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PERFORMANCE SPECIFICATION

GENERATOR, ALTERNATING CURRENT (650 AMPERE RECTIFIED), 28 VOLTS DIRECT CURRENT (OIL COOLED)

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

1. SCOPE

1.1 Scope. This specification covers a 28 Volt (V) alternating current (ac) direct current (dc), oil cooled generator with integral rectifier, referred to herein as "alternator". The alternator provides regulated output at any engine load up to 500 amperes (A) at any engine speed between 2000 and 2400 revolutions per minute (rpm), and at any load up to 650 A at any speed between 2400 and 8000 rpm, when its field excitation is controlled by a solid-state regulator (see 6.1).

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 requirement 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: U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BLUE, Warren, MI 48397-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A FSC 6115

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 of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

F-F-351	- Filters and Filter Elements, Fluids Pressure: Lubricating Oil, Bypass and Full Flow.
A-A-52557	- Fuel Oil, Diesel, for Posts, Camps, and Stations.

DEPARTMENT OF DEFENSE

MIL-L-2104	- Lubricating Oil, Internal Combustion Engine, Combat/Tactical Service.
MIL-L-21260	- Lubricating Oil, Internal Combustion Engine, Preservative and Break-In.
MIL-L-46167	- Lubricating Oil, Internal Combustion Engine, Arctic.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-462	- Measurement of Electromagnetic Interference Characteristics, Test Method Standard for.
MIL-STD-810	- Environmental Test Methods and Engineering Guidelines.

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-454	- General Guidelines for Electronic Equipment.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DRAWINGS

ARMY

10882774	- Cradle.
11655426	- Engine and Transmission Assembly.
11655469	- Generator, AC-DC (Oil Cooled).
11682700	- Engine, Diesel.
11682722	- Coupling.
11684057	- Support.
12354334	- Regulator, Voltage, DC.

(Copies of these drawings are available from the U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E/BLUE, Warren, MI 48397-5000.)

2.3 Non-Government publications. The following documents form 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 STANDARD INSTITUTE (ANSI)

ANSI/ASQC Z1.4	- Sampling Procedures and Tables for Inspection by Attributes (DoD Adopted).
ANSI/NCSL Z540-1	- General Requirements for Calibration Laboratories and Measuring Test Equipment (DoD Adopted).

(Application for copies should be addressed to American National Standard Institute, 11 West 42nd Street, New York, NY 10036.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, 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 and 6.4), samples shall be subjected to first article inspection in accordance with 4.4.

3.2 Materials. Materials shall be as specified herein, in applicable specifications, and on applicable drawings. Materials not specifically designated shall be suitable for use in the alternator conforming to the specified requirements (see 4.7.1).

3.2.1 Material compatibility. All materials used in the alternator shall be compatible with fluids per MIL-L-2104, MIL-L-21260, MIL-L-46167, and A-A-52557 (see 4.7.1).

3.2.2 Dissimilar metals. Except where necessary to complete an electrical circuit, contact between dissimilar metals which would encourage galvanic action shall be avoided. Separation of dissimilar metals shall be accomplished by providing insulation between mating surfaces (see 4.7.1).

3.2.3 External surfaces. All external surfaces shall be corrosion resistant (see 4.7.1).

3.2.4 Fungicidal materials. All nonmetallic materials shall be inherently fungicidal or treated to resist fungus growth except when used for components of potted compounds or otherwise moisture sealed assemblies (see 4.7.1).

3.2.5 Standard parts. Military standard parts shall be used wherever possible (see 4.7.1).

3.2.6 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Design and construction. The alternator shall conform to dimensions and requirements shown on Drawing 11655469. Further, MIL-HDBK-454 may be used for guidance (see 4.7.1 and 4.7.2).

3.3.1 Interchangeability. All alternators shall be interchangeable with respect to installation and performance. The alternator, after manufacture or overhaul, shall not require any adjustment at the time of installation. To provide for interchangeability, the assembly fabricated in accordance with this specification shall have external dimensions conforming to the Drawing 11655469. Electrical connectors, mounting dimensions, and locations shall conform to the detail requirements of 11655469. Contact designation shall conform to requirements of 11655469 (see 4.7.1 and 4.7.2).

3.3.2 Installation compatibility. The alternator shall fit and perform as specified when installed on an AVDS1790-2C engine (Drawing 11682700) for trial in an M60A1-RISE tank (see 4.7.1 and 4.7.2).

3.3.3 Regulator. The alternator shall function as specified with regulators depicted on Drawing 12354334 (see 4.7.1).

3.3.4 Weight. The weight of the alternator shall be not greater than 100 pounds (lbs) (see 4.7.3).

3.4 Performance.

3.4.1 Operating conditions. Unless otherwise specified (see 6.2), the alternator shall perform as specified herein under the following conditions (see 4.7.4):

a. Coolant oil

1. For ambient conditions of minus (-) 10 to plus (+) 225 degrees Fahrenheit (°F) (-23.3 to +107 degrees Celsius (°C)), oil used shall be in accordance with MIL-L-2104 as follows:

Ambient temperature	Grade of oil
-10 to +40°F (-23.3 to 4.4°C)	10
32 to 90°F (0 to 32.2°C)	30
60°F or above (15.6°C or above)	50

2. For ambient conditions of -25 to 0°F (-31.7 to -17.8°C), oil used shall be in accordance with MIL-L-46167.

b. Ambient temperatures:

1. Room ambient 80°F ± 20°F (26.7 ± 11°C).
2. Low temperature ambient -25°F ± 5°F (-31.7 ± 2.8°C).
3. High temperature ambient +225°F ± 5°F (107 ± 2.8°C).

c. Alternator inlet oil temperature range from -25°F ± 5°F (-31.7 ± 2.8°C) to +225°F ± 5°F (107 ± 2.8°C).
d. Alternator inlet oil pressure range from -0.385 pounds per square inch (psi) (-2.7 Kilopascals (kPa)) to 45 psi (310 kPa).
e. Rated output power: 650 ampere @ 28 Volts (V) direct current (dc).
f. AC signal load (L1) 1k ± 5 percent (%); 3 watt (W). resistor.

g. Current transformer (CT) signal load (L2) 40 ± 1%; 3W. resistor.
h. Signal loads (see figure 9): The alternating current (ac) signal load at L1 shall be 1 kilo-ohm ± 5% with a 3W resistor. CT signal load at L2 shall be 40 ohms ± 1% with a 3W resistor.
i. Room temperature: 80 ± 20°F (26.7 ± 11°C).

3.4.2 Overspeed. The alternator shall not be damaged when operated at 10 000 rpm for 1 minute (see 4.7.5).

3.4.3 Maximum field voltage. With the alternator not operating, the alternator's field shall not be damaged by application of maximum potential 22 V dc for 30 minutes (see 4.7.6).

3.4.4 Field resistance. The alternator control field resistance shall be 1.80 ± 0.25 ohms at room ambient temperature (see 4.7.7).

3.4.5 Output power. With the alternator providing output power of 650 A at 28 V dc, the field current shall be not greater than 4.25 A at 2400 rpm, and 3.15 A at 8000 rpm (see 4.7.8).

3.4.6 Ripple voltage. Ripple voltage shall not be greater than 4 V, peak to peak, with output voltage of 28 V dc (see 4.7.9).

3.4.7 Overload output current. The alternator shall not be damaged by an output load of 800 ± 25 A at not less than 23 V dc for 30 seconds. The field current shall be not greater than 4 A (see 4.7.10).

3.4.8 AC signal. With 20 ± 2 V dc applied to the field terminals, the ac signal level shall be 7.1 ± 0.5 V root mean square (rms) at an alternator speed of 900 rpm, and 8.9 ± 0.5 V rms at a speed of 1100 rpm (see 4.7.11).

3.4.9 CT signal. The CT signal level shall be 2.8 + 0.2, -0.3 V rms at 650 A load at 8000 rpm (see 4.7.12).

3.4.10 Alternator oil system. The alternator shall be equipped with a self-contained oil pump with a pressure regulator valve. The oil system shall produce a cooling oil flow of not less than 2.35 gallons per minute (gal/min) (0.15 Liter per second (L/s)), nor greater than 6.0 gal/min (0.38 L/s). The alternator oil pump outlet pressure shall be not greater than the proof pressure (see 4.7.13).

3.4.11 Transient load. The alternator, when subjected to transient loads, shall meet the performance requirements specified in figure 1 (see 4.7.14).

3.4.12 Efficiency. The efficiency of the alternator shall be not less than 65% (see 4.7.15).

3.4.13 Proof pressure. The alternator cooling system shall withstand a 200 psi (1379 kPa) pressure for a period of 5 minutes without evidence of permanent deformation or rupture. The leakage rate shall be not greater than a pressure drop of 10 psi (69 kPa) in 1 minute (see 4.7.16).

3.4.14 Endurance. The alternator shall withstand operation for the time specified in table I, with output voltage and speed/load conditions as specified therein. During this time the alternator shall require no servicing or replacement of parts (see 4.7.17).

3.4.14.1 System volts (see table I, normal attitude). System volts shall be applicable at 225°F (107°C). Voltage values at lower temperatures shall be in accordance with figure 2.

3.4.14.2 Operating time. At the conclusion of 22 cycles at normal attitude, the alternator shall be operated for 8 hours (hrs) at condition (a) and 4 hrs at condition (b), except with alternator constant load, only; followed by 2 cycles of inclined attitude.

3.4.14.3 Operating conditions. The total time, 3000 hrs, shall be run with alternator oil inlet pressures as follows:

1st 600 hrs at -0.385 ± 0.03 psi (-2.7 ± 0.2 kPa).
2nd 600 hrs at 45 ± 2 psi (310 ± 13.8 kPa).
3rd 600 hrs at -0.385 ± 0.03 psi (-2.7 ± 0.2 kPa).
4th 600 hrs at 45 ± 2 psi (310 ± 13.8 kPa).
5th 600 hrs at -0.385 ± 0.03 psi (-2.7 ± 0.2 kPa).

3.4.15 External oil leakage. The alternator shall not exhibit oil loss to external surfaces which at any location is greater than a loss of fluid of one drop (see 6.3) per hour (see 4.7.18).

3.4.16 Torsion.

3.4.16.1 Natural frequency. The natural torsional resonant frequency of the rotor and shafting system shall be 100 to 140 hertz (Hz) (see 4.7.19.1).

3.4.16.2 Vibratory torque. The alternator shall withstand a vibratory torque of 3600 inch-pounds (in.-lbs) (406.7 Newton meter (N.m)) double amplitude, maximum positive torque to be not greater than 2100 in.-lbs (237.3 N.m), at a frequency not greater than 25 Hz or less than 20 Hz for a period producing 12 000 torque reversals (see figure 3 and 4.7.19.2).

3.4.16.3 Torsional application. The alternator shall successfully withstand operation on an engine-transmission assembly (see 6.4) as specified in 4.7.19.3. There shall be no degradation of the system drive train elements or of the engine-transmission assembly performance. The alternator shall subsequently meet 3.4.2 through 3.4.10.

3.5 Environmental. The alternator shall perform as specified herein after meeting the extreme conditions of the military environment (see 4.7.20).

3.5.1 High temperature. While in an ambient temperature of 225 ± 5°F (107 ± 2.8°C), the alternator shall meet the performance requirements of 3.4.2 through 3.4.10 (see 4.7.20.1).

