INCH-POUND
MIL-DTL-38195D
01 Apr 2000
SUPERSEDING
MIL-G-38195C
10 Jul 1978

DETAIL SPECIFICATION

# GENERATOR SET, GAS TURBINE ENGINE, 60 kW 400 Hz, GENERAL PURPOSE

MIL-DTL-38195D remains inactive for new design and is no longer used, except for replacement purposes.

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

## 1. SCOPE

1.1 This specification covers general requirements for a general purpose, tactical generator set (herein after termed "set"), rated to 60 Kilowatts (kW) direct current (DC) and 60 kW at 400-Hertz (Hz) alternating current (AC). The set will include a wheel-mounted, towable, gas turbine engine-driven, Model MEP-356A (Air Force Model A/M32A-60A).

1.2 Classification. The generator set will have the rated outputs of the type and description as specified:

| CLASSIFICATION | TYPE | DESCRIPTION |
|---|---|---|
| Type I | Pneumatic power (bleed air) | 147 pounds per minute (lbs/min) at 48 pounds per square inch (psi) |
| Type II | AC | 3 phase, 4-wire, 120 Volt (V) line-to-neutral and 208 V line-to-line (120/208 V), 60 kW, 0.8 power factor (PF) (lagging) |
| Type III | DC | 200 Amperes (A) at 28 Volts |

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: WR-ALC/TILCC, 420 Second Street Suite 100, Robins AFB, GA 31098-1640 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index for Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

| | |
|---|---|
| MIL-PRF-2105 | Lubricating Oil, Gear, Multipurpose (METRIC) |
| MIL-DTL-5624 | Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8 ST |
| MIL-PRF-7808 | Lubricating Oil, Aircraft Turbine Engine, Synthetic Base |
| MIL-P-8686 | Power Units, Aircraft Auxiliary, Gas-Turbine-Type, General Specification for (ASG) |
| MIL-PRF-23699 | Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number O-156 |
| MIL-V-38398 | Valve, Starter Control, Pneumatic Aircraft Engine, General Specification for |

STANDARDS

DEPARTMENT OF DEFENSE

| | |
|---|---|
| MIL-STD-130 | Identification Marking of U.S. Military Property |
| MIL-STD-461 | Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment |
| MIL-STD-705 | Generator Sets, Engine Driven Methods of Tests and Instructions |
| MIL-STD-1474 | Noise Limits |
| MS90328 | Cable Assembly External Electric Power, Aircraft 15/200 Volt, 400 Hertz |

HANDBOOKS

DEPARTMENT OF DEFENSE

| | |
|---|---|
| MIL-HDBK-454 | General Guidelines for Electronic Equipment |
| MIL-HDBK-470 | Designing and Developing Maintainable Products and Systems, Volume I and Volume II |
| MIL-HDBK-781 | Reliability Test Methods, Plans, and Environments for Engineering, Development Qualification, and Production |
| MIL-HDBK-1473 | Color and Marking of Army Materiel |
| MIL-HDBK-1791 | Designing for Internal Aerial Delivery in Fixed Wing Aircraft |

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service (DAPS), 700 Robbins Ave, Building 4D, Philadelphia, PA 19111-5094, phone (215) 697-2197 or DSN 442-5164.)

2.3 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DOD adopted, are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

| | |
|---|---|
| ANSI S1.4 | Meters, Sound Level, Specification for |

| | |
|---|---|
| ANSI S1.11 | Octave-Band and Fractional-Octave-Band Analog and Digital Filters, Specification for |
| ANSI S1.13 | Sound Pressure Levels, Methods for Measurement of |

(Applications for copies may be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036, phone (212) 642-4900 or FAX (212) 398-0023)

AMERICAN SOCIETY for TESTING and MATERIALS (ASTM)

| | |
|---|---|
| ASTM D910 | Gasolines, Aviation |

(Applications for copies may be addressed to the American Society for Testing and Materials, 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959, phone (610) 832-9500 or FAX (610) 832-9555)

AMERICAN SOCIETY of MECHANICAL ENGINEERS (ASME)

| | |
|---|---|
| ASME PTC 19.5 | Application, Part II of Fluid Meters: Interim Supplement on Instruments and Apparatus |

(Applications for copies may be addressed to the American Society of Mechanical Engineers, 345 E. 47th Street, New York, NY 10017, phone (212) 705-7722 or FAX (212) 705-7739)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

| | |
|---|---|
| NEMA MG1 | Motors and Generators |

(Applications for copies may be addressed to the National Electrical Manufacturers Association, 1300 North 17th Street Suite 1847, Rosslyn VA 22209, phone (703) 841-3200 or FAX (703) 841-3300)

SOCIETY OF AUTOMOTIVE ENGINEERS

| | |
|---|---|
| SAE AS-8090 | Equipment, Towed Aerospace Ground, Mobility |

(Applications for copies may be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096-0001, phone (412) 776-4841 or FAX: (412) 776-4026)

2.4 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 First article. When specified (see 6.2), two generator sets shall be subjected to first article inspection (see 6.3.14 and 6.4) in accordance with (IAW) 4.3.

3.2 Materials. The contractor shall select the materials, but the materials shall be capable of meeting all of the operational and environmental requirements specified herein. (The materials previously specified in MIL-STD-970 are recommended, but are not mandatory.) Recovered materials shall be used to the maximum extent possible.

3.3 Design and construction. The design and construction of the set shall promote ease of use, ease of maintenance, and maximum reliability and maintainability (see 4.5.2 and 4.6.8).

3.3.1 Reliability. The set shall have a reliability of 425 hours meantime between failures (MTBF) (see 4.5.2 and 4.6.9).

3.3.2 Endurance. The set shall pass an endurance test of 1,000 hours of operation when at sea level or at equivalent atmospheric conditions (see 4.5.2 and 4.6.9).

