-L-2105, grade 80.

3.9.2 Fuels. The engine fuel shall conform to MIL-T-5624 and, under emergency conditions, MIL-G-5572.

3.10 Engine. Except as otherwise specified herein, the engine, encluding all systems, components, accessories and auxiliaries shall conform to applicable drawings and MIL-P-8686, Type IV.

3.10.1 Starting system. The set starting system shall be 24 volts dc negative ground. The turbine shall start under all conditions as specified in 3.4.1.

3.10.1.1 Battery. The set batteries shall be of the nickel-cadmium type and conform to MS24498.

3.10.1.1.1 Battery charger. The battery charging circuit shall maintain the set battery in a fully charged condition and be fully compatible with the nickel-cadmium type battery.

3.10.2 Engine safety devices. The engine shall have safety devices as specified herein.

3.10.2.1 Overspeed control. The overspeed safety device shall trip at 110 ± 2 percent of rated speed, to stop the engine.

3.10.2.2 Overtemperature control. The overtemperature control shall limit the turbine and nozzle box temperature during starting and operating.

3.10.2.3 Acceleration limiter. This device shall control the fuel rate to prevent compressor surge during starting, acceleration, transient and steady state loading.

3.10.2.4 Low oil pressure. The low-oil pressure device shall actuate to stop the engine when the lubricating oil pressure drops to approximately 5 psig.

3.10.3 Governing system. The governing system shall provide the speed (frequency) performance as specified herein.

3.10.3.1 Frequency regulation. The system shall provide isochronous operation. For every load change (including rated load) the frequency regulation shall not exceed 0.25 percent of rated frequency.

3.10.3.2 Short term stability (30 seconds). At every constant load from no-load to rated load, the system shall maintain frequency within a bandwidth equal to 0.5 percent of rated frequency.

3.10.3.3 Long term stability (4 hours). At constant ambient temperature, constant barometric pressure, constant voltage and constant load from no-load to rated load, the system shall maintain frequency within a bandwidth equal to 1 percent of rated frequency in a 4 hour operation period.

3.10.3.4 Transient performance. Following a sudden increase or decrease in load up to and including rated load, the governing system shall re-establish stable engine operating conditions within 1 second for load application and 1.5 seconds for load rejection.

3.11 Electrical system.

3.11.1 AC generator and exciter. The generator and excitation system (exciter, voltage regulator and other accessories necessary to control the output voltage) shall meet the requirements herein.

3.11.1.1 Overspeed. The generator shall withstand operation at 7500 rpm for 5 minutes without damage.

3.11.1.2 Temperature rise. The temperature rise shall not exceed 90°C (162° F) for Class B insulation, 100°C (180°F) for Class F insulation and 180°C (324°F) for Class H insulation (as defined in NEMA Standard MG-1), when measured by the resistance method. With rated load (208 amperes) on the generator, the temperature rise shall not exceed the following: (a) Main stator - 160°C (324°F), and (b) Exciter stator - 50°C (90°F).

3.11.1.3 Insulation resistance. Insulation resistance shall not be less than 1 megohm in a ambient temperature of 77°F (25°C).

3.11.1.4 Dielectric strength. Windings shall withstand the following 60 Hz voltage applied for 1 minute:

a. Generator armature - 1250 volts between phase windings and 1000 volts between phase windings and ground.

b. Generator field and exciter windings- 10 times ceiling voltage but not less than 500 volts (applied between windings and ground).

c. Windings energized by the 28 volt dc control, cranking and battery charging systems - 500 volts, (applied between windings and ground).

d. All others - twice rated voltage + 500 volts, (applied between windings and ground and between windings where applicable).

3.11.1.5 Short circuit. The generator and excitation system shall withstand a 5 second single phase line-to-line, single phase line-to-neutral and symmetrical 3 phase short circuits applied to its output terminals, when operating at rated load, without reduction of the dielectric strength to a point where it will not meet the requirements of 3.11.1.4. The sustained short circuit current shall be not less than 200 percent of rated output current.

3.11.1.6 Winding resistance. The resistance of each winding shall be as specified on the applicable drawing. All resistance values shall be corrected to a temperature of 77°F (25°C).

3.11.1.7 Voltage unbalance. Maximum difference between line-to-line and line-to-neutral voltages shall be not more than 5 percent under the condition of a single-phase, line-to-neutral, unity-pf load of 1/3 rated load (69 amperer) and no other load on the generator.

3.11.1.8 Phase balance voltage. The maximum difference in the three line-to-neutral voltages shall be not more than 1 percent of rated line-to-neutral voltage.

3.11.1.9 Voltage waveform. The maximum allowable single harmonic shall not exceed 2 percent of the fundamental. The content shall be measured line-to-line and line-to-neutral at no load, one half-load and full load; at 0.8 power factor and 1.0 power factor. There shall be no discontinuities in the waveform when viewed on the oscilloscope.

3.11.1.10 Voltage modulation. The voltage modulation for each of the line-to line and line-to-neutral voltages for any load from no-load to rated load shall not exceed 1 percent.

3.11.1.11 Phase sequence (rotation). Phase rotation shall be A, Band C (L1, L2 and L3).

3.11.1.12 Voltage regulation. The voltage regulation from no-load to rated load and from rated load to no-load shall be not more than 1 percent of rated voltage.

3.11.1.13 Short term stability (30 seconds). At every constant load from no-load to rated load, the voltage at the end of the power cable (Type MS 90328-28) shall remain within a bandwidth of 1.2 volts.

3.11.1.14 Long term stability (4 hours). At constant ambient temperature, constant barometric pressure, constant frequency and any constant load from no-load to rated load, the voltage shall remain within a bandwidth of 2.4 volts in a 4-hour operation period.

3.11.1.15 Transient performance. Performance of the set under transient conditions (as measured by magnetic oscillograph) shall be as follows:

a. With the set initially operating at no-load, rated voltage and rated frequency, the rms voltage (at the end of the power cable) shall not drop to less than 75 percent of no-load voltage, (rated voltage) when a balanced 3 phase, 0.8 pf (lagging) rated load is suddenly applied to the power cable. When connected to the specified load, the set shall recover to and remain within a bandwidth of 2 percent of rated voltage in not more than 0.5 seconds.

b. The requirements of (a) above shall also apply when the load is suddenly changed from rated load to no-load except that the initial voltage transient shall not exceed 125 percent of rated voltage.

3.11.2 DC transformer-rectifier. The direct current system shall be of the transformer-rectifier type and shall meet the requirements as specified herein.