3.5.2 Low temperature.

3.5.2.1 Cold soak. While in an ambient temperature of -25 ± 5°F (-31.7 ± 2.8°C) with an oil inlet pressure of 45 pounds per square inch gage (psig) (310 kPa), the alternator shall meet the performance requirements of 3.4.2, 3.4.5, 3.4.8, and 3.4.9. The alternator oil pump outlet pressure shall not exceed the proof pressure (see 4.7.20.2.1).

3.5.2.2 High viscosity oil. The alternator shall withstand operation in the intended application using grade 10 oil of MIL-L-2104 while at an ambient temperature of -10 ± 2°F (-23.3 ± 1°C). This condition represents the highest viscosity oil of the application. There shall be no indications of failure, fractures, distortions, erosion, internal oil leakage, or other evidence of deterioration. External oil leakage shall conform to 3.4.15 (see 4.7.20.2.2).

3.5.3 Shock. The alternator shall withstand a shock pulse of 20 gravity units for 11 milliseconds (ms) (saw tooth wave) (see 4.7.20.3).

3.5.4 Vibration. The alternator shall withstand exposure to input vibration levels outlined in figures 4, 5 and 6 for a period of 100 minutes in each of the mutually perpendicular axes (see 4.7.20.4).

3.5.5 Fungus. The alternator shall not be adversely affected by fungi under conditions favorable for their development (see 4.7.20.5).

3.5.6 Corrosion. The alternator shall resist the effects of a salt atmosphere (see 4.7.20.6).

3.5.7 Humidity. The alternator shall withstand subjection to a humid environment (see 4.7.20.7).

3.5.8 Waterproofness. The alternator shall be capable of maintaining of differential pressure of nitrogen at 10 psig (69 kPa). The leakage rate shall be not greater than 3 psig (20.7 kPa) in 2 minutes (see 4.7.20.8).

TABLE I. Endurance time schedule and conditions.

Condition	Time (hours)	Alternator (rpm)	Normal attitude: System (V)	Alternator constant load (A)	Resistive cyclic load (A)	Total alternator (A)	Load cycles (minutes)	Cyclic load (seconds) on	Cyclic load (seconds) off
a.	1.5	2400	26.50 ± 0.75	320	330	650	90	3	57
b.	7.5	5120	26.50 ± 0.75	320	330	650	450	3	57
c.	14.5	3520	26.50 ± 0.75	320	330	650	870	3	57
d.	0.5	8000	26.50 ± 0.75	650	0	650	0		
	24 hrs per cycle								
			Inclined attitude						
e.	9	2400	----------no. load----------						
f.	9	4000							
g.	9	5000							
h.	3	6000							
	30 hrs per cycle								

3.5.9 Electromagnetic interference. The alternator's broad-band conducted and radiated emissions shall be not greater than the limits of figures 7 and 8 (see 4.7.20.9).

3.6 Identification marking. The alternator assembly shall be marked legibly and permanently (see 4.5.2 and 4.7.2).

3.6.1 Nameplate. The alternator assembly shall have a nameplate affixed to the exterior of the alternator frame in a location specified on the drawing. All nameplates shall include the following information (see 4.5.2 and 4.7.2):

"Generator, Alternating Current, Direct Current (Oil Cooled)",
"28 V dc",
"650 A",
Military part number,
Federal stock number,
Manufacturer's identification (FSCM),
Manufacturer's serial number,
Contract number, and
Date of manufacture.

3.7 Workmanship. The workmanship shall be such as to assure a product free of rust, burrs, and scratches. All solder cleaning agents and flux shall be chemically neutralized and removed after soldering. Manufacturing methods shall not cause degradation of the inherent reliability and durability of the alternator (see 4.5.2 and 4.7.2).

4. VERIFICATION

4.1 Inspection equipment. Unless otherwise specified in the contract (see 6.2), the contractor is responsible for the provision and maintenance of all inspection equipment necessary to assure that supplies and services conform to contract requirements. Inspection equipment must be capable of repetitive measurements to an accuracy of 10% of the measurement tolerance. Calibration of inspection equipment shall be in accordance with ANSI/NCSL Z540-1.

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

a. First article inspection (see 4.4).
   1. Preproduction inspection (PPI) (see 4.4.1).
   2. Initial production inspection (IPI) (see 4.4.2).

b. Conformance inspections (see 4.5).
   1. Examination (see 4.5.2).
   2. Test (see 4.5.3).

c. Control tests (see 4.6).

4.3 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions:

a. Air temperature 80 ± 20°F (26.7 ± 11°C).
b. Barometric pressure 28.5 (+2.0, - 3.0) inches of mercury (Hg) (96.5 (+6.8, -10) kPa).
c. Relative humidity 50 ± 30%.

4.4 First article inspection. First article inspections shall be performed on preproduction or initial production samples as specified herein. Approval of the first article sample by the Government shall not relieve the contractor of the obligation to supply alternators that are fully representative of those inspected as a first article sample. Any changes or deviation of the production units from the first article sample shall be subject to the approval of the contracting officer.

4.4.1 Preproduction inspection. When specified (see 6.2), the preproduction sample shall consist of two alternators. Preproduction inspection shall consist of inspection as specified in table II.

4.4.2 Initial production inspection. Unless otherwise specified (see 6.2), the Government shall select two units, from the first ten alternators produced under the production contract for initial production inspection. Initial production units shall be inspected as specified in table II.

TABLE II. Classification of inspections.

Title	Requirement	Inspection	First Article Inspections				Conformance		Control	
			PPI samples		IPI samples		Examination	Test (100%)	1/50	1/100
			1	2	1	2				
Materials & construction	3.2 thru 3.3.3	4.7.1	X		X				X	
Defects (see table III & 4.7.2)	3.3, 3.3.2 & 3.6 thru 3.7	4.7.2	X		X		X		X	
Weight	3.3.4	4.7.3	X	X	X	X			X	
Overspeed	3.4.2	4.7.5	X	X	X	X		X		
Field voltage	3.4.3	4.7.6	X	X	X	X			X	
Field resistance	3.4.4	4.7.7	X	X	X	X		X		
Output current	3.4.5	4.7.8	X	X	X	X		X		
Ripple voltage	3.4.6	4.7.9	X	X	X	X				
Acceptance		4.7.9.1						X		
Overload output current	3.4.7	4.7.10	X	X	X	X				
Alternating current signal	3.4.8	4.7.11	X	X	X	X		X		
Current transformer signal	3.4.9	4.7.12	X	X	X	X		X		
Acceptance		4.7.12.1					X			
Alternator oil system	3.4.10	4.7.13	X	X	X	X	X	X		
Transient load	3.4.11	4.7.14	X		X					
Efficiency	3.4.12	4.7.15	X		X					
Proof pressure	3.4.13	4.7.16	X	X	X	X			X	
Acceptance		4.7.16.1						X		
Endurance	3.4.14	4.7.17	X							
On vehicle		4.7.17.1	X		X			X		
Control		4.7.17.2							X	
External oil leakage	3.4.15	4.7.18							X	
Torsion	3.4.16	4.7.19								
Natural frequency	3.4.16.1	4.7.19.1	X							
Vibratory torque	3.4.16.2	4.7.19.2	X							
Torsional application	3.4.16.3	4.7.19.3	X							
Environmental	3.5	4.7.20	X		X					
High temperature	3.5.1	4.7.20.1	X		X					X

TABLE II. Classification of inspections - Continued.

Title	Requirement	Inspection	First Article Inspections				Conformance		Control	
			PPI samples		IPI samples		Examination	Test (100%)	1/50	1/100
			1	2	1	2				
Low temperature	3.5.2	4.7.20.2	X		X					X
Cold soak	3.5.2.1	4.7.20.2.1								
High viscosity oil	3.5.2.2	4.7.20.2.2								
Shock	3.5.3	4.7.20.3	X		X				X	
Control		4.7.20.3.1								
Vibration	3.5.4	4.7.20.4	X		X				X	
Control		4.7.20.4.1								
Fungus	3.5.5	4.7.20.5	X							
Corrosion	3.5.6	4.7.20.6	X							
Humidity	3.5.7	4.7.20.7	X							
Waterproofness	3.5.8	4.7.20.8	X	X	X	X				
Electromagnetic	3.5.9	4.7.20.9				X				

4.5 Conformance inspection.

4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the alternators of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.5.1.2 Sampling for examination. Samples for conformance examination shall be selected in accordance with ASQC/ANSI Z1.4.

4.5.2 Examination. Each sample selected in accordance with 4.5.1.2 shall be examined for defects listed in table III.

4.5.3 Tests (100%). Each alternator assembly shall be subjected to the conformance tests specified in table II.

4.6 Control tests.

4.6.1 Inspection frequency. One in fifty (1/50) control tests shall be conducted on one alternator from each lot of 50 units consecutively produced or on one alternator every two months, whichever occurs first.

TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
Major:		
101	Nonconformance in design and construction (see 3.3).	Visual & SIE 1/
102	Nonconformance in external dimensions affecting interchangeability (see 3.3.1).	SIE
103	Incompatibility of alternator installation in M60 tank (see 3.3.2).	SIE
Minor:		
201	Nonconformance in external dimensions not affecting interchangeability (see 3.3.1).	SIE
202	Improper identification marking (see 3.6).	SIE
203	Incorrect information on nameplate (see 3.6.1).	Visual
204	Improper location of nameplate (see 3.6.1).	Visual
205	Faulty workmanship (see 3.7).	Visual

1/ SIE = Standard Inspection Equipment.

4.6.2 Inspection frequency. Other than one in fifty control tests shall be conducted on one alternator, at the interval specified in table II, from either the first 10 units produced for the interval stipulated or the last 10 units produced from the preceding interval.

4.7 Methods of inspection.

4.7.1 Materials and construction. Conformance to 3.2 through 3.3.3 shall be determined by inspection of contractor records providing proof or certification that design, construction, processing, and materials conform to requirements. Applicable records shall include drawings, specifications, design data, receiving inspection records, processing and quality control standards, vendor catalogs and certifications, industry standards, test reports, and rating data.

4.7.2 Defects. Conformance to 3.3, 3.3.2, 3.6 and 3.7 shall be determined by examination for the defects listed in table III. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.7.3 Weight. To determine conformance to 3.3.4, weigh the alternator without oil in the unit.

4.7.4 Performance conditions. Unless otherwise specified, tests shall be conducted under the following conditions: Performance tests shall be run at room ambient temperature. Oil Inlet temperature to the alternator shall be maintained at 225 ± 5°F (107 ± 2.8°C). Alternator coolant oil shall be MIL-L-2104 Grade 30. Inlet oil supply pressure (P_3) to be 45 ± 2 psi (310 ± 13.8 kPa) and the alternator outlet pressure (P_2) not to exceed 5 psi (34.5 kPa). Performance test shall be conducted with the alternator at a stabilized temperature. The alternator shall be considered to be temperature stabilized when constant conditions of speed and load current fail to cause a change in alternator oil inlet and outlet differential temperature by more than 2°F (-16.7°C) during a 10 minute period. The loads shall be resistive and variable to allow 1000 amperes maximum. A set of six batteries military type (TL) shall be connected in a series parallel combination for a nominal 24 V dc operation.

NOTE: Waterproofness 4.7.20.8, proof pressure 4.7.16, and overspeed 4.7.5 tests shall be performed prior to other tests.

4.7.5 Overspeed. To determine conformance to 3.4.2, operate the alternator at 10 000 rpm with open field for a period of 1 minute (see figure 9 and 3.4.15).

4.7.6 Field voltage. To determine conformance to 3.4.3, with the alternator not operating, apply a field supply voltage of 22 V dc (E_F) to the alternator field pin, A-to-C, at the J2 connector for 30 minutes (see figure 9 and 3.4.15).