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

3.4.1 Starting. The set shall start (see 6.3.1) within 30 seconds as specified (see 3.9.1; 3.10.1; 3.11; 4.2; 4.4.1.2.4; 4.4.1.2.5; 4.4.1.2.7; 4.5.1; and 4.5.2):

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

b. At ambient temperatures for -65° to +20° F (-53.9° to -28.9° 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 (see 4.5.2).

d. With base of the set in planes from level to 15 degrees from level, in all 4 directions (see 4.5.2).

e. At any altitude up to an including 10,000 feet above sea level at an ambient temperature of 77° F (25° C) (see 4.5.2).

3.4.2 Operation. Within 20 seconds after starting, the set shall accept full load without surging or creating an engine over-temperature condition (see 4.5.1 and Table V test 27).

3.4.2.1 Operating speed. The operating speed of the generator set shall withstand 5 minutes of continuous operation at no-load and 105 percent of rated speed without mechanical or thermal damage (see 4.2; 4.3.3; and 4.5.1).

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 over speed 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 (see 4.2; 4.5.1; and 6.3.2).

3.4.3 Handling. Forklift 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 (see 4.3.2).

3.4.3.1 Rough handling. The set shall not be damaged (see 6.3.8; 6.3.9; 6.3.10; and 6.3.11) by rough handling which could be encountered during transportation (see 4.5.2; 4.6.3; 4.6.4; and 4.6.6).

3.4.4 Storage temperature and humidity. The set shall not be damaged (see 6.3.3) by storage in temperatures from -65° to +155° F (-53.9° to 68.3° 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 711.1d (see 4.5.2).

3.5 Performance.

3.5.1 Electrical performance (no pneumatic output).

3.5.1.1 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 Hz (measured at load end of power cable using a reactive load bank).

b. 200 Ampere at 28 VDC (measured at DC output receptacle using a load bank).

c. 60 kW, any combination of AC or DC.

3.5.1.2 Overload rating. The overload rating of the electrical output of the set shall be as follows (see 4.2; 4.3.3; 4.5.1 and 4.6.9.1):

a. 75 kW at 0.8 PF, 3-phase, 4 wire, 120/208V, 400 Hz for 5 minutes.

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

c. 75 kW, any combination of AC or DC for 5 minutes.

3.5.2 Pneumatic performance. The continuous, automatically controlled, rated pneumatic output of the set at the bleed air outlet flange shall meet the minimum conditions in Table I. Airflow measurements shall be made in accordance with (IAW) the procedures specified in ASME Power Test Code 19.5; 5-1949, Part 5, Chapter 4, or by method acceptable to the procuring activity (see 3.11).

3.5.3 Combined pneumatic and electrical output. The set shall be rated for continuous 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. Rated turbine temperature & its measurement shall be in accordance with (IAW) the turbine manufacturer's specifications. (See Table I and Table V)

3.5.4 Fuel consumption. At the horsepower required to produce rated load (see 6.3.6) at standard sea level conditions, the specific fuel consumption of the set shall not exceed 1.5 pounds per shaft horsepower per hour (see 4.5.2).

3.5.5 Audio noise. The audio noise emanating 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 (see 4.5.2 and 4.6.2):

a. Eighty-five decibels as measured on the A-scale of a standard sound level meter at slow response (85 dB), 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 | 1,000 | 2,000 | 4,000 | 8000 |
|---|---|---|---|---|---|---|---|---|
| Sound Pressure Level (dB, reference 0.0002 ..microbar) | 101 | 91 | 84 | 79 | 76 | 74 | 74 | 75 |

3.5.5.1 Measurement. 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 4.6.2).

3.5.5.2 Sound level meter. The sound level meter used shall conform to ANSI S1.4, Type 2. The octave band filter set used shall conform to ANSI Sl. 11 Type E, Class II.

3.5.5.3 Measurement Procedure. The sound measurement procedures used shall conform to ANSI S1.13, except that the microphone height shall be as specified in 3.5.5.1.

3.5.5.4 Pressure level. If the sound pressure level at any measurement location specified in 3.5.5.1 exceeds the limits of 3.5.5.1 a, b or c, a caution sign, in accordance with (IAW) current industry practices (reference MIL-HDBK-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 3.5.5.1 a, b, or c.

3.6 Transportability. The set shall meet air transportability requirements (reference MIL-HDBK-1791) when the set is loaded into the aircraft with longitudinal axis of the set parallel to the longitudinal axis of the aircraft (see 4.5.2 and 4.6.6).

3.7 Mobility. The set shall meet the general and Type II, Group C, mobility requirements of SAE AS8090 except that the cramping angle of the trailer shall be sufficient to obtain 17 ½ feet or less turning radius. The trailer shall have four wheels with 6:00 by 9, 6-ply pneumatic tires (see 4.5.2 and 4.6.7).

3.8 Lubricating oils and fuels. Lubrication and fuels shall be as specified herein (see 4.3.2).

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

3.8.2 Fuels. The engine fuel shall conform to MIL-DTL-5624 and, under emergency conditions, ASTM D910.

3.9 Engine. Except as otherwise specified herein, the engine, including all systems, components, accessories and auxiliaries shall conform to engine manufacturer's specification and this specification (reference MIL-P-8686, Type IV).

3.9.1 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.

3.9.1.1 Battery. The set batteries shall be of the nickel-cadmium type and conform to current industry standards (reference MIL-B-81757/9).

3.9.1.1.1 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 (see 4.2; 4.4.1.2.10; and 4.5.1).

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

3.9.2.1 Over-speed control. The over-speed safety device shall trip at 110 ± 2 percent of rated speed, to stop the engine (see 4.2; 4.4.1.2.3; and 4.5.1).