3.11.2.1 Rated load. Continous output of 200 amperes at 28 VDC.

3.11.2.2 Overload. 300 ± 50 amperes at 28 VDC for 5 minutes.

3.11.2.3 Current limit. Current shall be self-limiting. Maximum current shall not exceed 300 ± 50 amperes at 28 VDC.

3.11.2.4 Regulation. Output voltage from no-load to full load and full load to no-load shall not exceed ± 1.5 VDC.

3.11.2.5 Output ripple. The output ripple shall not exceed 5% at 28 VDC.

3.11.3 Instruments, controls and other devices.

3.11.3.1 Protective devices. Protective devices shall act to open or close the main contactor as applicable.

3.11.3.2 Short circuit. This device shall trip the load contactor in not more than 1.5 seconds, in the event set output current is short circuited either single phase or 3 phase.

3.11.3.3 Overload. This device shall trip the load contactor in 1 to 5 seconds when the output current is 200 percent of rated current.

3.11.3.4 Overvoltages. This device shall trip the load contactor in not more than 1.5 seconds, when the set output voltage (line-to-neutral) increases to 134 ± 4 volts.

3.11.3.5 Undervoltages. This device shall trip the load contactor when the set output voltage (line-to-neutral) decreases to 97 ± 5 volts (3 phase average).

3.11.3.6 Underfrequency. This device shall trip the load contactor when the frequency of the set output voltage decreases to 365 ± 5 Hz.

3.11.3.7 Instrument accuracy. The maximum allowable error (see 6.3.12) of the metering system shall be as follows:

Instrument	Maximum Allowable Error
AC Voltmeter	0.5 percent
DC Voltmeter	0.5 percent
AC Ammeter	1.0 percent
DC Ammeter	1.0 percent
Frequency Meter	0.1 percent

3.12 Pneumatic system. The pneumatic power system shall consist of a load control valve for controlling compressor bleed air through flexible ducting to an exterior pneumatic servicing connection, and all necessary controls for regulating loading of the air source. The system shall furnish continuous automatically controlled pneumatic power, which shall meet the minimum output requirements specified herein (see 3.6.2).

3.12.1 Load control. The load shall be controlled by the load control valve which shall open only after the operating speed range is reached regardless of the position of the load switch. The valve shall have an opening rate in the range of 3 to 10 seconds and a closing rate of not more than 0.5 seconds. Normal operating pressures shall be automatically maintained unless manual change of the load switch is selected.

3.12.2 Transient performance. Pressure fluctuations from a suddenly applied load, shall be critically damped within 5 seconds after valve opening, and shall not exceed ± 3 percent of rated output from the steady-state condition (± 1 percent of rated output).

3.12.3 Depressurization. The air delivery hose shall be automatically depressurized to not more than 1 psig in 5 seconds upon closure of the outlet valve.

3.12.4 Protective devices. The engine shall be automatically protected from excessive loading or temperatures by a regulating load control valve and independent over-temperature limiting control and flow restrictor.

3.12.5 Remote control operation. The pneumatic control panel shall have provisions for remote control of the pneumatic power system. The remote control-capability shall include (a) starting and stopping of the turbine engine and (b) application and removal of bleed air to the load.

3.13 Treatment and painting. The set shall be treated and painted in accordance with the applicable drawings (see 3.3), except as specified herein. The following shall not be painted: Terminal wiring connections, governor linkage, instruction diagrams, nameplates, rectifiers, relays, circuit breakers, switches, hose, drivebelts, and all other parts whose operation or function would be adversely affected by paint. Treatment and painting shall be optional for the following if located within the set housing and not

...nts shall not exceed .040. ...Misalignment between any two adjacent segme...

visible during operation of the set: Corrosion-resisting metals; metals treated to be corrosion resistant; and items treated and painted to be corrosion resistant by the original manufactures, such as MS starting motor, main contactor, after assembly and testing. The interior of the set shall be retouched to correct any paint damage; the entire exterior of the set, except items adversely effected, shall be oversprayed.

3.14 Information and instruction plates. First Article sets shall be delivered with all specified plates installed. For production sets, information and instruction plates may be installed after individual quality conformance tests (see 4.5) have been completed and the final overspray of paint is applied (see 3.13).

3.15 Electromagnetic interference. The electromagnetic interference emission and susceptibility characteristics of the set shall conform to MIL-STD-461A, Notices 5 and 6, Class V, even through the set KVA is greater than specified in the standard.

3.16 Marking. The set shall be marked in accordance with the applicable drawing (see 3.3) and MIL-STD-130. In the event of conflict between the referenced drawings and MIL-STD-130, the drawings take precedence except as a minimum each set shall be marked with (a) model number, (b) serial number, (c) procurement instrument identification number, and (d) manufacturer's identification.

3.17 Workmanship shall be in accordance with Requirement 9 of MIL-STD-454.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Disassembly inspection. Failure of any inspection by First Article generators, generator with excitation system or sets shall be cause for disassembly, in the presense of a Government representative, to the extent necessary to determine the cause of the failure. Each disassembled part shall be examined in detail for compliance with this specification and referenced drawings. Parts not complying with such requirements shall be rejected and shall be cause for rejection of the First Article set. Reassembly with acceptable components or parts and reinspection shall be the responsibility of the contractor.

4.2 Classification of inspection. Inspections shall be classified as follows:

1. First article inspection (see 4.4).
2. Initial production inspection (see 4.5).

3. Quality conformance inspection (see 4.6).
4. Inspection comparison (see 4.9).
5. Packaging inspection (see 4.10).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in MIL-STD-705 and TABLE II (see 4.4.3).

4.4 First article inspection. The first article generator sets shall be examined and tested as specified herein to determine compliance with this specification (see 3.3). Noncompliance shall be cause for performing the disassembly inspection specified in 4.1.1.

4.4.1 Examination of components and subassemblies. Examination of components and subassemblies shall be made prior to assembly of the generator or set. Evidence that any components or subassemblies do not comply with the requirements of the drawings shall be cause for rejection of that component or subassembly.

4.4.2 Examination. Examination of the generator sets shall be made without disassembly. Evidence that the generator sets do not comply with the drawing shall be cause for rejection of the generator sets.

4.4.3 Tests. Conduct the applicable tests marked "X" in Column A of Table II. The set tests may be conducted in any order unless otherwise specified in the contract. Failure of any test to comply with the applicable requirements paragraph cited in Column F of Table II shall be cause for performing the inspection specified in 4.1.1. The following tests shall be conducted in addition to the Quality Conformance tests (Column C):

4.4.3.1 Short circuit (mechanical strength) test. Perform at rated voltage and frequency (see 3.11.1.5).

4.4.3.2 Overspeed test. Perform as specified (see 3.4.2.1).

4.4.3.3 Frequency and voltage stability test (long term). Perform at rated voltage and frequency (see 3.10.3.3 and 3.11.1.14).

4.4.3.4 Voltage unbalance with unbalanced load. Perform at rated voltage and frequency (see 3.11.1.7).

4.4.3.5 Voltage and frequency regulation test. Perform at rated voltage and frequency (see 3.10.3.1 and 3.11.1.12).

4.4.3.6 Phase balance (voltage)test. Perform at rated voltage and frequency (see 3.11.1.8).

4.4.3.7 High temperature test (temperature rise). Perform at rated voltage and frequency and at ambient temperature of 125°F (see 3.11.1.2).