4.7.7 Field resistance. To determine conformance to 3.4.4, measure the alternator field resistance between terminals A and C on the J2 connector with the power supply disconnected (see figure 9 and 3.4.15).

4.7.8 Output current. To determine conformance to 3.4.5, the alternator shall operate with output power of 650 A (I_A) at 28 V dc (E_A). The field current (I_F) shall be measured (see figure 9).

4.7.9 Ripple voltage. To determine conformance to 3.4.6, connect the alternator into a test circuit such as is shown in figure 10 and measure ripple voltage at ES at the following conditions. Verify that the ripple voltage is not greater than 4 V for each condition.

rpm	Load (amperes)	Regulated volts	Ripple volts (+peak -peak)	Ripple volts (peak to peak)
3000	50	28 ± 0.5		
3000	650	28 ± 0.5		
8000	50	28 ± 0.5		
8000	650	28 ± 0.5		

4.7.9.1 Acceptance. With the alternator connected as shown in figure 10, the following readings shall be recorded at 8000 rpm and 650 A as follows:

rpm	Load (A)	Regulated V	Ripple V (+peak -peak)	Ripple V (peak to peak)
8000	650	28 ± 0.5		

4.7.10 Overload output current. To determine conformance to 3.4.7, operate the alternator at 5000 rpm with output power of 800 ± 25 A (I_A) at not less than 23 V dc (E_A) for 30 seconds. Measure the field current (I_F). At the conclusion and prior to further testing, cool the alternator for 5 minutes by operating at 5000 rpm with battery load only (see figure 9 and 3.4.15).

4.7.11 Alternating current (AC) signal. To determine conformance to 3.4.8, apply 20 ± 2 V dc to the alternator field at pin C-to-pin A at the J2 connector and measure the AC signal voltage (E_{AC}) at pin A-to-pin C at the J1 connector, at alternator speed of 900 rpm and 1100 rpm (see figure 9 and 3.4.15).

4.7.12 Current transformer (CT) signal. To determine conformance to 3.4.9, operate the alternator at 8000 rpm with a power output of 650 A (I_A) and 28 V dc (E_A). Measure the CT signal (E_{CT}) at the J1 connector from pin B to pin C (see figure 9).

4.7.12.1 Acceptance. Operate the alternator as in 4.7.12, and measure the CT signal at the J2 connector from pin B to pin C (see 3.4.15).

4.7.13 Alternator oil system. To determine conformance to 3.4.10, with no electrical load, and with alternator speed, alternator outlet pressure (P2), and oil inlet pressure (P3) as follows, measure oil flow (F1) and pump outlet pressure (P1) (see figure 9 and 3.4.15).

Test	Alternator speed (rpm)	Alternator outlet pressure (P2)	Alternator oil inlet pressure (P3)
1	2000 and 8000	5 psi (34.5 kPa) maximum	-0.385 ± 0.03 psi (-2.7 ± 0.2 kPa)
2	2000 and 8000	5 psi (34.5 kPa) maximum	45 ± 2 psi (310 ± 13.8 kPa)

4.7.14 Transient load. To determine conformance to 3.4.11, record voltage (E_A) and current (I_A) on an oscillograph tape. While connected in a test circuit as in figure 10, subject the alternator to ten motor load applications and removals at 2400 rpm and 8000 rpm, and at each speed per figure 1. Oscillograph galvanometer response from 0 to 2000 Hz shall be flat within ± 5.0%.

4.7.15 Efficiency. To determine conformance to 3.4.12, with the alternator speed at 8000 rpm, the output current at 650 A, the output voltage at 28 V dc (measured at the alternator terminals), the inlet oil temperature at 225°F (107°C), and the temperature at room ambient (see 3.4.1); connect the alternator as shown on figure 9, and obtain the efficiency by use of a suitable test stand. Calculate the efficiency as follows:

$$\text{Efficiency (n)} = \frac{0.001341\ E_A \times I_A \times 100}{S_{HP}}$$

n = Efficiency at terminals in %.
E_A = Alternator terminal voltage.
I_A = Alternator current in A.
S_{HP} = Shaft horsepower input to alternator measured by a dynamometer or by test stand calibration.

4.7.16 Proof pressure. To determine conformance to 3.4.13, cap and seal the oil inlet port of the alternator. Connect a regulated supply of dry nitrogen to the oil outlet port. Pressurize to 200 psi (1379 kPa) for 5 minutes. With the nitrogen supply turned off, verify that the pressure drop is not greater than 10 psi (69 kPa) in 1 minute.

4.7.16.1 Acceptance. With the oil inlet capped and sealed, connect a regulated supply of dry nitrogen to the oil outlet port. Pressurize to 150 psi (1034 kPa), and shut off the supply. Verify that the pressure drop is not greater than 10 psi (69 kPa) in 1 minute.

4.7.17 Endurance. To determine conformance to 3.4.14, subject the alternator to 3000 hrs of operation per table I (five 600 hrs cycles) at constant and cyclic loads, in accordance with the following conditions:

a. Oil shall be per MIL-L-2104.
b. Oil shall be contaminated with soft C-2A per F-F-351, according to table IV.
c. Total internal oil leakage shall be no greater than 91.5 cubic inches (in^3) (1500 cubic centimeters (cm^3)).
d. Internal oil leakage during any 600 hrs cycle shall be no greater than 24.4 in^3 (400 cm^3).
e. External oil leakage shall not be greater than one drop (see 6.3) per hour exhibited by alternator.
f. Ambient temperature shall be 225 ± 5°F (107 ± 2.8°C), except as specified in (g).
g. Inclined operation shall be at room temperature, with alternator motor driven at no load and not excited during the last 60 hrs of each 600 hrs cycle, and with alternator drive and tilted down 45° from horizontal for 30 hrs and tilted up 45° from horizontal for 30 hrs.

TABLE IV. Oil contamination.

Test hours	Oil contamination
At start of 600 hrs cycle	Provide 3.2 g 1/ of C-2A per 5 gal 2/ of new MIL-L-2104 oil in oil system.
At 200 hrs	Add 3.2 g of C-2A per 5 gal of used oil already in system.
At 400 hrs	Add 3.2 g of C-2A per 5 gal of used oil. Total contamination now 9.6 g C-2A per 5 gal oil.
At 600 hrs	Drain used oil and grit out of system. Thoroughly flush oil and grit from system with solvent. Use air to dry system thoroughly. Refill system per "start" for next 600 hrs period, if required.

1/ Gram (g)
2/ Gallon (gal)

Perform 4.7.5 through 4.7.15 before and after 4.7.17.

4.7.17.1 Record readings. The following readings shall be recorded at the beginning and end of each speed change:

a. Oil leakage at drain ports shown on drawings 11655469,
b. Oil temperature [in (T1) and out (T2)].
c. Oil flow (F1) (gal/min).
d. Pump discharge pressure (P1), back pressure (P2), and inlet pressure (P3).
e. Time.
f. Amount of external oil leakage.

4.7.17.2 Operation. Install the alternator on the engine-transmission assembly provided by the Government acquiring agency (see 6.2 and 6.4). Operate the engine-transmission assembly to provide alternator performance per table I, running through a, b, c, and d in sequence, twice, for a total of 48 endurance hrs. Visually inspect the alternator for indications of failures, fractures, distortions, erosion, external oil leakage (see 3.4.15), or other evidence of deterioration.

4.7.17.3 Control (100 hrs). Operate the production alternator for 100 hrs per table I, consisting of four cycles of a through d, followed by 2 hrs at a and 2 hrs at b. Total internal oil leakage shall be not greater than 12.2 in^3 (200 cm^3). The internal leakage shall be not greater than an average rate of 0.03 in^3 (0.50 cm^3) per hr from the eightieth hour to the one-hundredth hour for a total internal leakage of 0.6 in^3 (10 cm^3) during the last 20 hrs. External oil leakage shall be not greater than one drop (see 6.3) per hour.

4.7.17.3.1 Other conditions. Use uncontaminated MIL-L-2104 oil. Ensure that the inlet oil is at 225 $\pm$ 5°F (107 $\pm$ 2.8°C) and the alternator is at room temperature. Run the cycles with alternator oil and inlet port pressures as follows:

25 cycles at -0.385 ± 0.03 psi (-2.7 ± 0.2 kPa),
25 cycles at 45 ± 2 psi (310 ± 13.8 kPa),
25 cycles at -0.385 ± 0.03 psi (-2.7 ± 0.2 kPa), and
25 cycles at 45 ± 2 psi (310 ± 13.8 kPa).

4.7.18 External oil leakage. Conformance to 3.4.15 shall be determined by exercising the alternator and by qualitative observation sufficient to demonstrate that specified characteristics and features are present and functional.

4.7.19 Torsion.

4.7.19.1 Natural frequency. To determine conformance to 3.4.16.1, support the alternator and drive shaft system in the normal bearings. Rigidly attach the rotor and shafting at the driven end to a reaction flywheel having a mass moment of inertia not less than 20 times that of the alternator rotating system. Excite the rotor and shafting system in a torsional manner. Determine the natural torsional resonant frequency.

4.7.19.2 Vibratory torque. To determine conformance to 3.4.16.2, attach the alternator to an engine-transmission assembly, and drive the alternator to obtain a vibratory torque of ± 2100 in.-lbs (237.3 N.m) (or 3600 in.-lbs (406.7 N.m) double amplitude). With positive torque not greater than 2100 in.-lbs (237.3 N.m), drive the alternator at a frequency of 20 to 25 Hz for a period which produces 12 000 torque reversals. Record on suitable oscillographic equipment the torque input to and reversals at the alternator drive shaft. The oscillograph galvanometer response shall be flat within 5% from 0 to 2000 Hz.

4.7.19.3 Torsional application. To determine conformance to 3.4.16.3, operate the alternator on an engine-transmission assembly for 4 cycles of 48 hrs each per items a, b, c, and d of table I (at room temperature), for a total of 192 hrs; during which time there shall be no failure, parts replacement or servicing, or loss of oil greater than one drop (see 6.3). Subject the alternator to 4.7.8 through 4.7.13. Subsequently, visually inspect the alternator for indications of failures, fractures, distortions, erosion, external oil leakage greater than one drop (see 6.3), or other evidence of deterioration; and the engine-transmission assembly for evidence for deterioration of the drive train elements.

4.7.20 Environmental. Unless otherwise specified, environmental tests shall be performed at standard ambient conditions of 4.3.

4.7.20.1 High temperature test. To determine conformance to 3.5.1, the alternator oil circuits shall be filled with MIL-L-2104, grade 50. The unit shall be subjected to a high temperature test in accordance with procedure II, method 501.3 of MIL-STD-810 except that 36 hrs of storage at 225°F (107°C) shall be substituted for steps 1, 2, 3, 4, 5 and 6 and that the hot operational test of steps 7 and 8 be performed at standard ambient operating test of steps 9,

10 and 11 shall be performed at standard ambient conditions. While stabilized at the 225°F (107°C) operational temperature, the unit shall be subject to the tests specified in:

4.7.5	Overspeed
4.7.8	Output power
4.7.11	AC signal
4.7.12	CT signal
4.7.13	Oil system

The same tests are to be repeated at the ambient operating test.