3.9.2.2 Over-temperature control. The over-temperature control shall limit the turbine and nozzle box temperature during starting and operating (see 4.2; 4.4.1.2.1; and 4.5.1). Over Temperature Control Device shall be in accordance with (IAW) current industry standards.

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

3.9.2.4 Low oil pressure. The low oil pressure device shall actuate to stop the engine when the lubricating oil pressure drops to approximately 5 psig (see 4.2; 4.4.1.2.2; 4.5.1).

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

3.9.3.1 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 (see 3.10.1; 4.2; 4.3.3; and 4.5.1).

3.9.3.2 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 (see 4.2 and 4.5.1).

3.9.3.3 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 (see 4.2; 4.3.3; and 4.5.1).

3.9.3.4 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 (see 6.3.5) within 1 second for load application and 1.5 seconds for load rejection (see 4.2 and 4.5.1).

3.10 Electrical system.

3.10.1 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 in Table II (see 3.4.1).

3.10.2 DC transformer-rectifier. The direct current system shall be of the transformer-rectifier type and shall meet the requirements as specified in Table III.

3.10.3 Instruments, controls and other devices.

3.10.3.1 Protective devices. Protective devices shall act to open or close the main contactor as specified in Table IV.

3.11 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 3.4.1; 3.5.2; 4.2; 4.4.1.2.5; and 4.5.1).

3.11.1 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.

3.11.2 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) (see 3.10.1; 4.2; and 4.5.1).

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

3.11.4 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.

3.11.5 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 (see 3.4.1; 4.2; 4.4.1.2.11; and 4.5.1).

3.12 Treatment and painting. The set shall be treated and painted as specified herein. The following shall not be painted: Terminal wiring connections, governor linkage, instruction diagrams, nameplates, rectifiers, relays, circuit breakers, switches, hose, drive-belts, 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 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 affected, shall be over-sprayed.

3.13 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 4.4) have been completed and the final over-spray of paint is applied (see 3.12).

3.14 Electromagnetic interference. The electromagnetic interference emission and susceptibility characteristics of the set shall conform to MIL-STD-461, Class V, even through the set Kilo-Volt Ampere (kVA) is greater than specified in the standard (see 4.5.2 and 4.6.5).

3.15 Marking. The set shall be marked in accordance with (IAW) MIL-STD-130. 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.

3.16 Workmanship. Workmanship shall be in accordance with (IAW) current industry practices (reference Requirement 9 of MIL-HDBK-454).

3.17 Mechanical Parking Brake System. The generator set shall include a mechanical parking brake system to prevent the set from moving when it is parked. The mechanical parking brake shall be capable of locking the set in place on a 6 percent grade when the handle is applied once then released, applied a second time then released, and applied a final time then released (applied three times). The brake system shall be mounted in a convenient accessible location on the front of the generator set. The parking brake system shall also provide for a dead-man system incorporated in the draw bar.

## 4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).

c. Conformance inspection (see 4.4).

d. Inspection comparison (see 4.7).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be preformed in accordance with (IAW) the test conditions specified in MIL-STD-705 and Table V (see 4.3.3).

4.3 First article inspection. The first article generator sets shall be examined and tested as specified herein to determine compliance with this specification (see 3.1).

4.3.1 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 this specification shall be cause for rejection of that component or subassembly.

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

4.3.3 Tests. Conduct the applicable tests marked "X" in Column A of Table V. The set tests may be conducted in any order unless otherwise specified in the contract. The following tests in Table VI shall be conducted in addition to the Conformance tests (Column B):

4.4 Conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of individual set examination and tests as specified herein.

4.4.1.1 Examination. Each set shall be examined, without disassembly for conformance with the requirements of this specification. Non-compliance shall be cause for rejection.

4.4.1.2 Tests. Each set shall be subjected to the applicable tests marked "X" under Column B of Table V (see 4.5.1). For generator, the tests shall be conducted prior to assembly into the set. Failure (see 6.3.13) of any test shall be cause for rejection.

4.4.1.2.1 Exhaust over-temperature 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) (see 3.9.2.2; 4.2; and 4.5.1).

4.4.1.2.2 Low oil pressure safety device test. (See 3.9.2.4; 4.2; and 4.5.1).

4.4.1.2.3 Over-speed safety device test. (See 3.9.2.1; 4.2; and 4.5.1).

4.4.1.2.4 Preliminary check run. The generator set shall be operated for at least one (1) hour in accordance with (IAW) the following schedule (see 3.4.14.2; and 4.5.1):

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

4.4.1.2.4.1 Frequency of readings (pre-check run).

4.4.1.2.4.1.1 Items (a) through (d) of paragraph 4.4.1.2.4.2 shall he recorded at least five (5) minutes after the start of the rated pneumatic test.

4.4.1.2.4.1.2 Items (e) through (k) of paragraph 4.4.1.2.4.2 shall be recorded approximately mid-way between the start and finish of all test time periods.

4.4.1.2.4.1.3 Items (l) through (n) of paragraph 4.4.1.2.4.2 shall be recorded one (1) minute before the conclusion of all test time periods.

4.4.1.2.4.2 Test data. For each run at the loading specified in paragraph 4.4.1.2.4 or 4.4.1.2.6, 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 (Lbs./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-neutral @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)

4.4.1.2.5 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 percent ±10 percent of rated (RPM) speed (see 3.4.1; 4.2; and 4.5.1).

4.4.1.2.6 Normal operation checks. The generator set shall be operated for at least 27 minutes in accordance with (IAW) the following schedule (see 3.4.1; 4.2; 4.5.1; and 4.6.9.2):

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

4.4.1.2.6.1 Test duration.

4.4.1.2.6.1.1 Items (a) through (d) of paragraph 4.4.1.2.4.2 shall be recorded at least five (5) minutes after the start of rated load pneumatic test.