4.4.3.8 Overload test (ac generator). Perform at rated voltage and frequency and at ambient temperature of 125°F (see 3.6.1.2). CAUTION: Exercise care to avoid excessive exhaust temperature on the turbine engine.

4.4.3.9 DC power unit (transformer - rectifier) test. Perform the following tests at an ambient temperature of 125°F.

4.4.3.9.1 Rated load test. 200 amperes at 28 ± 1 VDC for 2 hours.

4.4.3.9.2 Overload test. 300 ± 50 amperes at 28 ± 1 VDC for 5 minutes.

4.4.3.9.3 Current limit test. Output current shall be self-limiting at 300 ± 50 ADC.

4.4.3.9.4 Regulation test. Regulation from no-load to full load and full load to no-load shall not exceed ± 1.5 VDC.

4.4.3.9.5 Ripple voltage test. The output ripple voltage at 200 ADC load and VDC shall not exceed 5%.

4.4.4 Inspection report. The contractor shall furnish, within the time interval specified (see 6.2), inspection reports in accordance with MIL-STD-831 covering first article inspection. The inspection reports shall also include the following:

a. All test data obtained from applicable tests.
b. Description of malfunction, damages, failures, and adjustments (other than adjustments permitted by this specification) which occur during inspection.
c. Caused and analysis of malfunction, damages, or failures, and reasons for adjustments.
d. Corrective actions taken or required.

4.5 Initial production inspection. When specified (see 3.5), one or more initial production sets will be selected at random by the Government from the sets being produced by production tooling and will be subjected to the tests marked "X" in Column B of Table II to determine conformance to the requirements of this specification. These sets shall have successfully passed the examination and tests specified in 4.6.1. The inspection will be performed by the Government at a site selected by the Government, utilizing the appropriate technical manual for maintenance and servicing procedures. Acceptance of an initial production set shall not exclude the remaining sets from the quality conformance inspection and acceptance provisions specified in Section 4. In addition to any test specified as part of the initial production tests, the Government reserves the right to conduct any and all other tests contained in this specification as a part of the initial production test and failure of such additional tests shall have the same affect as failure of those tests specified as initial production tests.

4.5.1 Inspection failure. Failure of an initial production set to meet any requirement specified herein during and as a result of the examination and tests specified in 4.5 shall be cause for rejection of the initial production set (s) and shall be cause for [illegible] by the Government to continue acceptance of production sets until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiencies. Correction of such deficiencies shall be accomplished by the contractor at no cost to the Government on sets previously accepted and produced under the contract. Any deficiencies found as a result of the initial production inspection will be

considered prima facie evidence that all sets accepted prior to the completion of initial production inspection are similarly deficient unless evidence to the contrary is furnished by the contractor and such evidence is acceptable to the contracting officer.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of individual set examination and tests as specified herein (see 4.6.2 and 4.6.2.1).

4.6.1.1 Examination. Each set shall be examined, without disassembly for conformance to the drawings (see 3.3). Non-compliance shall be cause for rejection.

4.6.1.2 Tests. Each set shall be subjected to the applicable tests marked "X" under Column C of Table II (see 4.7.1). For generator, the tests shall be conducted prior to assembly into the set. Failure of any test shall be cause for rejection.

4.6.1.2.1 Exhaust overtemperature safety device test. With normal load control inoperative, increase the electrical load (at unity power factor) on the generator set until safety device operates; exercise care to avoid damage to the generator.

4.6.1.2.2 Low oil pressure safety device test. (See Table II).

4.6.1.2.3 Overspeed safety device test. (See Table II).

4.6.1.2.4 Preliminary check run. The generator set shall be operated for at least one (1) hour in accordance with the following schedule:

Time Period (Minutes)	Load
20	50% Rated AC 50% Rated DC
20	Rated AC Electrical Rated DC Electrical
5	No Load
15	Rated Pneumatic

4.6.1.2.4.1 Frequency of readings (pre-check run).

4.6.1.2.4.1.1 Items (a) through (d) of paragraph 4.6.1.2.4.2 shall be recorded at least five (5) minutes after the start of the rated pneumatic test.

4.6.1.2.4.1.2 Items (e) through (k) of paragraph 4.6.1.2.4.2 shall be recorded approximately mid-way between the start and finish of all test time periods.

4.6.1.2.4.1.3 Items (l) through (n) of paragraph 4.6.1.2.4.2 shall be recorded one (1) minute before the conclusion of all test time periods.

4.6.1.2.4.2 Test data. For each run at the loadings specified in paragraph 4.6.1.2.4 or 4.6.1.2.6, instrumentation shall be provided, readings taken and necessary calculations made to obtain data as follows:

a. Exhaust temperature indicated on unit.
b. Bleed Air Flow (lb./Min.)
c. Bleed Air Press indicated on unit gage.
d. RPM (% rated) indicated on unit gage.
e. Frequency (Hz).
f. AC volts (line to line or line-neut. @load).
g. AC volts current (amps).
h. DC volts indicated on unit meter.
i. DC current (amps) indicated on unit meter.
j. Power factor (calculated).
k. AC power (KW).
l. AC generator air temperature, inlet and outlet (°F).
m. TR air temperature, inlet and outlet (F°).
n. Ambient air temperature (°F).

4.6.1.2.5 Automatic start test. The generator set shall be tested for satisfactory functional operation of the automatic start controls by five (5) consecutive automatic starts at no load. Shutdown shall be approximately two (2) minutes after the turbine reaches operating speed and exhaust temperatures below 600°F. All restarts, except one, shall be initiated as soon as the compressor reaches zero (0) RPM. One (1) restart shall be initiated while the compressor is rolling to a stop at 20% ± 10% of rated speed (RPM).

4.6.1.2.6 Normal operation check. The generator set shall be operated for at least 27 minutes in accordance with the following schedule:

Test Time (Minutes)	Load
15	Rated load pneumatic
6	Rated load AC
6	75% rated load AC and 100% rated load DC

4.6.1.2.6.1 Frequency of readings (normal OPs).

4.6.1.2.6.1.1 Items (a) through (d) of paragraph 4.6.1.2.4.2 shall be recorded at least five (5) minutes after the start of rated load pneumatic test.

4.6.1.2.6.1.2 Items (e) through (k) of paragraph 4.6.1.2.4.2 shall be recorded approximately mid-way between the start and finish of the full load pneumatic test and every three (3) minutes during the electrical tests.

4.6.1.2.6.1.3 Items (l) through (n) of paragraph 4.6.1.2.4.2 shall be recorded at the mid-point and conclusion of the electrical test time periods.