4.7.20.2 Low temperature test.

4.7.20.2.1 Cold soak test. To determine conformance to 3.5.2.1, the alternator oil circuits shall be filled with MIL-L-46167 prior to start of cold soak test. The alternator shall be subjected to a low temperature storage test at -65°F ± 5°F (-54 ± 2.8°C) for 12 hrs. At the conclusion of the -65°F (-54°C) cold soak test, the alternator and its oil supply will be temperature stabilized at -25°F ± 5°F (-31.7 ± 2.8°C). Conduct a low temperature operation test at -25°F (-31.7°C) temperature, in accordance with procedure 1, method 502.3, of MIL-STD-810. While stabilized at the -25°F (-31.7°C) temperature, and with 45 psig (310 kPa) oil pump inlet pressure, the unit shall be subjected to the test specified in:

4.7.5	Overspeed
4.7.8	Output power
4.7.11	AC signal
4.7.12	CT signal

The alternator oil pump outlet pressure shall not exceed the proof pressure.

4.7.20.2.2 High viscosity oil test. To determine conformance to 3.5.2.2, to an engine-transmission assembly (see 6.2d) and operated at no electrical load with 10 wt MIL-L-2104 lubricating oil to circulate oil throughout the alternator. The test system shall then be cold soaked at -10°F (-23.3°C) for 24 hrs. The engine shall be started while at -10°F (-23.3°C) using standard procedures and shall remain at idle rpm until engine oil pressure stabilizes. The engine shall then be immediately accelerated to maximum.

4.7.20.3 Shock. To determine conformance to 3.5.3, mount the alternator on a shock test machine, utilizing the alternator mounting brackets and simulating the actual installation as far as is practical. Subject the alternator to sawtooth shock pulses of 20 gravity units for a duration of 11, +2 ms in accordance with MIL-STD-810, method 516.4, procedure 1. At the conclusion, examine the alternator for damage.

4.7.20.3.1 Control. Perform as in 4.7.20.3, except subject the alternator to shock pulses of 15 gravity units.

4.7.20.4 Vibration. To determine conformance to 3.5.4, mount the alternator as in intended use. Vibrate the alternator along each axis according to figures 4, 5, and 6, using vibrating equipment capable of providing the amplitude and frequencies specified therein. The vibration axis shall be oriented per figure 11. Cycling time in each axis shall be 100 minutes. Each sweep shall be 5 to 500 to 5 Hertz (Hz) in 15 minutes. Resonant frequencies of the alternator shall be determined and a sinusoidal resonance search shall be conducted for the four most severe resonant frequencies of the alternator. The test sample shall be subjected to dwell time at the most severe resonance in accordance with the applicable figure. The frequency of applied vibration shall be swept over the specified range in accordance with figure 12. The sweep time of figure 12 is that of an ascending plus a descending time. At the conclusion, confirm that there is no internal or external oil leakage or other damage resultant from the vibration test.

4.7.20.4.1 Control. Perform as in 4.7.20.4, except the dwell time at each resonance shall be 5 minutes.

4.7.20.5 Fungus. To determine conformance to 3.5.5, seal all installation openings and install the alternator in a fungus chamber. Subject the alternator to method 508.4 of MIL-STD-810 for 28 days. Incubate samples under cyclic temperature and humidity conditions to include 20 hrs of relative humidity at 95 ± 5% at an air temperature of 86 ± 2°F (30 ± 1°C) followed by 4 hrs of 100% relative humidity at 77 ± 2°F (25 ± 1°C).

4.7.20.6 Corrosion. To determine conformance to 3.5.6, seal all installation openings, and subject the alternator to method 509.3 of MIL-STD-810 for four test cycles (192 hrs).

4.7.20.7 Humidity. To determine conformance to 3.5.7, seal all installation openings, and place the alternator in a test chamber. Perform the following:

a. Operate the alternator under standard ambient conditions.
b. Dry the alternator at 129°F (54°C) for 24 hrs.
c. Condition the alternator at 73°F (22.8°C) and 50 ± 10% relative humidity for 24 hrs.
d. Record data for determining satisfactory operation of the alternator as specified herein.

NOTE: The alternator may be readjusted or realigned, as necessary, to meet requirements. No further realignment or readjustment shall be permitted throughout this period, other than with accessible controls employed for operation of the alternator. No repair or replacement of parts shall be permitted. Equipment shall be operated only when specified procedures are being performed.

e. Raise the internal chamber temperature to 86°F (30°C) and the relative humidity to 94 ± 4%.
f. Subject the alternator to five continuous 48 hr cycles in accordance with figure 13.
g. On completion of the test cycles, remove the alternator from the chamber to room ambient conditions. With MIL-L-2104 grade 30 oil at 225 ± 5°F (107 ± 2.8°C) oil temperature, perform 4.7.4.4 without delay. Return the alternator, all installation openings sealed, to the chamber. Raise the chamber to 73 ± 5°F (22.8 ± 2.8°C) and 50 ± 10% relative humidity, and condition for 24 hrs.
h. Remove the alternator to room ambient conditions. With MIL-L-2104 grade oil at 225 ± 5°F (107 ± 2.8°C) oil inlet temperature, perform 4.7.4.4 without delay.

4.7.20.8 Waterproofness. To determine conformance to 3.5.8, seal all installation openings, and pressurize the alternator inside a storage container of approximately 1 cubic foot (ft^3) (0.028 cubic meters (m^3)) to 10 psig (69 kPa) of nitrogen. With the nitrogen supply shut off, verify that the leakage rate shall not exceed 3 psig (20.7 kPa) in 2 minutes.

4.7.20.9 Electromagnetic interference. To determine conformance to 3.5.9. the alternator shall be subjected to test methods RE 02 and CE 04 specified in MIL-STD-462. Operate the alternator at 5000 rpm. Measure broadband radiated emission with a 500 A load. Broadband conducted emission shall be measured with a balanced 650 A split load having the current probe on a 50 A load lead. Conduct this with the regulator (Drawing 11668583) interconnected (see figures 7, 8, and 10).

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's 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 which may be helpful, but is not mandatory.)

6.1 Intended use. The alternator is intended for use in the electrical generating systems of the M60 tanks, consisting of an alternator-rectifier, referred to herein as "alternator", and a solid-state voltage regulator.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this 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. When first article is required (see 3.1).
d. If inspection conditions should be other than as specified (see 3.4.1 and 4.3).
e. If responsibility for inspection equipment should be other than as specified (see 4.1).
f. If preproduction inspection is required (see 4.4.1).
g. If initial production inspection is not required (see 4.4.2).
h. Selection of applicable level and packaging requirements (see 5.1).

6.3 Definitions.

6.3.1 Fully charge battery. For the purposes of this specification, a fully charged battery is defined as a battery having current consumption of not greater than 4 A and 28 V at room temperature (90 ± 10°F) (32 ± 5.8°C).

6.3.2 Load current. For the purposes of this specification, load current is defined as that current from generator to batteries and resistive load, and controlled by the regulator (see figure 10).

6.3.3 Drop. Drop is defined as a volume of fluid equal to 0.03 in^3 (0.5 cm^3).

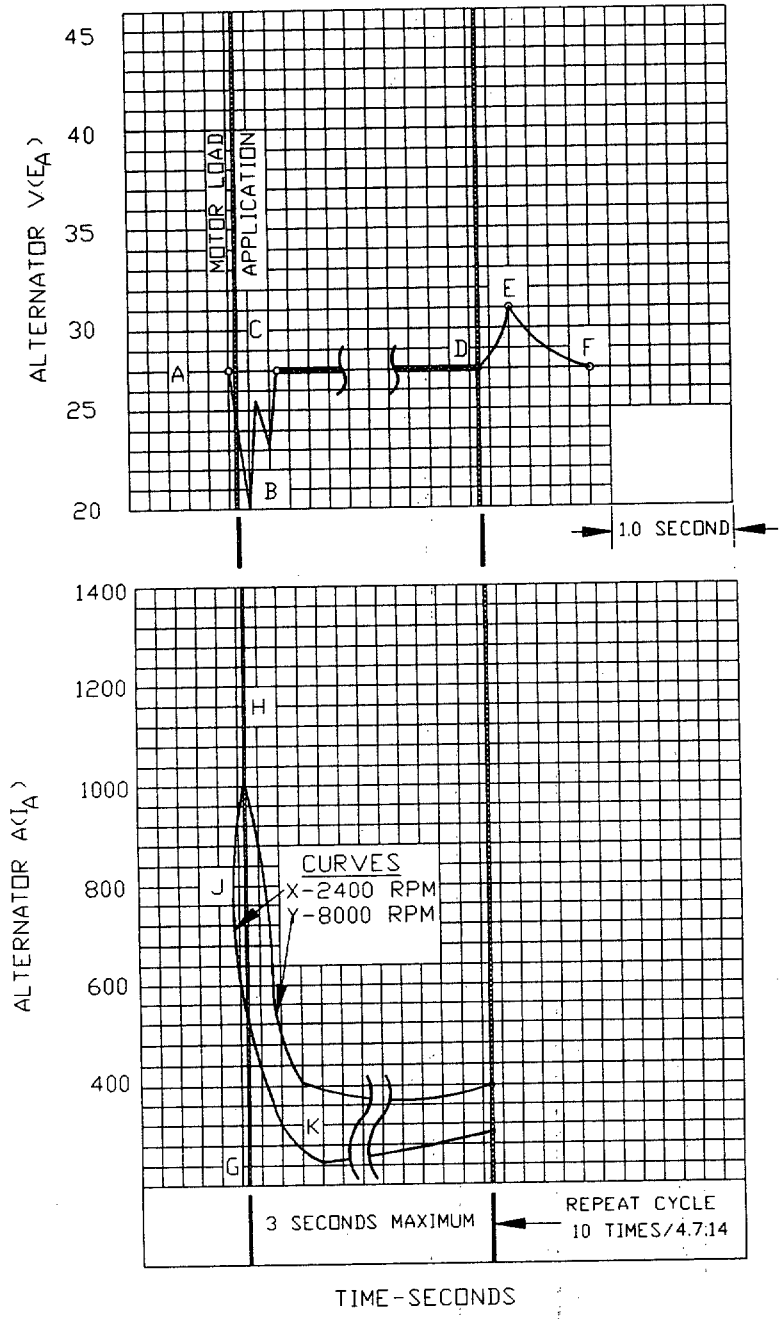
6.3.4 Temperature stabilized. For the purpose of this specification, a temperature stabilized alternator is defined as a situation when constant conditions of speed and load current fail to cause a change in alternator oil inlet and outlet differential temperature by more than 2°F (1°C) during a 10 minute period.

6.4 Engine-transmission assembly. When required, the engine-transmission assembly (Drawing 11655426) will be furnished by the Government contracting authority, at a site it will designate (see 3.1 and 4.7.17.2).

6.5 Subject term (key word) listing.

AC/DC Convertor
Engine load
Engine speed
Regulated output
Ripple voltage
Solid-state regulator

6.6 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.



REQUIREMENTS:

1. MAXIMUM RECOVERY TIME:
   (A-C) 0.500 SECOND
   (D-F) 0.700 SECOND
   (G-H-K) 0.700 SECOND
   (G-J-K) 0.700 SECOND
2. ALTERNATOR OUTPUT CURVE SHALL BE WITHIN ENVELOPE DEFINED BY CURVES X AND Y.
3. VOLTAGE RESPONSE LIMIT:
   A. UNDERSHOOT POINT B NOT LESS THAN 20 V.
   B. OVERSHOOT POINT E NOT MORE THAN 32 V.
   C. UNDERSHOOT POINT K NOT LESS THAN 250 A.

FIGURE 1. Transient loading - oil cooled alternator.