4.4.1.2.6.1.2 Items (e) through (k) of paragraph 4.4.1.2.4.2 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.

4.4.1.2.6.1.3 Items (l) through (n) of paragraph 4.4.1.2.4.2 shall be recorded at the mid-point and conclusion of the electrical test time periods.

4.4.1.2.7 Full load start test. The full load start test shall be conducted with the bleed air valve open to the atmosphere in accordance with (IAW) the procedures as follows (see 3.4.1, 4.2; 4.5.1; and 4.6.9.2):

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.

4.4.1.2.8 Braking systems test. The dead-man system shall be tested on relatively level ground to demonstrate that the brakes will be properly applied upon release of the draw bar. The parking brake shall be tested to demonstrate that it will hold the generator set on a 6 percent grade (see 3.17; 4.2; 4.5.1; and Table V Test 29).

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

a. Bleed Air – As corrected for sea level and 59° F; 147 +5/-0 pounds per minute and 48 ± 2 psi @ 385° F minimum.

b. AC – 60 kW @ 0.8 PF, 3 Phase, 4 wire, 120/208 volts ± 1 percent (steady state), 400 Hz ± 0.25%.

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

4.4.1.2.10 Battery charger test. The battery charging circuit shall be checked for proper operation. Charging rate shall he at least 15 amperes when observed immediately following engine start-up (see 3.9.1.1.1; 4.2; and 4.5.1).

4.4.1.2.11 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 1) shall be connected to J34 receptacle and the set operated as follows (see 3.11.5; 4.2; and 4.5.1):

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 (see Figure 1) are in the OFF position.

c. Connect remote test circuit (see Figure 1) 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 percent speed and remote READY-TO-LOAD indicator (DSICR) 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.

4.5 Test schedules. The test schedules shall be as shown in Table V. 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.

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

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

4.6 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 (see 6.3.12) 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-Al6-XT or equal shall be used. Oscillograph galvanometer frequency response shall be not less than 3,000 Hz. When recording meters are specified for any part of a test, turn on the recording meters prior to starting the warm-up period of the set and record continuously 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.

4.6.1 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.

4.6.2 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 (see 3.5.5 and 4.5.2).

4.6.3 Railroad humping test. The railroad-humping test shall be performed in accordance with (IAW) Method 740.5c of MIL-STD-705 (see 3.4.3.1 and 4.5.2).

4.6.4 Drop test. The drop test shall be performed in accordance with (IAW) Method 740.3c of MIL-STD-705 (see 3.4.3.1 and 4.5.2):

4.6.5 Electromagnetic interference test. The electromagnetic interference test shall be performed in accordance with (IAW) MIL-STD-461 (see 3.14 and 4.5.2).

4.6.6 Air transportability test. The set shall be tested to determine compliance with the air transportability requirements (see 3.4.3.1; 3.6; and 4.5.2) (reference MIL-HDBK-1791).

4.6.7 Mobility test. The set shall be subjected to and shall pass all tests specified in SAE AS8090 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 (see 3.7 and 4.5.2).

4.6.8 Maintainability demonstration test. The maintainability demonstration shall be performed in accordance with (IAW) current industry practices (reference Method 1B of MIL-HDBK-470) with assigned risk of 10 percent ($\phi$ = 1.28) (see 3.3 and 4.5.2).

4.6.9 Endurance-reliability test. Except as specified herein, the endurance reliability test shall be conducted in accordance with (IAW) Test Method 690.1d and 695.1a of MIL-STD-705 (reference MIL-HDBK-781) (see 3.3.1; 3.3.2; and 4.5.2).

4.6.9.1 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-8 fuel conforming to MIL-DTL-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 as specified in Table VIII (see 3.5.1.2).

4.6.9.2 Post-endurance operation. Immediately following the endurance test, the tests specified in 4.4.1.2.6 and 4.4.1.2.7 shall be repeated. The generator set shall then be subjected to a disassembly inspection in accordance with (IAW) 4.6.9.4.

4.6.9.3 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 |
| 2 | Idle or no load |
| 1 | Full normal air load |
| 5 | Non-rotating |

4.6.9.3.1 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 he actuated within 5 seconds after the final full load of each cycle is complete.

4.6.9.3.2 Test limits. The 250 starts completed in the endurance test specified in 4.6.9.1 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-V-38398. 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 325° F. Matched pressure in accordance with (IAW) 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.

4.6.9.4 Disassembly inspection. Following the test specified in 4.6.9.2, the generator set shall he 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 fluorescent penetrant inspection. Indication of fracture in the material as a result of test shall be cause for rejection.

4.7 Inspection comparison. The Government Quality Representative at the contractor's facility may select sample 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.

4.7.1 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 4.7 shall be cause for rejection of the inspection comparison

set. In addition, this failure 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 he 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 will 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.

## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DOD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

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

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

c. Packaging requirements (see 5.1).

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

e. 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 will be conducted by the contractor (see 3.1).

f. When test schedule is other than as specified in Table V (see 4.5.1).

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

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

i. 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 (see 3.4.1).

6.3.2 Stop. A set is considered to have stopped when it is at 0 rpm (see 3.4.2.3).

6.3.3 Temperature and humidity damage. 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 (see 3.4.4).

6.3.4 Dangerous flexural vibration. Dangerous flexural vibration is defined as a vibration, which occurs at a speed at which maximum stress in the shaft, from flexural vibration, exceeds 9,000 psi (see 3.4.2.2).

6.3.5 Stable engine operating conditions (frequency). Stable engine operating conditions are the conditions specified for short-term steady-state performance (see 3.9.3.4).