4.6.1.2.7 Full load start test. The full load start test shall be conducted with the bleed air valve open to the atmosphere in accordance with the procedures as follows:

a. Place master switch (S-5) in the "ON" position.

b. Actuate the turbine start switch (S-7).

c. When the percentage of RPM reaches 30%, place the bleed air switch (S-10) in the "ON" position.

d. When the READY-TO-LOAD light comes on, actuate the AC RESET SWITCH (S-3) which will arm the generator. The AC output voltage (120 volts nominal) should stabilize at 400 ± 1 Hz within 20 seconds.

4.6.1.2.8 Self propulsion test. The propulsion test shall be conducted over locally available terrain, at speeds of 0-3 MPH, for a total of five (5) minutes, according to the following schedule:

Test Time (Minutes)	Test Condition
2	Forward
2	Reverse
1/2 (1/4 forward) (1/4 reverse)	Full Cramp Right Turn
1/2 (1/4 forward) (1/4 reverse)	Full Cramp Left Turn

4.6.1.2.9 Braking systems test. The deadman system shall be tested on relatively level ground to demonstrate that the brakes will be properly applied and the propulsion motor is de-energized upon release of the drawbar. The parking brake shall be tested to demonstrate that it will hold the generator set on a 6% grade.

4.6.1.2.10 Rated load test. Rated loads shall be as follows:

a. Bleed Air - As corrected for sea level and 59°F; 147 + pounds per minute and 48 ± 2 psi @ 385°F. minimum.

b. AC - 60KW @ 0.8 PF, 3 Phase, 4 wire, 120/208 volts ± 1% (steady state), 400 Hertz ± 0.25%.

c. DC 200 amperes @ 28 ± 1.5 volts; at no time shall output voltage exceed 29.5 volts.

4.6.1.2.11 Battery charger test. The battery charging circuit shall be checked for proper operation. Charging rate shall be at least 15 amperes when observed immediatley following engine start-up (see Figure 5).

4.6.2 Completion inspection. The government may select load banks at any time

4.6.1.2.12 Remote control circuit test. Using the remote control receptacle (J34), mounted externally on the front of the set enclosure, it shall be demonstrated that the "bleed-air" system can be controlled remotely. A test circuit (see Figure 6) shall be connected to J34 receptacle and the set operated as follows:

a. Verify that the MASTER switch (S5) and BLEED AIR switch (S10) on the generator set instrument panel are in the OFF position.

b. Verify that all switches on the remote control test panel (Figure 6) are in the OFF position.

c. Connect remote test circuit (Figure 6) into receptacle J34.

d. Place remote MASTER switch (S5R) in the "ON" position, remote battery power indicator (DS2R) should light.

e. Close momentary remote TURBINE START switch (S7R); cranking cycle should be initiated; cranking cycle indicator (DS3R) should light and remain lighted until turbine accelerates to starter trip-out speed (35%); turbine should accelerate through 95% speed and remote READY-TO-LOAD indicator (DS1CR) should light.

f. Place AC CONTACTOR switch (S3) on set panel in the momentary RESET position.

g. Place remote BLEED AIR switch (S10R) in the ON position; bleed air solenoid valves should actuate to permit flow of bleed air through the flexible duct.

h. Place remote BLEED AIR switch (S10R) in the OFF position; air solenoid valves should close and stop flow of bleed air in duct.

i. Place remote MASTER switch (S5R) in the OFF position; READY-TO-LOAD indicator light should go out as turbine rolls to a stop.

j. Repeat steps "d" through "i" two more times.

4.6.1.2.13 Individual set test report. The data required for the individual set test report shall be recorded, as applicable, on forms specified in MIL-STD-[illegible] or on forms similar to those listed below:

[illegible] maintenance most likely to cause dam

Test Data	Test Paragraph	Sample form/ Test Circuit
a. Preliminary check run	4.6.1.2.4 & 4.6.1.2.4.2	Figure 1
b. Normal operation check	4.6.1.2.6 & 4.6.1.2.4.2	Figure 1
c. Automatic start test	4.6.1.2.5	Figure 2
d. Full load start test	4.6.1.2.7	Figure 3
e. Self-propulsion test and Braking test	4.6.1.2.9 & 4.6.1.2.8	Figure 4
f. Battery charger test	4.6.1.2.11	Figure 5
g. Remote control test circuit	4.6.1.2.12	Figure 6
h. Discrepancy sheet	4.6.1.2	Figure 7

4.6.2 Sample inspection. Sampling shall be in accordance with MIL-STD-105 after all sets comprising a lot have passed the inspection and test specified in 4.6.1. Unless otherwise specified (see 6.2, 4.6.1.1 and 4.6.1.2), lot sizes shall consist of not more than 50 sets except that the first lot shall contain not less than 25 sets. The inspection level shall be S-3 and the AQL shall be 6.5 percent defective. No adjustment or substitution of components shall be made on the sets selected for sample inspection.

4.6.2.1 Tests. Sets selected in accordance with 4.6.2 shall be subjected to the tests marked "X" under Column D of Table II in the order listed.

4.7 Test schedules. The test schedules shall be as shown herein. Non-conformance to the applicable requirement paragraph shown in Column E of the schedules shall constitute failure of this test and rejection of the generator, the generator with excitation system, or the set, as applicable. The Government reserves the right to reject the equipment for not meeting any requirement herein, even though not performing a test directly related to the specific requirement. The requirements in Section 3 shall apply to another test.

4.7.1 Table II. Unless otherwise specified (see 6.2), the test schedule shall be as shown in Table II.

4.7.2 Table III. Schedule of optional tests as indicated in Table III shall be conducted to determine set compliance subsequent to changes in parts or material. All quality assurance provisions of Section 4 shall apply.

TABLE II TEST SCHEDULE

TEST NO.	First Article Inspection	Initial Production Insp.	Quality Conformance	Sample Inspection	TEST	Test Method (MIL-STD-705) and/or Test Paragraph: Requirement Paragraph
	A	B	C	D	E	F
					Generator only	
1	X	-	X	-	Insulation resistance	301.1b;3.11.1.3 (Isolate diodes)
2	X	-	X	-	High potential	302.1a (Isolate diodes); 3.11.1.4
3	X	X	-	X	Winding resistance	401.1a; 3.11.1.6
4	-	-	X	X	Overspeed	505.3b; 3.11.1.1
5	X	-	-	-	Short ciruit (mechanical strength)	625.1c/4.4.3.1; 3.11.1.5 (Apply single phase line-to-line, single phase line-to-neutral and symmetrical 3 phase short circuits for 5 seconds at output terminals)
					Generator Set	
6	X	X	X	X	Start and stop	503.1b; 3.4.1 & 3.4.2.3
7	X	-	-	-	Overspeed	505.1a; 4.4.3.2 & 3.4.2.1 (At 105 percent of rated speed for 5 minutes)
8	X	X	X	-	Overspeed protection device	505.2e; 4.6.1.2.3; 3.10.2.3
9	X	X	X	-	Frequency and Voltage Regulation, Stability and Transient Response (Short term)	608.1a; 3.10.3.2 3.10.3.4, 3.11.1.1 3.11.1.15