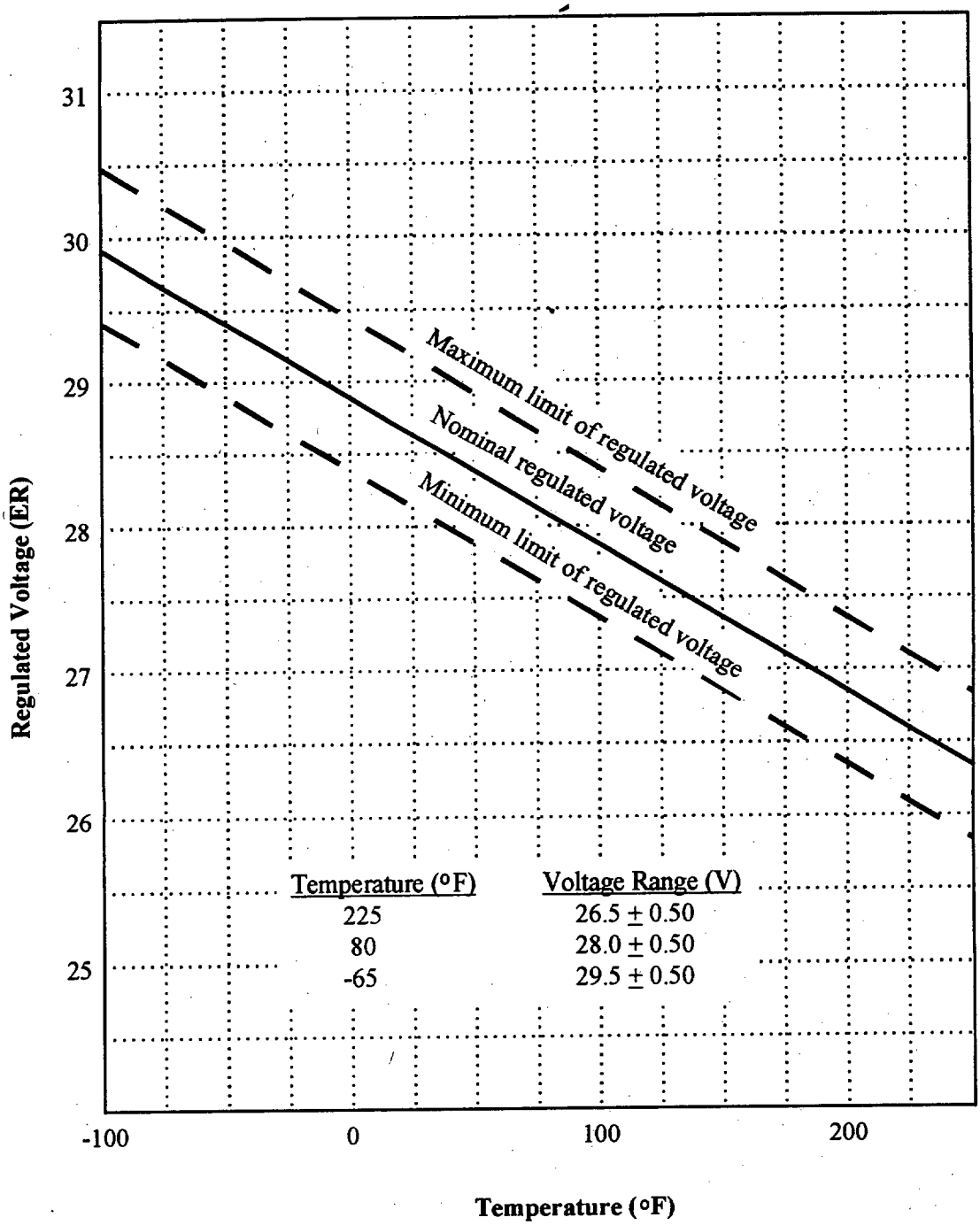
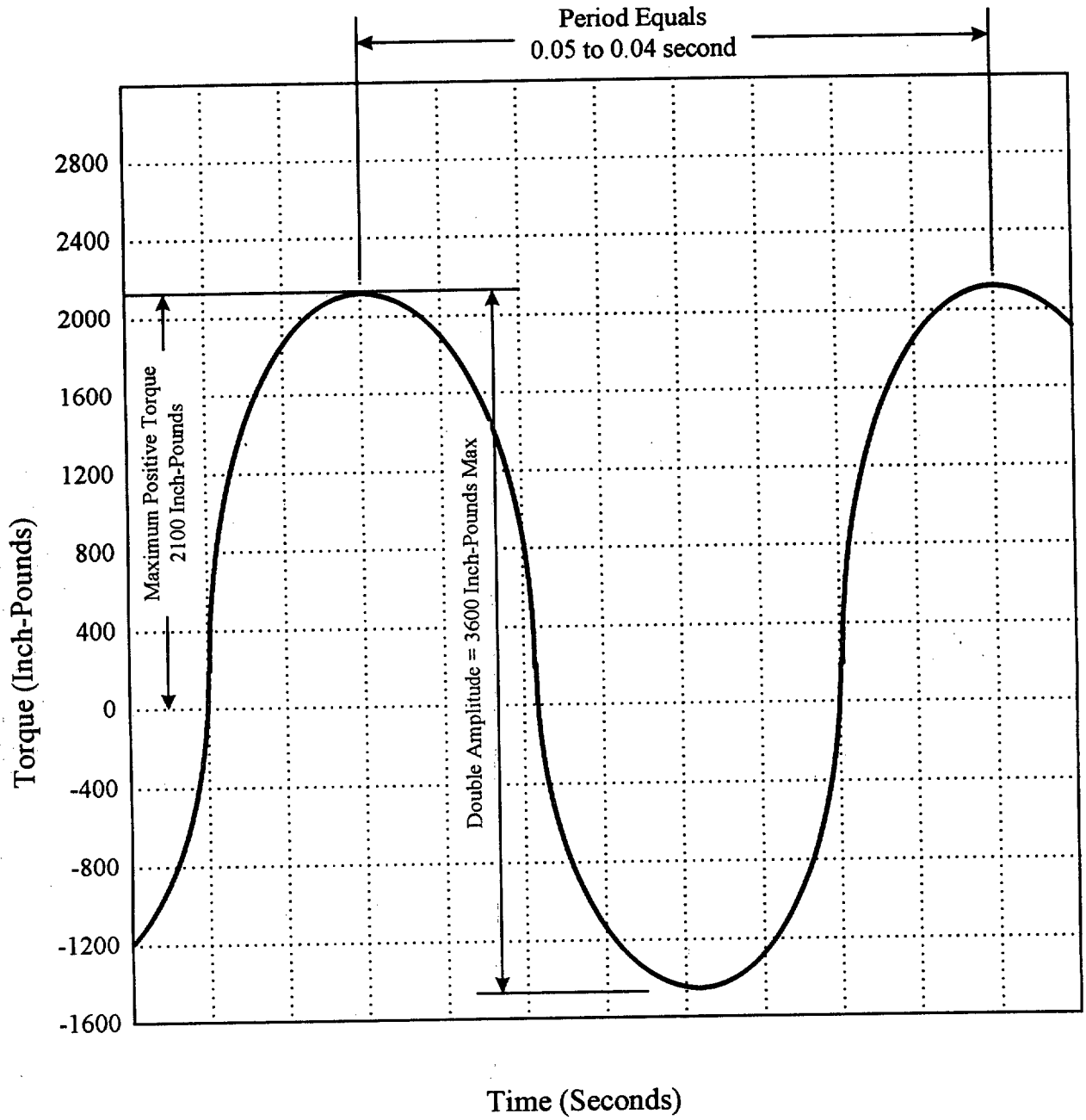


FIGURE 2. Temperature compensation.



NOTE: FREQUENCY EQUALS 20 TO 25 Hz FOR THESE LIMITS.

FIGURE 3. Alternator torsional vibration torque requirements.

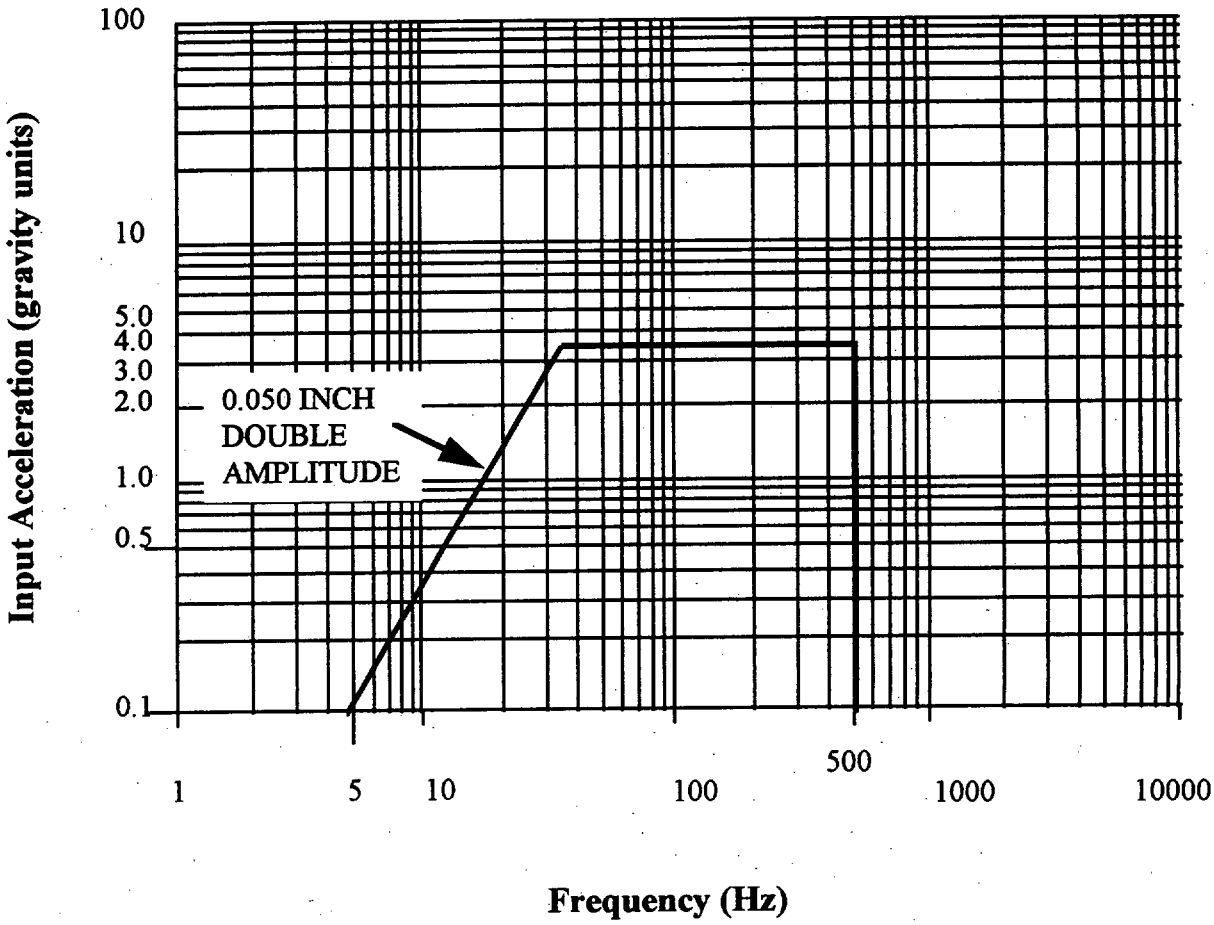


FIGURE 4. Vibration input (vertical) oil cooled alternator.