6.3.6. Rated load. Rated load is rated kW at rated power factor, rated frequency (speed) and rated voltage (see 3.5.4).

6.3.7 Dangerous torsional critical speed. Dangerous torsional critical speed is defined as the speed at which maximum vibrating stress in the shaft from torsional vibration exceeds 5,000 psi (see 3.4.2.2).

6.3.8 Rough handling damage. 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 (see 3.4.3.1).

6.3.9 Normal railroad transportation. Normal railroad transportation will be interpreted to mean humping speeds up to and including 10 miles per hour (mph) (see 3.4.3.1).

6.3.10 Normal truck or trailer transportation. 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 (see 3.4.3.1):

| 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. Normal aircraft and helicopter transportation will be interpreted to mean a 12-inch drop (see 3.4.3.1).

6.3.12 Meter accuracy. Meter accuracy (see 4.6) 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 (see 3.10.3.1).

6.3.13 Failure. Failure is defined as the inability of the set(s) to meet the requirements herein. A failure classification board will be established by the contracting officer to identify and classify all failures (see 4.4.1.2).

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 (see 3.1).

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 (see 3.1).

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TABLE I. Pneumatic performance. 1/ 2/

| Min Pressure (psia) | Min Flow (Lbs./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) |

1/ See 3.5.2.
2/ 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.

TABLE II. AC generator and exciter electrical values and limits. 1/

| | | Minimum | Nominal | Maximum | Units |
|---|---|---|---|---|---|
| Over-speed 2/ | | | 3/ | | RPM |
| Temperature rise 4/ 5/ | Class B insulation | | | 162° (90°) | F (C) |
| | Class F insulation | | | 180° (100°) | F (C) |
| | Class H insulation | | | 324° (180°) | F (C) |
| .. Main stator | At rated load (208 Amperes) on the generator | | | 324° (180°) | F (C) |
| .. Exciter stator | | | | 90° (50°) | F (C) |
| Resistance | | | | | |
| .. Insulation 6/ | Ambient temperature of 77° F (25° C) | 1 M | | | Ohm Ω |
| .. Winding 7/ | Temperature of 77° F (25° C) | | | 8/ | Ohm Ω |
| Dielectric strength 9/ 10/ | | | | | |
| .. Generator armature | Between phase windings | | 1,250 | | Volts |
| | Between phase windings and ground | | 1,000 | | Volts |
| .. Generator field and exciter windings | Between windings and ground | 500 | 11/ | | Volts |
| .. Windings 12/ | Between windings and ground | | 500 | | Volts |
| .. All others | Between windings and ground and between windings where applicable | | 13/ | | Volts |
| Short circuit 14/ 15/ | At output terminals | | 5 | | Seconds |
| .. Sustained current | Of rated output current | 200 | | | % |
| Voltage unbalance 16/ | Difference between line-to-line and line-to-neutral voltages 17/ | | | 5 | % |
| Phase balance voltage 18/ | Difference in the three line-to-neutral voltages to rated line-to-neutral voltage | | | 1 | % |
| Voltage waveform 19/ | Single harmonic 20/ | | | 2 | % |
| .. Modulation 21/ | Each of the line-to line and line-to-neutral voltages 22/ | | | 1 | % |
| .. Regulation 23/ | Rated voltage from no-load to rated load and from rated load to no-load | | | 1 | % |
| Phase sequence 24/ | Phase rotation | | 25/ | | |
| Stability | | | | | |
| .. Short term 26/ | At constant load from no-load to rated load for 30 seconds 27/ | | 1.2 | | Volts |
| .. Long term 28/ | At constant ambient temperature, constant barometric pressure, constant frequency and any constant load from no-load to rated load in a 4-hour operation period 29/ | | 2.4 | | Volts |

TABLE II. AC generator and exciter electrical values and limits. 1/ – continued

| | | Minimum | Nominal | Maximum | Units |
|---|---|---|---|---|---|
| Transient performance30/ | | 31/ | | | |

1/ See 3.10.1.
2/ See Table V, Test Number 4.
3/ The generator shall withstand operation at 7500 rpm for 5 minutes without damage.
4/ The temperature rise shall not exceed these stated values for the type class insulation (as defined in NEMA Standard MG1), when measured by the resistance method.
5/ See Table V, Test Number 436 and Table VI.
6/ See Table V, Test Number 1.
7/ See Table V, Test Number 3.
8/ The resistance of each winding shall be as specified on the applicable drawing.
9/ Windings shall withstand the stated 60 Hz voltage applied for 1 minute.
10/ See Table V, Test Number 2.
11/ 10 times ceiling voltage
12/ Windings energized by the 28-volt DC control, cranking and battery charging systems
13/ Twice rated voltage +500 volts
14/ 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 stated in Table II, under dielectric strength.
15/ See Table V, Test Number 5 and Table VI.
16/ See Table V, Test Number 11 and Table VI.
17/ Maximum difference 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 ampere) and no other load on the generator.
18/ See Table V, Test Number 15 and Table VI.
19/ See Table V, Test Number 12.
20/ 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 (PF) and 1.0 power factor. There shall be no discontinuities in the waveform when viewed on the oscilloscope.
21/ See Table V, Test Number 13.
22/ The voltage modulation for any load from no-load to rated load shall not exceed as specified herein.
23/ See Table V, Test Number 14 and Table VI.
24/ See Table V, Test Number 23.
25/ Phase rotation shall be A, Band C (L1, L2 and L3).
26/ See Table V, Test Number 9.
27/ The voltage at the end of the power cable (Type MS 90328-28) shall remain within a bandwidth as specified herein.
28/ See Table V, Test Number 10 and Table VI.
29/ The voltage shall remain within a bandwidth as specified herein.
30/ See Table V, Test Number 9.
31/ 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.