TABLE II TEST SCHEDULE

TEST NO.	First Article Inspection	Initial Production Insp.	Quality Conformance	Sample Inspection	TEST	Test Method (MIL-STD-705) and/or Test Paragraph: Requirement Paragraph
	A	B	C	D	F	F
					Generator Set	
10	X	-	-	-	Frequency and Voltage Stability (long term)	608.2: 4.4.3.3 & 3.10.3.3 3.11.1.14
11	X	-	-	-	Voltage unbalance with unbalance load	620.1a: 4.4.3.4 & 3.11.1.7
12	X	-	-	X	Voltage waveform (Harmonic analysis)	601.4a: 3.11.1.9
13	X	-	-	X	Voltage modulation	602.1: 3.11.1.10
14	X	-	-	-	Voltage and frequency regulation	614.1a: 4.4.3.5 & 3.11.1.12 & 3.10.3.1
15	X	-	-	X	Phase balance (voltage)	508.1c (508.1.2 only) 4.4.3.6 & 3.11.1.8
16	X	-	X	-	Circuit Interrupter (Short Circuit)	512.1c (Oscillo-graph on First Article only): 3.11.1
17	X	-	X	-	Circuit Interrupter (overload trip)	512.2c: 3.11.3.3
18	X	-	X	-	Circuit Interrupter (undervoltage and overvoltage trip)	512.3c: 3.11.3.4 3.11.3.5
19	X	-	X	-	Instrument check	513.1c: 3.11.3.7
20	X	-	X	-	Underfrequency trip	506.1a: 3.11.3.6

TABLE II TEST SCHEDULE

TEST NO.	First Article Inspection	Initial Production Insp.	Quality Conformance	Sample Inspection	TEST	Test Method (MIL-STD-705) and/or Test paragraph: Requirement paragraph
	A	B	C	D	E	F
21	X	-	X	-	Low oil pressure protective device	515.1a; 4.6.1.2.2 3.10.2.4
22	X	-	X	-	Over-temperature protective device	4.6.1.2.1; 3.10.2.2
23	X	-	X	-	Phase sequence (rotation)	507.1c; 3.11.1.11
24	X	-	X	-	Remote control	4.6.1.2.12; 3.12.5
25	X	X	X	-	Preliminary check run	4.6.1.2.4; 3.4.1
26	X	-	X	-	Automatic start	4.6.1.2.5; 3.4.1 & 3.12
27	X	X	X	-	Normal operation check	4.6.1.2.5; 3.4.1 & 3.12
28	X	-	X	-	Full load start	4.6.1.2.7; 3.4.1
29	X	-	X	-	Self-propulsion and braking test	4.6.1.2.8 &4.6.1.2.9 (8% grade required on First Article only); 3.8.1
30	X	-	X	-	Battery charging system	4.6.1.2.11; 3.10.1.1.1
31	X	-	-	-	DC rated load	4.4.3.9.1; 3.11.2.1
32	X	-	-	-	DC overload	4.4.3.9.2; 3.11.2.2

55 REMARKS

TABLE II TEST SCHEDULE

TEST NO.	First Article Inspection	Initial Production Insp.	Quality Conformance	Sample Inspection	TEST	Test Method (MIL-STD-705) and/or Test paragraph: Requirement paragraph
	A	B	C	D	E	F
33	X	-	-	-	DC current limit	4.4.3.9.3; 3.11.2.3
34	X	-	-	-	DC regulation	4.4.3.9.4; 3.11.2.4
35	X	-	-	-	DC ripple	650.1a; 4.4.3.9.5; 3.11.2.5
36	X	-	-	-	High temperature at 125°F	710.1c; 4.4.3.7; 3.11.1.2
37	X	-	-	-	Overload (AC)	4.4.3.8; 3.6.1.2

TABLE III SCHEDULE OF OPTIONAL TESTS

TEST NO.	TEST	TEST METHOD (MIL-STD-705) TEST PARAGRAPH	REQUIREMENT PARAGRAPH
1a	Rain	711.3b (To include 45 degrees)	3.4.1c
2a	Inclined operation	660.1c	3.4.1d
3a	Fuel consumption	670.1a	3.6.4
4a	Starting and operating (Moderate cold)	701.2c at -25°F (-31.7°C)	3.4.1
5a	Audio noise	4.8.2	3.6.5
6a	Altitude operation (Before reliability)	720.1c (at 10,000 feet, 77°F (25°C)	3.4.1
7a	Endurance-reliability	690.1c: 4.8.9	3.3.2 & 3.3.3
8a	Altitude operation (After reliability)	720.1c (At 10,000 feet, 77°F (25°C)	3.4.1
9a	Mobility	4.8.7	3.8
10a	Railroad bumping	740.5b: 4.8.3	3.4.3.1
11a	Drop	740.3b: 4.8.4	3.4.3.1
12a	Air transportability	4.8.6	3.7
13a	Maintainability demonstration	4.8.8	3.3
14a	Humidity	711.1c	3.4.4
15a	Electromagnetic interference	4.8.5	3.15

4.8 Test procedures. Test shall be conducted as specified herein. Test instruments shall be of the laboratory type and shall have been calibrated within 30 days of the start of testing and at 6-month periods thereafter. Instruments used in calibration should have at least five times the accuracy of the instrument being calibrated. Calibrated reference instruments of lesser accuracy than standard and which are not used for any other purpose may be used for the required periodic check of test instruments. Instruments shall be calibrated at the frequencies at which they are going to be used. Direct-reading instruments shall have at least 0.5 percent instrument manufacturer's accuracy and shall be connected to indicate in the most accurate portion of their range. On dc instruments, the readings shall not be made on the lower 15 percent of the scale. On ac instruments, the readings shall not be made on the lower one-third of the scale. When the test methods call for the use of recording-type meters, the Texas Instrument Company Model PDRHXFHXVA-A16-VT or equal shall be used. Oscillograph galvanometer frequency response shall be not less than 3,000 cps. When recording meters are specified for any part of of a test, turn on the recording meters prior to starting the warmup period of the set and record continously for the test. The recording meters shall be operated at a minimum speed of 6 inches per hour during the portions of the test where steady-state loading conditions exist and shall be operated at a minimum speed of 6 inches per minute at least 30 seconds before, during and after a load change.

4.8.1 Government performed tests. It shall be the option of the Government to perform the first article reliability test, altitude operation (after reliability), road test, and railroad hump test at Government expense at a Government installation.

4.8.2 Audio noise test. Except as specified herein, the instrumentation and procedures for the audio noise test shall conform to MIL-STD-1474. When any component is changed which may affect the noise limits, the number of feet to be specified in the caution notice as required in MIL-STD-1474, shall be determined by selecting the measurement position with the highest sound pressure levels and repositioning the microphone outward to a point where the measured sound pressure levels fall within the specified limits. Measure the distance from the set to the new microphone position and repeat the test for the eight positions at the new distance.