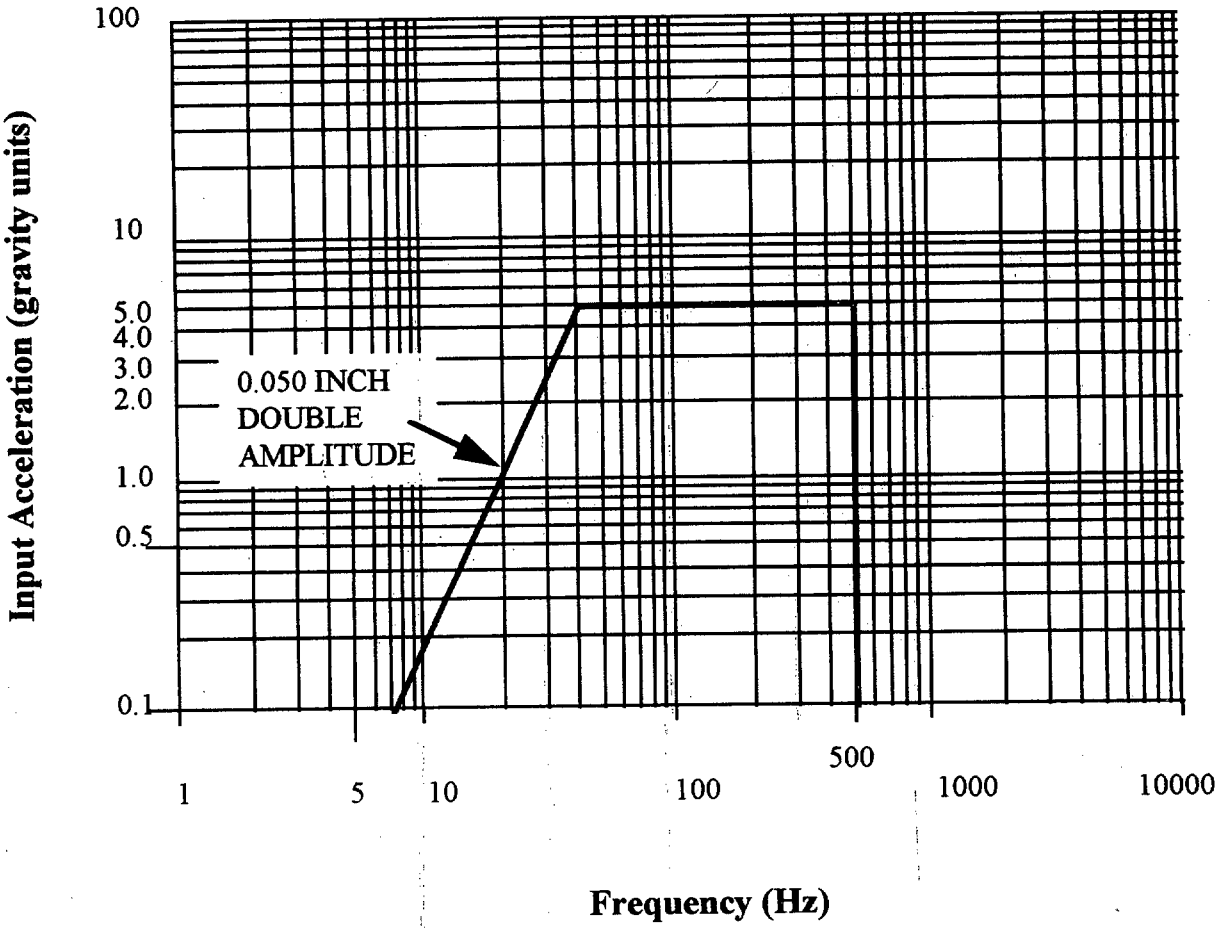


FIGURE 5. Vibration input (longitudinal) oil cooled alternator.

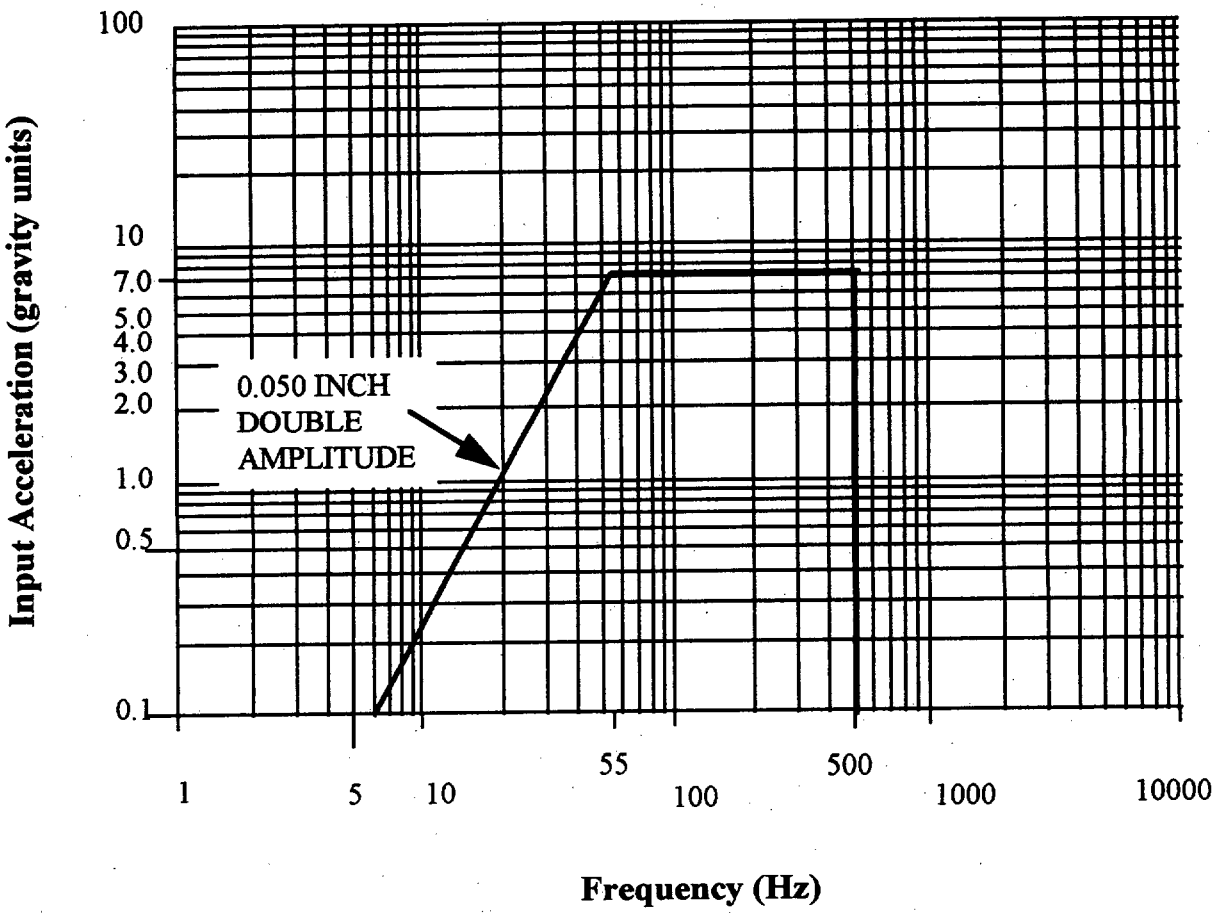


FIGURE 6. Vibration input (horizontal) oil cooled alternator.

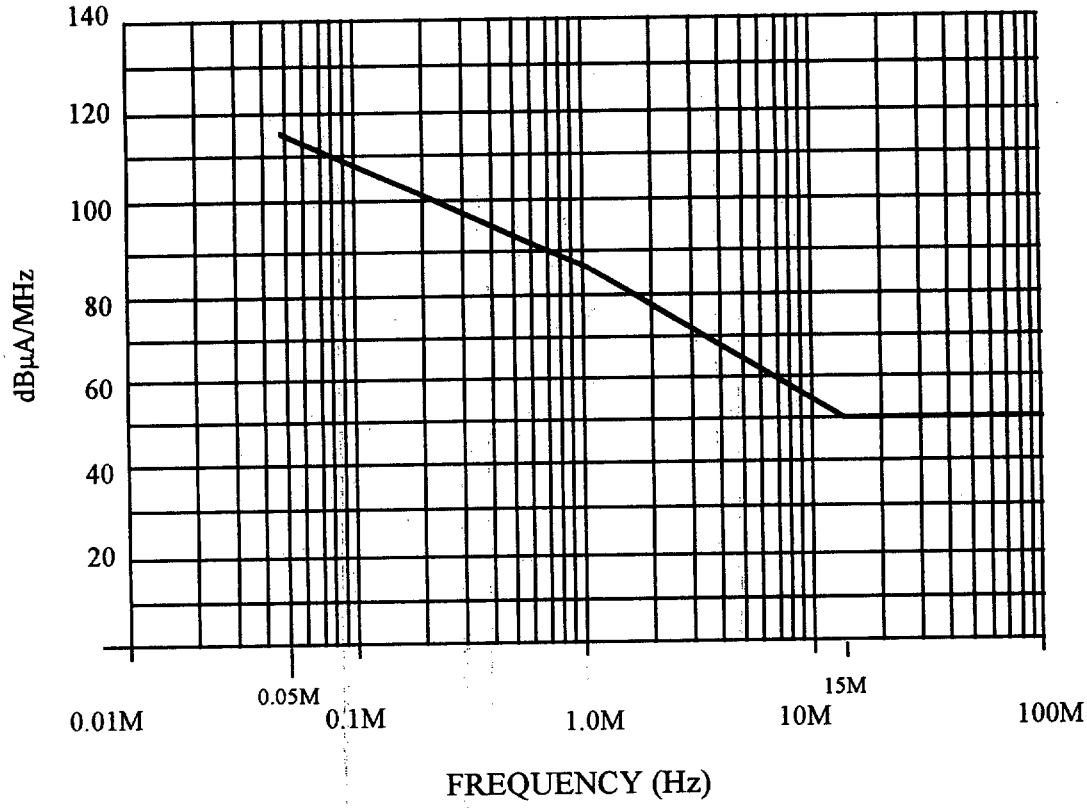


FIGURE 7. Broadband emission limits (conducted EMI).