TABLE III. DC transformer-rectifier electrical values and limits. 1/

| | | Minimum | Nominal | Maximum | Units |
|---|---|---|---|---|---|
| Rated load 2/ | Continuous output at 28 VDC | | 200 | | Ampere |
| Current overload 3/ | At 28 VDC for 5 minutes | 250 | 300 | 350 | Ampere |
| Current limit 4/ | Self-limiting. At 28 VDC | 250 | 300 | 350 | Ampere |
| Output DC voltage regulation 5/ | From no-load to full load and full load to no-load | 0.5 | 1.0 | 1.5 | Volts |
| Output ripple 6/ | At 28 VDC | | | 5 | % |

1/ See 3.10.2.
2/ See Table V, Test Number 31 and Table VI.
3/ See Table V, Test Number 32 and Table VI.
4/ See Table V, Test Number 33 and Table VI.
5/ See Table V, Test Number 34 and Table VI.
6/ See Table V, Test Number 35 and Table VI.

TABLE IV. Instruments, controls and other device electrical values and limits. 1/

| | | Minimum | Nominal | Maximum | Units |
|---|---|---|---|---|---|
| Short circuit 2/ | In the event set output current is short circuited either single phase or 3 phase 3/ | | | 1.5 | Seconds |
| Overload 4/ | When the output current is 200 percent of rated current 5/ | 1 | | 5 | Seconds |
| Over-voltages 6/ | When the set output voltage (line-to-neutral) increases to 134 ± 4 volts 7/ | | | 1.5 | Seconds |
| Under-voltages 8/ | When the set output voltage (line-to-neutral) decreases to 97 ± 5 volts (3 phase average) 9/ | 92 | 97 | 102 | Volts |
| Under-frequency 10/ | When the frequency of the set output voltage decreases to 365 ± 5 Hz 11/ | 360 | 365 | 370 | Volts |
| Instrument accuracy 12/ 13/ | AC Voltmeter<br>DC Voltmeter<br>AC Ammeter<br>DC Ammeter<br>Frequency Meter | | | 0.5<br>0.5<br>1.0<br>1.0<br>0.1 | %<br>%<br>%<br>%<br>% |

1/ See 3.10.3.
2/ See Table V, Test Number 16.
3/ This device shall trip the lead contactor as specified herein.
4/ See Table V, Test Number 17.
5/ This device shall trip the load contactor as specified herein.
6/ See Table V, Test Number 18.
7/ This device shall trip the load contactor as specified herein.
8/ See Table V, Test Number 18.
9/ This device shall trip the load contactor as specified herein.
10/ See Table V, Test Number 20.
11/ This device shall trip the load contactor as specified herein.
12/ The maximum allowable error (see 6.3.12) of the metering system.
13/ See Table V, Test Number 19.

Table V. Test schedule. 1/

| Test Number | First Article Inspection<br>A | Quality Conformance<br>B | Sample Inspection<br>C | Test<br>D | Test Method Requirement Paragraph (MIL-STD-705 and/or Test Paragraph)<br>E |
|---|---|---|---|---|---|
| | | | | Generator only | |
| 1 | X | X | -- | Insulation resistance | 301.1c; Table II (Isolate diodes) |
| 2 | X | X | -- | High potential | 302.1b (Isolate diodes); Table II |
| 3 | X | -- | X | Winding resistance | 401.1b; Table II |
| 4 | -- | X | X | Over-speed | 505.3c; Table II |
| 5 | X | -- | -- | Short circuit (mechanical strength) | 625.ld; Table II; Table VI (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 | Start and stop | 503.1c; 3.4.1; 3.4.2.3 |
| 7 | X | -- | -- | Over-speed | 505.lb; 3.4.2.1; Table VI; (At 105 percent of rated speed for 5 minutes) |
| 8 | X | X | -- | Over-speed protective device | 505.2b; 3.9.2.1; 4.4.1.2.3 |
| 9 | X | X | -- | Frequency and voltage regulation, stability and transient response (short term) | 608.1b; 3.9.3.2; 3.9.3.4; Table II |
| 10 | X | -- | -- | Frequency and voltage stability (long term) | 608.2a; 3.9.3.3; Table II; Table VI |
| 11 | X | -- | -- | Voltage unbalance with unbalanced load (line to neutral load) | 620.1b; Table II; Table VI |
| 12 | X | -- | X | Voltage waveform (harmonic analysis) | 601.4b; Table II |

Table V. Test schedule. 1/ – Continued

| Test Number | First Article Inspection<br>A | Quality Conformance<br>B | Sample Inspection<br>C | Test<br>D | Test Method Requirement Paragraph (MIL-STD-705 and/or Test Paragraph)<br>E |
|---|---|---|---|---|---|
| | | | | Generator Set (continued) | |
| 13 | X | -- | X | Voltage modulation | 602.1b; Table II |
| 14 | X | -- | -- | Voltage and frequency regulation | 614.1b; 3.9.3.1; Table II; Table VI |
| 15 | X | -- | X | Phase balance (voltage) | 508.1d (508.1.2 only); Table II; Table VI |
| 16 | X | X | -- | Circuit interrupter (short circuit) | 512.1d (Oscillograph on First Article only); 3.10.1 Table IV |
| 17 | X | X | -- | Circuit interrupter (overload current) | 512.2d; Table IV |
| 18 | X | X | -- | Circuit interrupter (over voltage and under voltage) | 512.3d; Table IV |
| 19 | X | X | -- | Indicating instrument (electrical) | 513.1d; Table IV |
| 20 | X | X | -- | Under speed protective device | 506.1b; Table IV |
| 21 | X | X | -- | Low oil pressure protective device | 515.1b; 3.9.2.4;.4.1.2.2 |
| 22 | X | X | -- | Over-temperature protective device | 515.2b; 3.9.2.2; 4.4.1.2.1 |
| 23 | X | X | -- | Phase sequence (rotation) | 507.1d; Table II |
| 24 | X | X | -- | Start and stop (remote control) | 503.2c; 3.4.1; 3.11.5; 4.4.1.2.11 |
| 25 | X | X | -- | Preliminary check run | 3.4.1; 4.4.1.2.4 |
| 26 | X | X | -- | Automatic start | 3.4.1; 3.11; 4.4.1.2.5 |
| 27 | X | X | -- | Normal operation check | 3.4.1; 3.4.2; 3.11; 4.4.1.2.6 |
| 28 | X | X | -- | Full load start | 3.4.1; 4.4.1.2.7 |