4.8.3 Railroad humping test. The railroad humping test shall be performed in accordance with Method 740.5b with the following changes:

a. Paragraph 740.5.2, first sentence, delete in its entirety and substitute, "All instruments and load banks necessary to perform Test Method 608.1a."

b. Paragraphs 740.5.3 (b) and (f), delete "Method 614.1, Voltage and Frequency Regulation Test" and substitute, "Method 608.1a, Frequency and Voltage Stability and Transient Reponse Test, on each set, at rated load only."

c. Paragraph 740.5.3 (d), second line, delete "8, 9, and 10" and substitute "not less than 5, 6, 7, 8, 9, and 10."

4.8.4 Drop test. The drop test shall be performed in accordance with Method 740.3b with the following changes:

a. Paragraph 740.3 (a) and (g), delete "Method 614.1, Voltage and Frequency Regulation Test" and substitute, "Method 608.1a, Frequency and Voltage Stability and Transient Response Test, on each set, at rated load only."

b. Paragraph 740.3.5, add "(e) Voltage and Frequency Performance requirements."

4.8.5 Electromagnetic interference test. The electromagnetic interference test shall be performed in accordance with MIL-STD-461.

4.8.6 Air transportability test. The set shall be tested in accordance with MIL-A-8421 to determine compliance with the air transportability requirements.

4.8.7 Mobility test. The set shall be subjected to and shall pass all tests specified in MIL-M-8090 for type II mobility. After each test, the set shall be examined for wear and any other fault, and shall then perform a simulated aircraft start. Any malfunction shall be cause for rejection.

4.8.8 Maintainability demonstration test. The maintainability demonstration shall be performed in accordance with Method 1B of MIL-STD-471 with assigned risk of 10 percent ($\emptyset$=1.28).

4.8.9 Endurance-reliability test. Except as specified herein, the endurance-reliability test shall be conducted in accordance with Test Method 609.1c of MIL-STD-705B and MIL-STD-781, Test Plan IV.

4.8.9.1 Endurance. The generator set shall be subjected to and shall pass an endurance test of not less than 1,000 hours of operation at the prevailing sea-level atmospheric condition. Sufficient readings shall be recorded at least every 30 minutes and before each change of operation condition. The endurance test shall consist of two phase, each phase using a different fuel, as follows:

a. Using grade JP-4 fuel conforming to MIL-T-5624, at least 250 starts and 95 test cycles shall be accomplished. Electrical loads shall be instantaneously applied and removed. One test cycle shall consist of the following:

Step	Time Period	Output of Load
1	1 hour	Normal full rated electrical (ac + 0 air)
2	1 hour	Normal full rated electrical output (dc + 0 air)
3	1 hour	Normal full rated pneumatic output (0 electrical)

Step		Time Period	Output of Load
4		1 hour	75 percent rated electrical output (ac + air)
5		1 hour	75 percent rated electrical output (dc + air)
6		3/4 hour	60 percent rated electrical output (ac + air)
7		3/4 hour	50 percent rated electrical output (ac + air)
8		1/2 hour	25 percent rated electrical output (dc + air)
9		1/2 hour	25 percent rated electrical output (dc + air)
10		2-1/2 hours	alternate periods as follows:
	(a)	5 minutes	Electrical overload rating 3.6.1.2a
	(b)	5 minutes	No load
	(c)	5 minutes	Electrical overload rating 3.6.1.2b
	(d)	5 minutes	No load
	(e)	5 minutes	Electrical overload rating 3.6.1.2c
	(f)	5 minutes	No load

b. Using grade 100/130 or 115/145 fuel conforming to MIL-G-5572, 5 cycles shall be accomplished.

4.8.9.2 Post-endurance operation. Immediately following the endurance test, the tests specified in 4.6.1.2.6 and 4.6.1.2.7 shall be repeated. The generator set shall then be subjected to a disassembly inspection in accordance with 4.8.9.4.

4.8.9.3 Start-stop test. One generator set shall be subjected to 500 cycles of operation. Each cycle shall consist of the following:

Time Period (Minutes)	Load or Condition
1	Full normal air load

Time Period (Minutes)	Load or Condition
2	Idle or no load
1	Full normal air load
5	Nonrotating

4.8.9.3.1 Acceleration. The unit shall be accelerated automatically from test to full speed at no load. The unit shall be fully loaded within 10 seconds of attaining full speed. The stop switch shall be acutated within 5 seconds after the final full load of each cycle is complete.

4.8.9.3.2 Test limits. The 250 starts completed in the endurance test specified in 4.8.9.1 shall be credited to completion of 250 cycles of this test if the same generator set is used. Loading and unloading shall be accomplished with a pressure regulating and shutoff valve conforming to MIL-S-39398. The pressure regulation sensing line shall be disconnected during the test. Time for acceleration and deceleration shall not be credited to this test. Pneumatic output shall be directed through a starter valve to a converging nozzle which is designed for 125 cfm of air at 70 psia and 32°F. Matched pressure in accordance with the generator set rating for the particular ambient shall be maintained until maximum limits of speed and temperature have been reached. The test shall be continued to completion at these limits, and a record of the best obtainable matched pressure shall be maintained.

4.8.9.4 Disassembly inspection. Following the test specified in 4.8.9.1, the generator set shall be disassembled to the maximum practicable extent. Parts shall be inspected, photographed, and measured to disclose failure, distortion, excessive wear, weakness, and other unsatisfactory conditions. Compressor impeller and turbine rotor parts shall be subjected to visual, sonic, and flourescent penetrant inspection. Indication of fracture in the material as a result of test shall be cause for rejection.

4.9 Inspection comparison. The Government may select sets at any time during the contract production period and subject these sets to any examination and test specified herein necessary to determine that the selected sets meet all requirements of this specification. The inspection will be performed by the Government at a site selected by the Government. Sets will be selected at random from those which have been accepted by the Government and will not include the previously inspected first article and initial production sets. Acceptance of an inspection comparison set shall not exclude the remaining sets from the quality conformance inspection and acceptance provisions specified in Section 4. In addition to any test specified as a part of the inspection comparison, the Government reserves the right to conduct any and all other tests contained in this specification as part of the inspection comparison and failure of such additional tests shall have the same effect as failure of those tests specified as inspection comparison.

4.9.1 Inspection failure. Failure of an inspection comparison set to meet any requirement specified herein during and as a result of the examination and tests specified in 4.9 shall be cause for rejection of the inspection comparison set and shall be cause for refusal by the Government to continue acceptance of production sets until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiencies. Correction of such deficiencies shall be accomplished by the contractor at no cost to the Government on sets previously accepted and produced under the contract. Any deficiencies found as a result of the inspection comparison set shall be considered prima facie evidence that all sets accepted prior to the completion of the inspection comparison are similarly deficient unless evidence to the contrary is furnished by the contractor and such evidence is acceptable to the contracting officer.