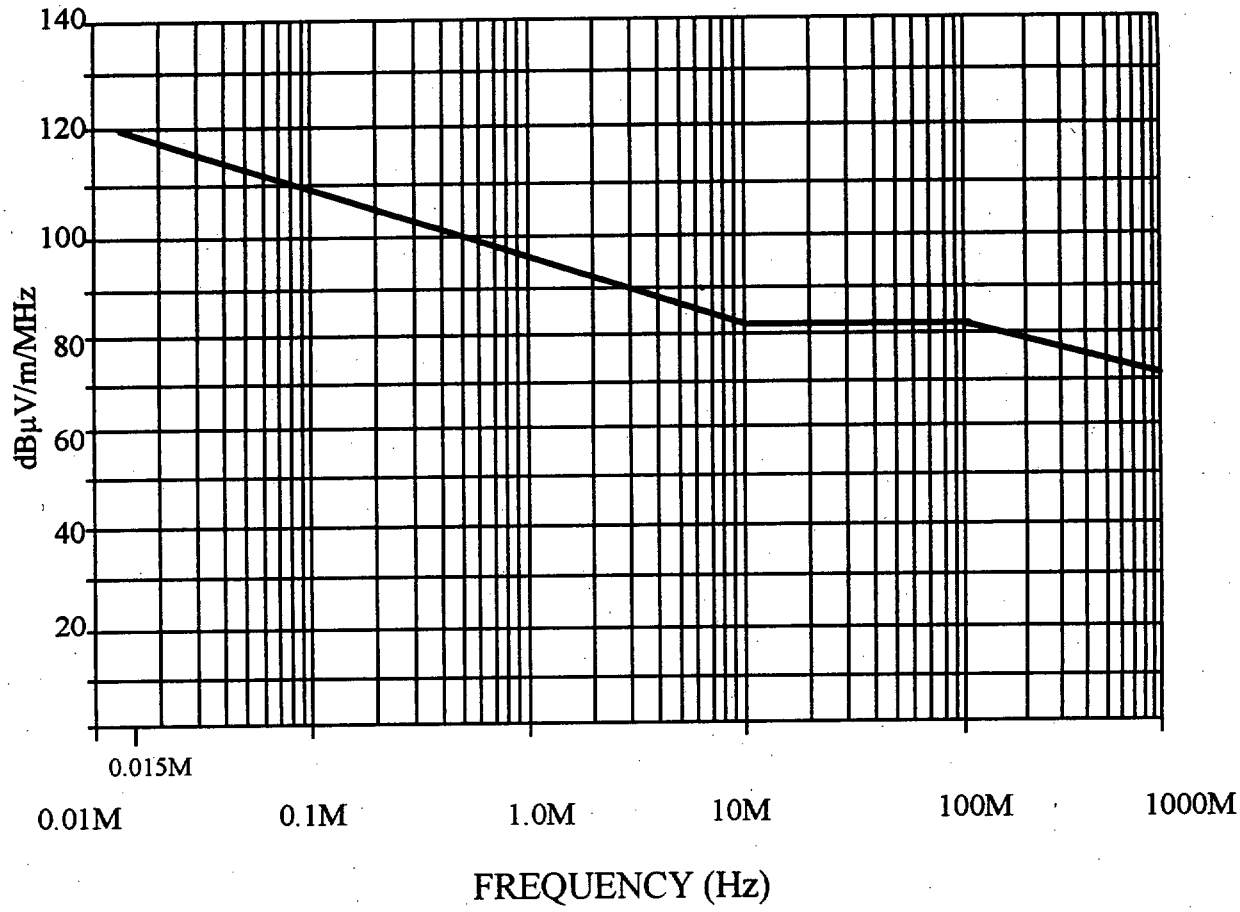


FIGURE 8. Broadband emission limits (radiated EMI).

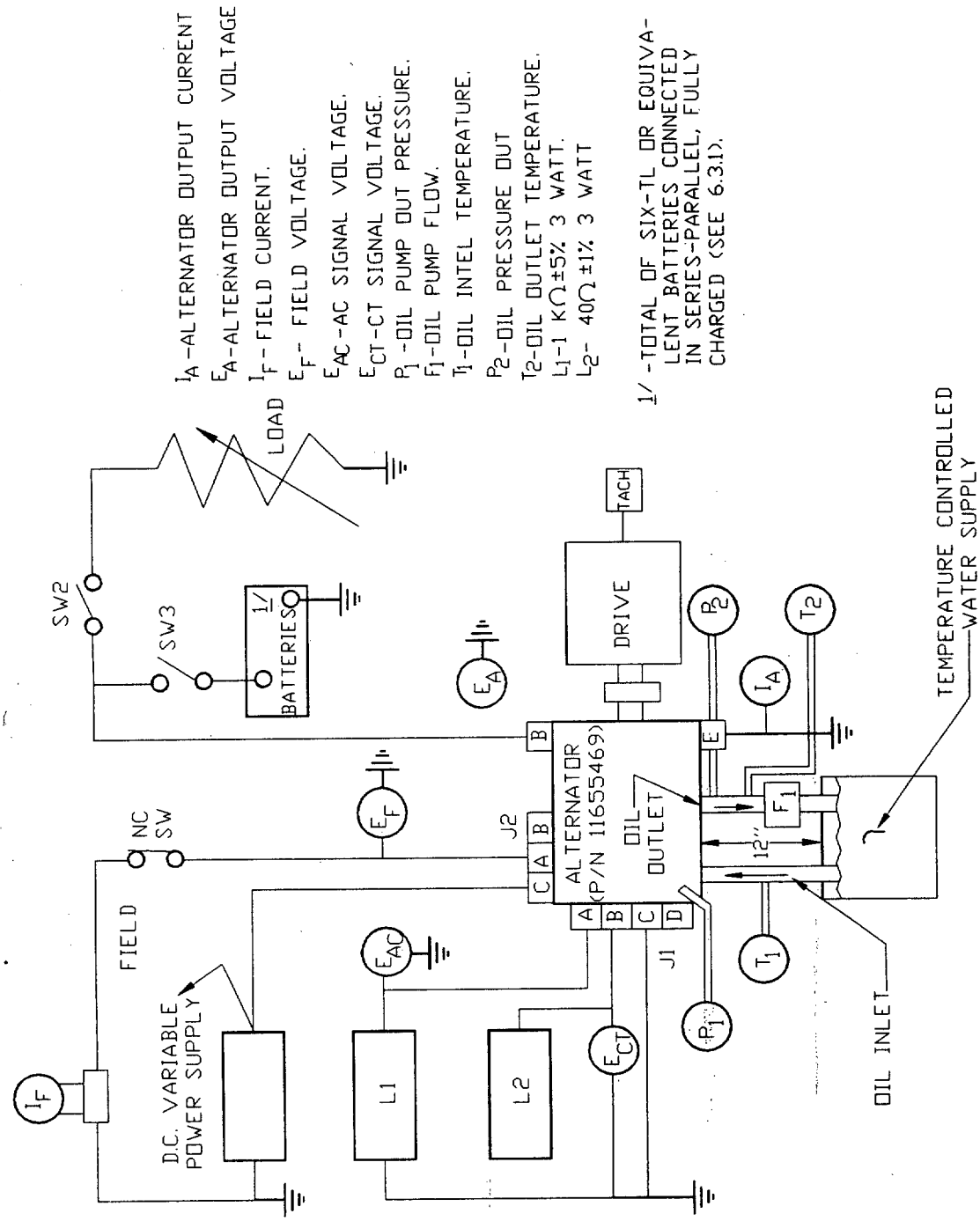
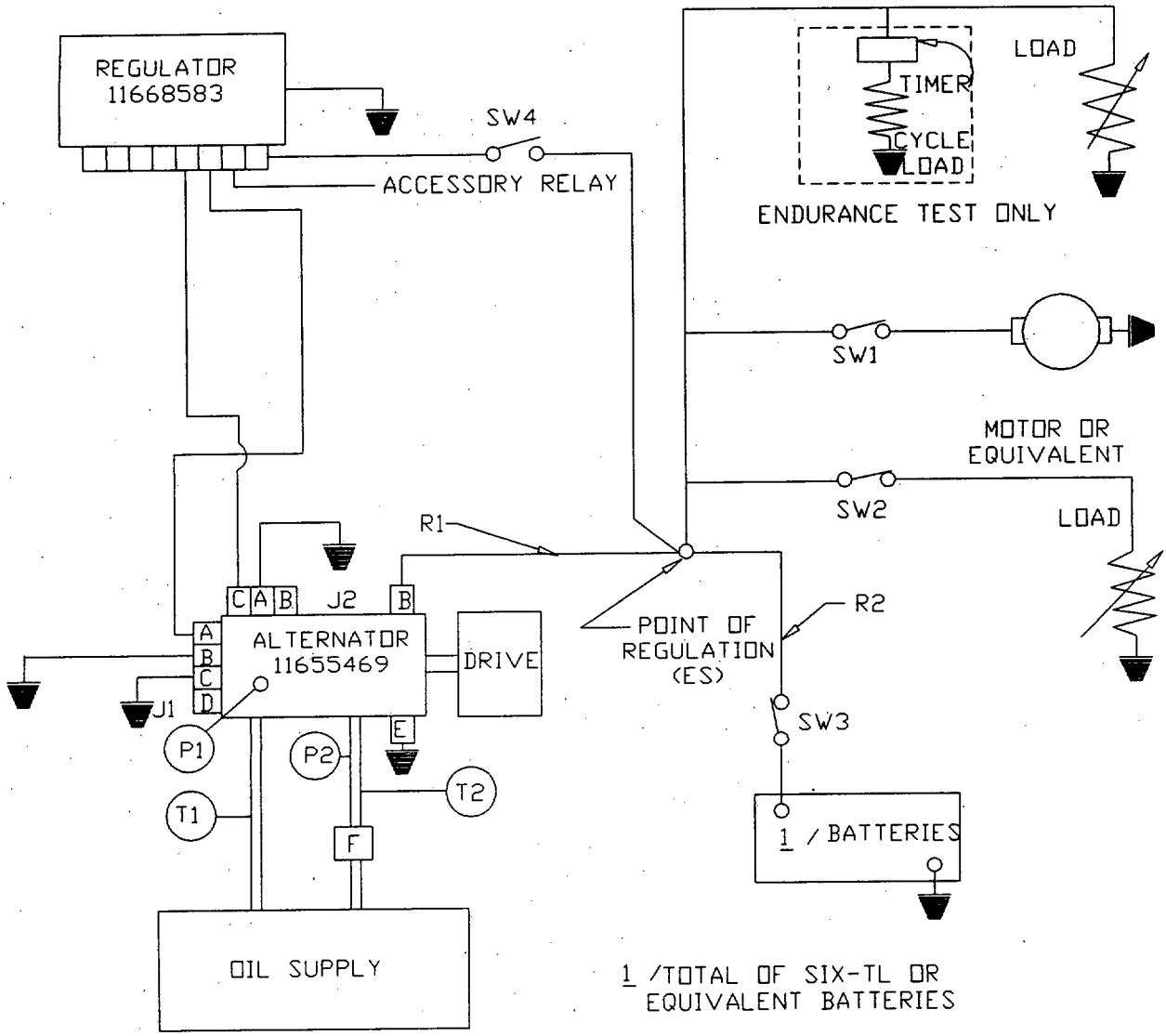
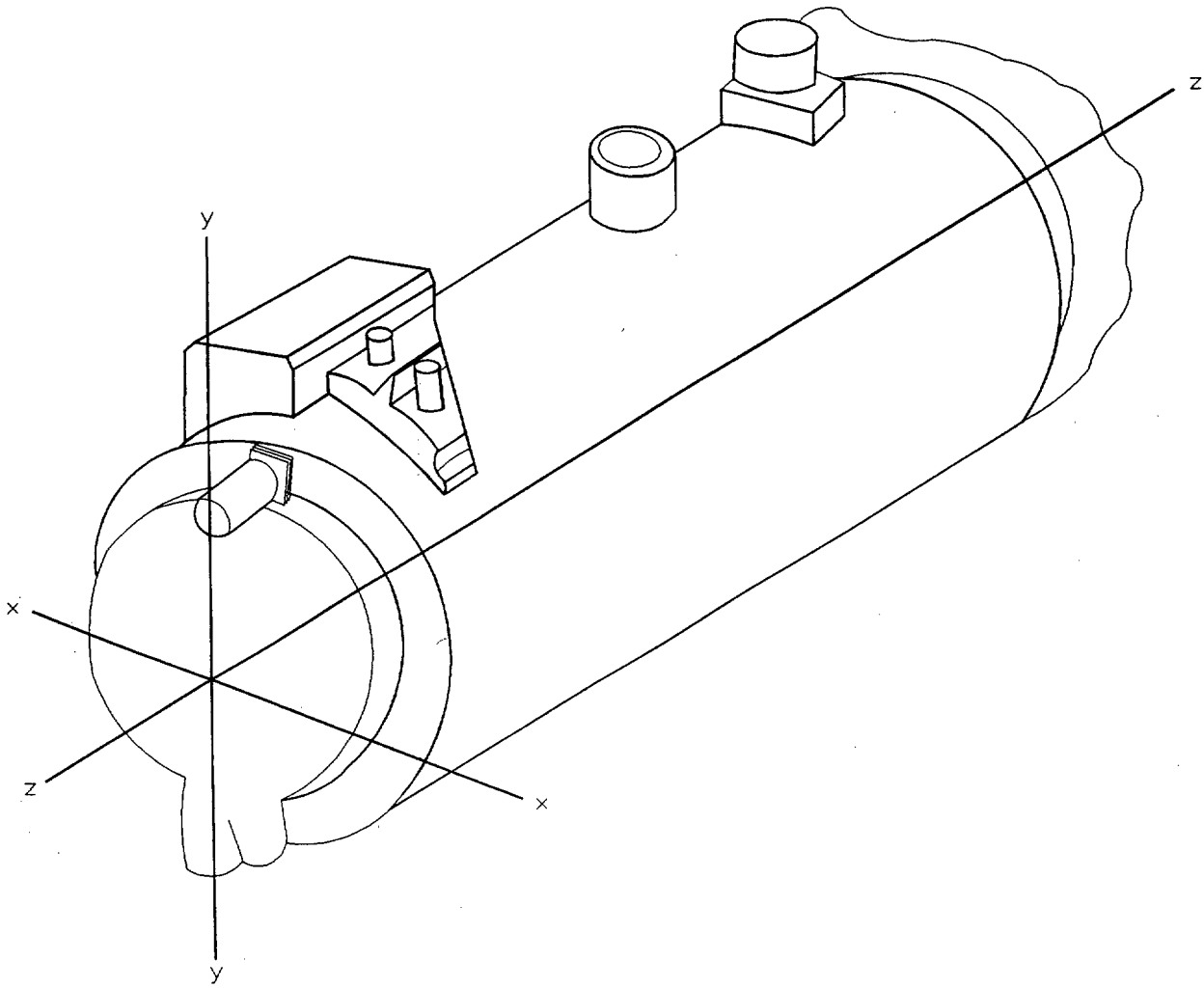