Table V. Test schedule. 1/ – Continued

| | First Article Inspection | Quality Conformance | Sample Inspection | Test | Test Method (MIL-STD-705 and/or Test Paragraph) Requirement Paragraph |
|---|---|---|---|---|---|
| Test Number | A | B | C | D | E |
| | | | | Generator Set (continued) | |
| 29 | X | X | -- | Braking test | 3.7; 3.17; 4.4.1.2.8; (6% grade required on First Article only); |
| 30 | X | X | -- | Battery charging system | 3.9.1.1.1; 4.4.1.2.10 |
| 31 | X | -- | -- | DC rated load | Table III; Table VI |
| 32 | X | -- | -- | DC overload | Table III; Table VI |
| 33 | X | -- | -- | DC current limit | Table III; Table VI |
| 34 | X | -- | -- | DC regulation | Table III; Table VI |
| 35 | X | -- | -- | Ripple voltage | 650.1b; Table III; Table VI |
| 36 | X | -- | -- | High temperature at 125° F (51.7° C) | 710.1d; Table II; Table VI |
| 37 | X | - | -- | Overload (AC) | 3.5.1.2; Table VI |

1/ See 4.2.

TABLE VI. First article tests. 1/

| Title | Test parameters | Applicable paragraph or table |
|---|---|---|
| Short circuit test | Perform at rated voltage and frequency | Table II; Table V |
| Over-speed test | Perform as specified | 3.4.2.1; Table V |
| Frequency and voltage stability test (long term) | Perform at rated voltage and frequency | 3.9.3.3; Table II; Table V |
| Voltage unbalance with unbalanced load | Perform at rated voltage and frequency | Table II; Table V |
| Voltage and frequency regulation test | Perform at rated voltage and frequency | 3.9.3.1; Table II; Table V |
| Phase balance (voltage) test | Perform at rated voltage and frequency | Table II; Table V |
| High temperature test (temperature rise) | Perform at rated voltage and frequency and at ambient temperature of 125° F | Table II; Table V |
| Overload test (ac generator) | Perform at rated voltage and frequency and at ambient temperature of 125° F 2/ | 3.5.1.2; Table V |
| DC power unit (transformer-rectifier) test | Perform the following tests at an ambient temperature of 125° F | |
| .. Rated load test | 200 amperes at 28 ± 1 VDC for 2 hours | Table III; Table V |
| .. Overload test | 300 ± 50 amperes at 28 ± 1 VDC for 5 minutes | Table III; Table V |
| .. Current limit test | Output current shall be self-limiting at 300 ± 50 Amperes at 28 VDC | Table III; Table V |
| .. Regulation test | Regulation from no-load to full load and full load to no-load shall not exceed ± 1.5 VDC | Table III; Table V |
| .. Ripple voltage test | The output ripple voltage at 200 Amperes at 28 VDC load and VDC shall not exceed 5%. | Table III; Table V |

1/ See 4.3.3.
2/ CAUTION: Exercise care to avoid excessive exhaust temperature on the turbine engine.

Table VII. Schedule of optional tests. 1/

| Test Number | Test | Test Method (MIL-STD-705) Test Paragraph | Requirement Paragraph |
|---|---|---|---|
| 1a | Rain | 711.3c (To include 45 degrees) | 3.4.1c |
| 2a | Inclined operation | 660.1d | 3.4.1d |
| 3a | Fuel consumption | 670.1b | 3.5.4 |
| 4a | Starting and operating (moderate cold Battery start) | 701.2d at -25° F (-31.7° C) | 3.4.1 |
| 5a | Audio noise | 4.6.2 | 3.5.5 |
| 6a | Altitude operation (before reliability) | 720.1d (at 10,000 feet, 77° F (25° C)) | 3.4.1 |
| 7a | Endurance | 690.1d; 4.6.9 | 3.3.2 |
| 8a | Reliability | 695.1a; 4.6.9 | 3.3.1 |
| 9a | Altitude operation (after reliability) | 720.1d (At 10,000 feet, 77° F (25° C)) | 3.4.1 |
| 10a | Mobility | 4.6.7 | 3.7 |
| 11a | Railroad impact | 740.5c; 4.6.3 | 3.4.3.1 |
| 12a | Drop (end) | 740.3c; 4.6.4 | 3.4.3.1 |
| 13a | Air transportability | 4.6.6 | 3.6 |
| 14a | Maintainability demonstration | 4.6.8 | 3.3 |
| 15a | Humidity | 711.1d | 3.4.4 |
| 16a | Electromagnetic interference | 4.6.5 | 3.14 |

1/ See 4.5.2.