4.10 Inspection of preparation for delivery. Inspection of preparation for delivery shall be in accordance with section 4 of MIL-C-28554.

5. PACKAGING

5.1 Preservation and packaging. The preservation and packaging shall be level A, B, or C as specified (see 6.2). The generator sets shall be preserved and packaged in accordance with MIL-C-28554 as applicable and as specified herein.

5.1.1 Disassembly. Unless otherwise specified (see 6.2), the extent of disassembly shall be confined to the removal of parts that would otherwise increase cubage or would be vulnerable to damage, and shall be in accordance with the reccommendations of the manufacturer, subject to the approval of the procuring activity. All bolts, nuts, pins, and washers removed during disassembly shall be replaced in one of the mating parts and secured in such manner as to prevent loss.

5.1.2 Batteries. The nickel cadium batteries furnished with the generator sets shall be furnished wet, sealed, fully discharged and securly fastened in place in the battery compartments. The battery cables shall be disconnected from the battery terminal posts. Battery cables shall be disconnected from the battery terminal posts and secured to the battery compartment or box with tape confirming to PPP-T-60, Type IV, Class 1. Shorting devices shall be installed on the terminals of the battery.

6. NOTES

6.1 Intended use. The set is intended to supply pneumatic/electrical power for aircraft ground support and general purpose military applications.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.

b. Time frame required for submission of First Article model) (see 3.1).

c. When the Government will conduct any or all of the first article examination and tests. When the Government will conduct some but

not all of the first article examination and tests, the contracting officer should specify which examination and tests will be conducted by the Government and which examination and test shall be conducted by the contractor (see 3.1).

d. When initial production inspection is required and number of sets to be furnished, as applicable (see 3.5).

e. Time interval for submission of First Article test report (see 4.4.4).

f. Size of lots for production sets if other than as specified (see 4.6.2).

g. When test schedule is other than as specified in Table II (see 4.7.1).

h. Level of preservation and packaging and level of packing required (see 5.1).

i. Conditions under which Government loaned property will be made available to the contractor.

j. Disposition of Government loaned property at close of contract.

6.3 Definitions.

6.3.1 Start. A set is considered to have started when it is operating at rated voltage and speed.

6.3.2 Stop. A set is considered to have stopped when it is at 0 rpm.

6.3.3 Temperature and humidity damage is defined as corrosion, breakage, deformation, reduction of insulation resistance below 50,000 ohms, or conditions causing malfunction of any component or part.

6.3.4 Dangerous flexural vibration is defined as a vibration which occures at a speed at which maximum stress in the shaft, from flexural vibration, exceeds 9,000 psi.

6.3.5 Stable engine operating conditions (frequency). Stable engine operating conditions are the conditions specified for short term steady-state performance.

6.3.6 Rated load, is rated KW at rated power factor, rated frequency (speed) and rated voltage.

6.3.7 Dangerous torsional critical speed, is defined as the speed at which maximum vibrating stress in the shaft from torsional vibration exceeds 5,000 psi.

6.3.8 Rough handling damage is defined as deformation, loosening, breakage, change of fit of any component or part, or any condition resulting in malfunctioning of the set.

6.3.9 Normal railroad transportation shall be interpreted to mean humping speeds up to and including 10 miles per hour.

6.3.10 Normal truck or trailer transportation is defined as the conditions encountered during four cycles of a road endurance test, each cycle consisting of the following, with the set mounted on a suitable Army truck or trailer:

Road Condition	Distance (miles)	Speed (mph)
Paved highway	250	up to 50
Level cross-country	250	up to 20
Hilly cross-country	125	up to 20
Belgian block	15	up to 20

6.3.11 Normal aircraft and helicopter transportation shall be interpreted to mean a 12 inch drop.

6.3.12 Meter accuracy, is a number which defines the limit of error expressed as a percentage of full-scale value. Error is the difference between the indication and the true value of the quantity measure. It is the quantity which, when algebraically subtracted from the indication, gives the true value. A positive error denotes that the indication of the meter is greater than the true value.

6.3.13 Failure is defined as the inability of the set(s) to meet the requirements herein. A failure classification board shall be established by the contracting officer to identify and classify all failures.

6.3.14 Inspection. The examination and testing of supplies or services including, when appropriate, raw materials, components, and intermediate assemblies to determine conformance with contract requirements.

6.4 First article. Any changes or deviations of production sets from the approved first article or drawings during the production will be subject to the approval of the contracting officer. Approval of the first article will not relieve the contractor of his obligation to furnish sets conforming to this specification.

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Custodian:

Navy - YD
Air Force - 99

Review Activity:
DLA - GS

User Activity:
Navy - AS

Preparing Activity:
Air Force - 99

(Project 6115-0181)

MEP-365A (A/M32A-60A) INDIVIDUAL SET TEST RECORD
PRELIMINARY CHECK RUN AND NORMAL OPERATION CHECK

UNIT SER. NO. _____ DATE _____

ENGINE SER. NO. _____ GENERATOR SER. NO. _____

TEST	PRELIMINARY CHECK				NORMAL OPERATION		
SPECIFIED LOAD	50% AC 50% DC	100% AC 100% DC	NO LOAD	RATED PNEU-MATIC	RATED PNEU-MATIC	100% AC	75% AC 100% DC
TIME OF DAY ON / OFF							
REQUIRED TEST TIME (MINS)	20	20	5	15	15	5	5
EXHAUST TEMP. (°F)							
BLEED AIR FLOW (LB/MIN)							
BLEED AIR PRESSURE (PSI)							
BLEED AIR TEMP. (°F)							
SPEED (% RATED)							
FREQUENCY (HZ)							
AC VOLTS A–B							
AC VOLTS B–C							
AC VOLTS C–A							
AC AMPS A							
AC AMPS B							
AC AMPS C							
DC VOLTS							
DC CURRENT (AMPS)							
POWER FACTOR							
AC POWER (KW)							
TEMPERATURES (°F)							
AC GEN. INLET							
AC GEN. OUTLET							
TR INLET							
TR OUTLET							
AMBIENT							

Figure 1. Sample Individual Set Test Record

INDIVIDUAL TEST REPORT

Production No._____ Engine Serial No._____

Set Serial No._____ Generator No._____

Date_ _____

AUTOMATIC START TEST

The turbine generator set was tested for functional operation of automatic starts.

Five (5) consecutive automatic starts were performed at no load. Shutdown was accomplished approximately two (2) minutes after normal no-load operating speed was reached. Four (4) restarts were made when the engine was at 0 RPM. The fifth restart was made when the engine was still rotating at 20 ± 10% of rated speed.

All restarts were accomplished satisfactorily.