FIGURE 9. OIL COOLED ALTERNATOR TEST CIRCUIT.



R1 - RESISTANCE EQUIVALENT TO 2 PARALLEL COPPER CABLES. #00 GAGE, 17.5 FEET LONG.
R2 - RESISTANCE EQUIVALENT TO 2 PARALLEL COPPER CABLES. #00 GAGE, 30 INCHES LONG.

FIGURE 10. Oil cooled alternator test circuit with regulator.



X - Horizontal
Y - Vertical
Z - Longitudinal

FIGURE 11. Orientation of vibration axes for 11655469 alternator.

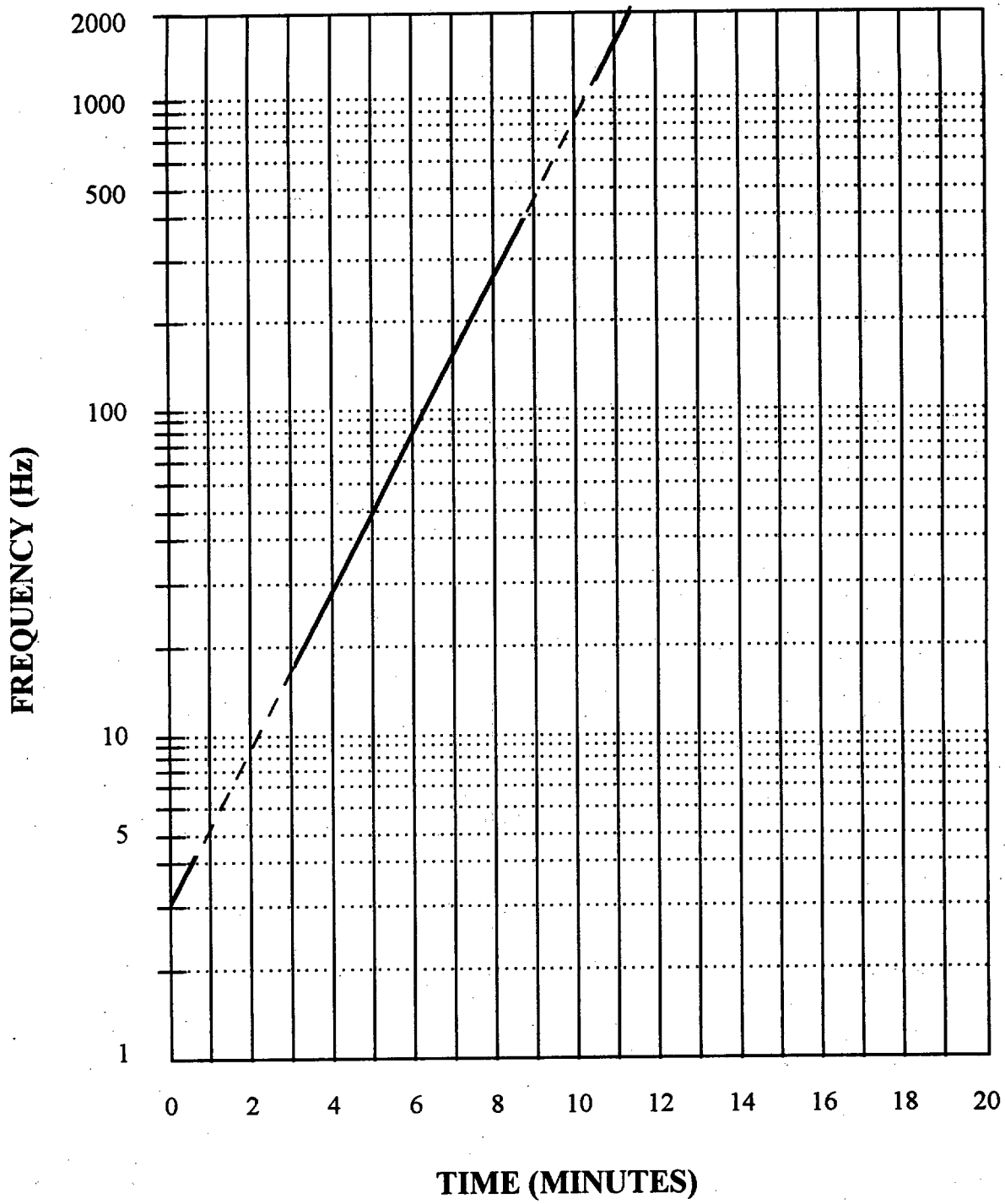
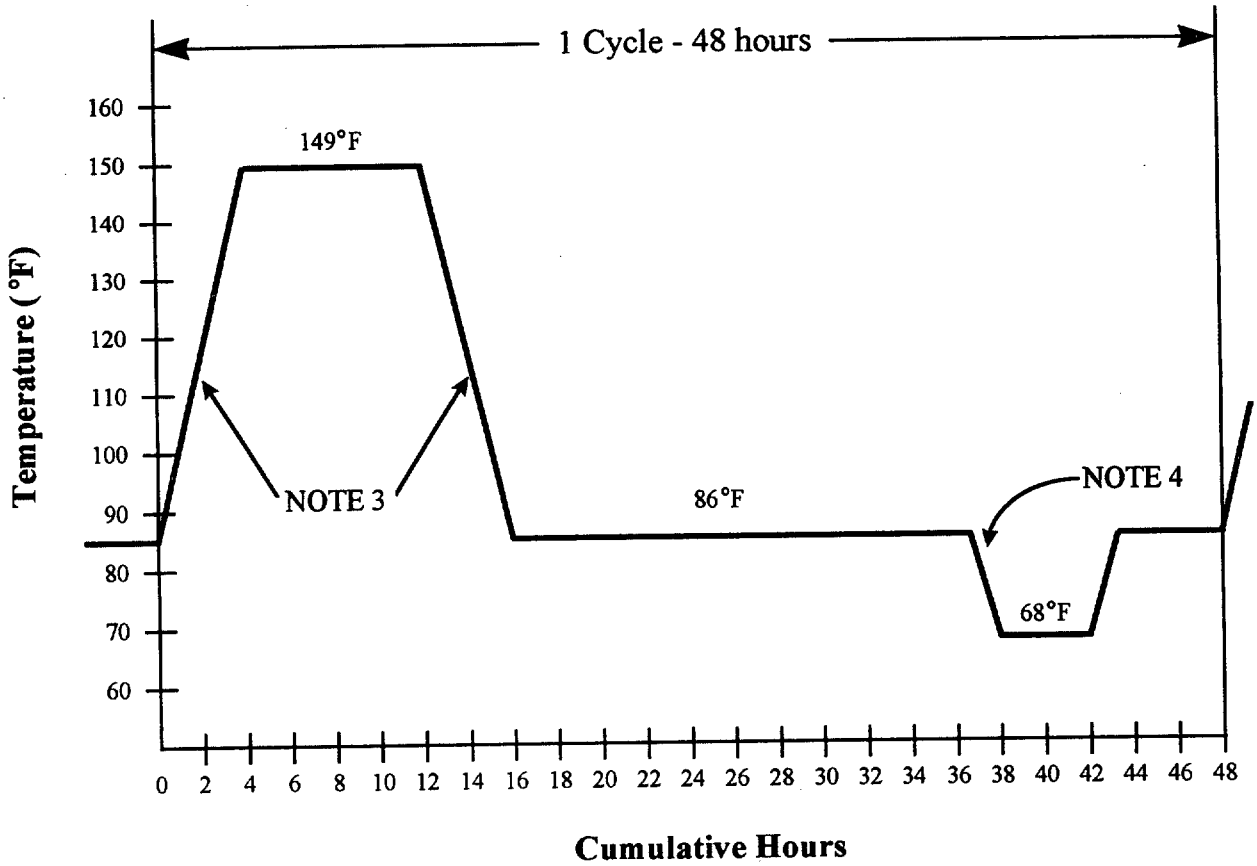


FIGURE 12. Logarithmic sweep.



NOTES:

1. TOLERANCE DURING TEMPERATURE CHANGE SHALL NOT BE GREATER THAN 5°F.
2. RELATIVE HUMIDITY SHALL BE MAINTAINED AT 94 ± 4% AT ALL TIMES, EXCEPT THAT DURING THE DESCENDING TEMPERATURE PERIOD. THE RELATIVE HUMIDITY MAY BE PERMITTED TO DROP AS LOW AS 85%.
3. RATE OF TEMPERATURE CHANGE BETWEEN 86° AND 149°F SHALL NOT BE LESS THAN 14.4°F PER HOUR.
4. THE TEMPERATURE INCREASE IN THIS PORTION OF THE CURVE SHALL NOT BE LESS THAN 18°F.

FIGURE 13. Humidity cycle.

Custodians:
Army - AT
Air Force - 99

Preparing Activity:
Army - AT

(Project 6115-0722)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. 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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-62186A	2. DOCUMENT DATE *(YYMMDD)* 970410

3. DOCUMENT TITLE
Generator, Alternating Current (650 Ampere Rectified), 28 Volt DC (Oil Cooled)

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)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE *(Include Area Code)* (1) Commercial (810) 574-8745	(2) AUTOVON 786-8745
c. ADDRESS *(Include Zip Code)* Commander U.S. Army Tank-automotive and Armaments Command ATTN: AMSTA-TR-E/BLUE Warren, MI 48397-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403 Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	