Table VIII. Endurance test. 1/

| 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) |
| 4 | 1 hour | 75 percent rated electrical output (AC + air) |
| 5 | 1 hour | 75 percent rated electrical output (DC + air) |
| 6 | ¾ hour | 60 percent rated electrical output (AC + air) |
| 7 | ¾ hour | 50 percent rated electrical output (AC + air) |
| 8 | ½ hour | 25 percent rated electrical output (DC + air) |
| 9 | ½ hour | 25 percent rated electrical output (DC + air) |
| 10 | 2 ½ hours | Alternate periods as follows: |
| 10a | 5 minutes | Electrical overload rating 3.5.1.2a |
| 10b | 5 minutes | No load |
| 10c | 5 minutes | Electrical overload rating 3.5.1.2b |
| 10d | 5 minutes | No load |
| 10e | 5 minutes | Electrical overload rating 3.5.1.2c |
| 10f | 5 minutes | No load |

1/ See 4.6.9.1.

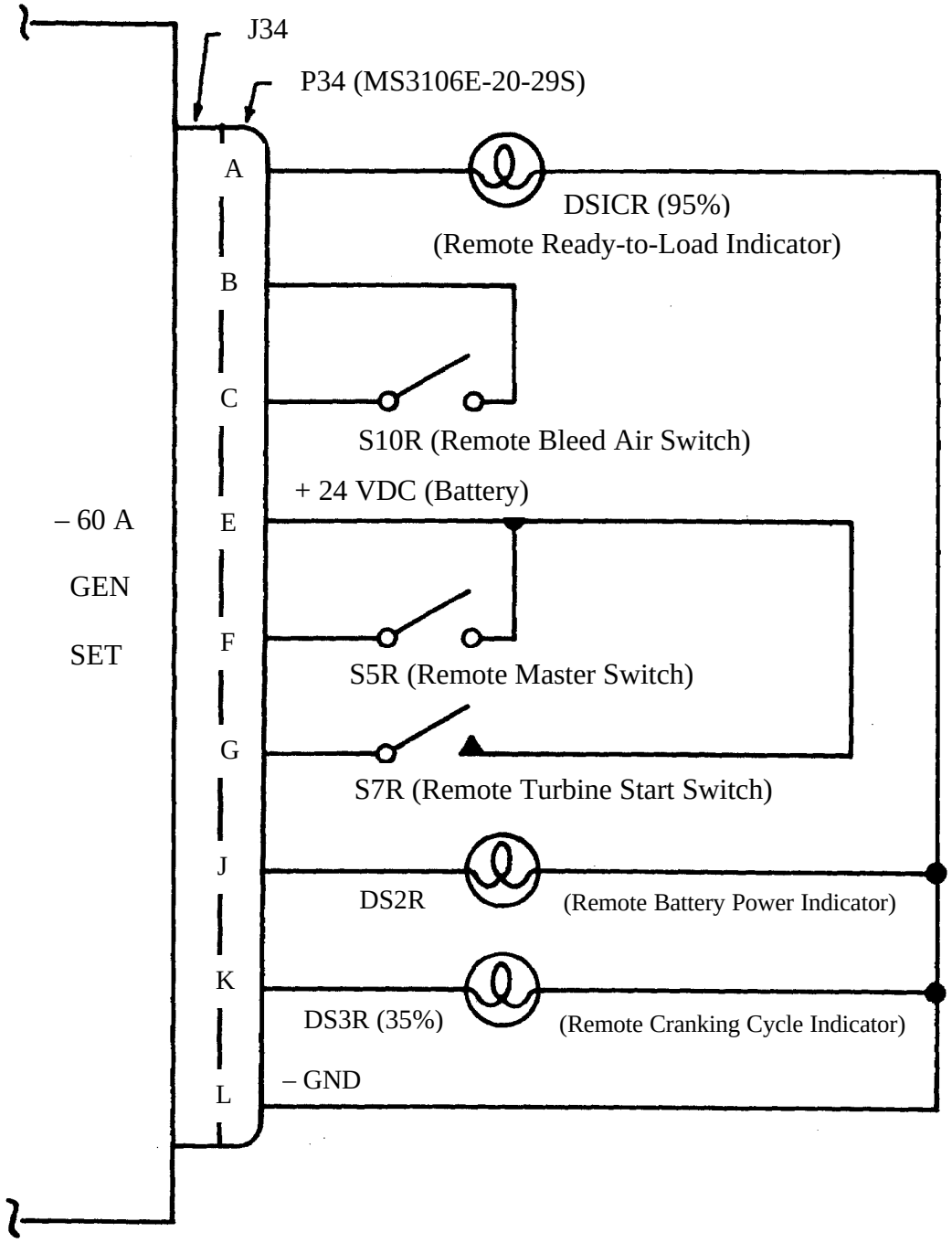


FIGURE 1. Remote control test circuit.

Custodian:
Navy – YD
Air Force – 99

Review Activity:
Navy – AS

Preparing Activity:
Air Force – 84

Agent:
Air Force – 99

(Project Number 6115-0809)

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| **I RECOMMEND A CHANGE:** | **1. DOCUMENT NUMBER** MIL-DTL-38195D | **2. DOCUMENT DATE *(YYYYMMDD)*** |
|---|---|---|

**3. DOCUMENT TITLE** GENERATOR SET, GAS TURBINE ENGINE, 60 kW 400 Hz, GENERAL PURPOSE

**4. NATURE OF CHANGE** *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

**5. REASON FOR RECOMMENDATION**

**6. SUBMITTER**

| **a. NAME** (Last, First, Middle Initial) | **b. ORGANIZATION** | |
|---|---|---|
| **c. ADDRESS** (Include Zip Code) | **d. TELEPHONE** (Include Area Code)<br>(1) Commercial:<br>(2) DSN:<br>(3) FAX:<br>(4) EMAIL: | **7. DATE SUBMITTED *(YYYYMMDD)*** |

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