Signed_____
Technician

Test Engineer_ _____

FIGURE 2 - Sample Auto-Start Test Report

INDIVIDUAL TEST REPORT

Production No. _____ Engine Serial No. _____

Set Serial No. _____ Generator No. _____

Date _____

FULL LOAD START TEST

The turbine generator set was started and when the speed reached 30%, the bleed air switch (S-10) was placed in the "ON" position. Bleed air flow was automatically actuated when the turbine speed reached 95% of rated RPM. The engine reached a stable mechanically governed speed of approximately 96% within 20 seconds, with no evidence of surging, hunting, or overtemperature after 20 seconds.

The static frequency control was functionally checked by actuating the AC reset switch (S-3) when stable governed speed was reached. The AC frequency stabilized at 400 plus/minus 1 hertz.

TEST SATISFACTORILY COMPLETED

Signed _____
Technician

Test Engineer _____

FIGURE 3 - Sample Full-Load-Start Test Report

INDIVIDUAL TEST REPORT

Production No. _____ Engine Serial No._____

Set Serial No._ _____ Generator No._____

Date _____

SELF PROPULSION TEST AND BRAKING TEST

The Self-Propulsion system was functionally tested for 2 minutes foward, and 2 minutes reverse motion, and with full cramped right and left turns of 1/2 minute each through speeds of 0 - 3 MPH for a total of five minutes.

Dead man's handle was released during the final phases of each of the above propulsion tests and unit braked to a stop.

Parking brake was applied three times and unit remained locked in place.

Apply parking brake three (3) times while unit is on a 6° grade. Move unit each time to ensure a positive application of brakes.

The Unit passed the above tests satisfactorily.

Signed: _____
Technician

Test Engineer: _____

FIGURE 4 - Sample Self-Propulsion & Braking Test Report

INDIVIDUAL TEST REPORT

Production No._____ Engine Serial No._____

Set Serial No._____ Generator No._____

Date_____

BATTERY CHARGER TEST

Start turbine generator set with the START switch. When the START switch is released, record the charging current indicated on the ammeter in the battery circuit. This value should be 15 amperes or greater.

Charging Current_____amps.

Signed_____
Technician

Test Engineer_____

FIGURE 5 - Sample Battery Charger Test Report

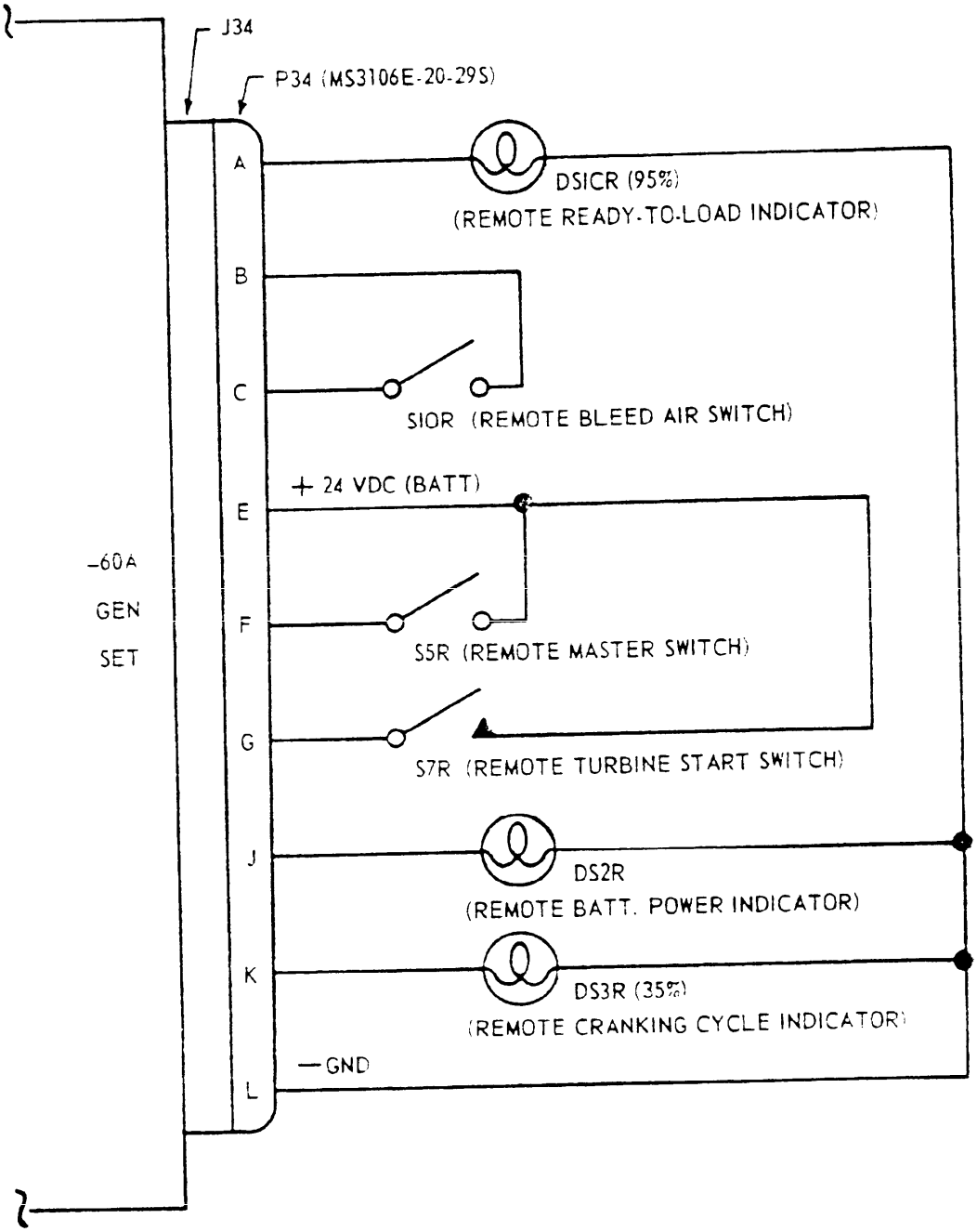

Figure 6. Remote Control Test Circuit

structureborne noise). Special attention may be given to the following points:

DISCREPANCY LOG

PRODUCTION NO. _____ UNIT NO. _____

ENGINE SER. NO. _____ DATE _____

GENERATOR SER. NO. _____

TEST	DEFICIENCY	CORRECTIVE ACTION	TIME SPENT	DATE	INITIALS

FIGURE 7 - Sample Discrepancy Log

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS. The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. Defense contractors, government activities, or manufacturers, vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE: "IL-G-38145C
GENERATOR SET, GAS TURBINE ENG: 60KW, 400 HERTZ, GENERAL PURPOSE

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A
[ ] DIRECT GOVERNMENT CONTRACT [ ] SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?
[ ] YES [ ] NO (If "Yes", in what way?)

4. REMARKS

SUBMITTED BY (Printed or typed name and address - Optional)

TELEPHONE NO.

DATE

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