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PERFORMANCE SPECIFICATION

MOTOR, GEARHEAD, 18 - 30 VOLTS, DIRECT CURRENT

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 direct current gearhead motor used to operate the Remote Arming Device (RAD) on a military ground vehicle.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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 of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

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 cited in the solicitation or contract (see 6.2).

Comments, suggestions, or questions on this document should be addressed to U.S. Army Tank-automotive and Armaments Command, ATTN: AMSRD-TAR-E/CM/DM/STND MS#268, 6501 E. 11 Mile Road, Warren, MI 48397-5000 or emailed to DAMI_STANDARDIZATION@conus.army.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

AMSC N/A FSC 6105

INTERNATIONAL STANDARDIZATION AGREEMENTS

STANAG 1135 - Interchangeability of Fuels, Lubricants and Associated Products used by the Armed Forces of the North Atlantic Treaty Nations

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-461 - Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-454 - General Guidelines for Electronic Equipment

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or 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 of these documents are those cited in the solicitation or contract.

US ARMY TACOM DRAWINGS

12265908 - Motor, Gearhead (Interface)

(Copies of this drawing are available from the U.S. Army Tank-automotive and Armaments Command, ATTN: AMSRD-TAR-E/CM/DM/STND MS #268, 6501 E. 11 Mile Road, Warren, MI 48397-5000, or email DAMI_STANDARDIZATION@conus.army.mil.)

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 these documents are those cited in the solicitation or contract (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes (DoD Adopted)
ANSI/SAE AS1933 - Age Controls for Hose Containing Age-Sensitive Elastomeric Material (DoD Adopted)

ANSI/SAE AS478 - Identification Marking Methods (DoD Adopted)

(Copies of these documents are available online at www.ansi.org or from ANSI Customer Service Department, 25 W. 43rd Street, 4th Floor, New York, NY 10036.)

ASTM INTERNATIONAL

ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron or Steel (DoD Adopted)

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Materials. Materials used shall be in accordance with the manufacturer's materials specifications for gearhead motors. The materials shall be capable of meeting all the operational and environmental requirements specified herein (see 4.5.1).

3.2.1 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 (see 4.5.1).

3.2.2 Age sensitive materials. The use of age-sensitive elastomers, as defined by ANSI/SAE AS1933, shall be identified and controlled in accordance with that standard (see 4.5.1).

3.2.3 Gearing. All gearing shall be of the necessary materials, finishes, and precision to provide reliable performance as outlined herein (see 4.5.1).

3.2.4 Lubrication. The unit shall be lubricated with grease conforming to STANAG 1135, method G-354 or equivalent and shall not require lubrication during the service of the assembly (see 4.5.1 and 6.4).

3.2.5 Cover and mounting flange. Material shall be suitable for the intended purpose. Non-corrosion metal resistant materials shall be zinc plated in accordance with ASTM B633, service condition (SC 8) (minimum), type II or equivalent (see 4.5.1).

3.2.6 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be placed in direct contact. When protection is used, it shall be such type that a low impedance path is offered to radio frequency currents (see 4.5.1).

3.3 Construction. The motor and the output shaft shall conform to the envelope dimensions and interfaces of Drawing 12265908 (see 4.5.1 and 4.5.2).

3.3.1 Backlash. Backlash shall be not more than 3 degrees (°) (see 4.5.1).

3.3.2 Bearings. Bearings shall be suitable for their intended purpose. Bearings which are exposed to the environment shall be of the sealed type (see 4.5.1).

3.3.3 Moisture pockets. Pockets, wells, and traps in which water or condensed water vapor can collect shall be avoided. Lead wire entry shall be sealed to prevent entrance of contamination into the motor (see 4.5.1).

3.3.4 Standard parts. Standard utility parts, such as screws, bolts, nuts, cotter pins, etc., shall be selected in accordance with the applicable guidelines of MIL-HDBK-454 (see 4.5.1).

3.4 Performance. Unless otherwise specified herein, the motor shall meet all performance requirements of this specification with an applied voltage of 24 ±0.5 volts (V) direct current (dc), and with the motor flange mounted on a 0.13 by 1.88 by 3 inch (in.) (3.3 by 7.8 by 76.2 millimeters (mm)) thick aluminum alloy plate.

3.4.1 Rotation of output shaft. The shaft rotation, as viewed from the shaft end, shall be in a counterclockwise (CCW) direction with positive voltage applied to plus (+) terminals of the filter. Reversing lead polarity shall reverse shaft rotation (see 4.5.3).

3.4.2 No load speed. The no load speed of the motor shall be no more than 36 revolutions per minute (rpm) (see 4.5.4).

3.4.3 Zero torque current. The zero torque current of the motor shall be no more than 0.5 amperes (A) dc (see 4.5.5).

3.4.4 Speed and current at 640 ounce-inch (oz-in.) (4.52 Newton-meter (N-m)). With the torque at 640 oz-in., the speed shall be no less than 22 rpm in either direction, and the current shall be no more than 1.5 A dc (see 4.5.6).

3.4.5 Speed and current at 950 oz-in. (6.71 N-m). With the torque at 950 oz-in., the speed shall be no less than 15 rpm in either direction, and the current shall be no more than 2.5 A dc (see 4.5.7).

3.4.6 Stall torque and current. The stall torque shall be no less than 1590 oz-in. (11.3 N-m) and the stall current at stall torque shall be no more than 7 A dc. The motor shall

stall without incurring damage, and performance after stall shall remain within specification limits (see 4.5.8).

3.4.7 Plug reversal. The motor performance shall remain within specified limits after application of rated voltage of polarity opposite the back electromotive force (emf) while rotating at any speed up to no-load speed. The speed in either direction shall not be less than that specified in 3.4.4 and 3.4.5. The following parameters shall apply to the plug reversal requirements (see 4.5.9).

a) Resistance of switching circuit: 1 ohm (maximum) - excluding gear motor
b) Voltage switching time: 100 milliseconds (ms) (maximum). Typical direction of switching sequence is CCW-OFF-clockwise (CW). "OFF" switch position connects both motor leads to ground potential during a minimum interval of 10 milliseconds (ms).

3.4.8 Duty cycle. The duty cycle shall be as follows (see 4.5.10):

a) On for 2 seconds at 640 oz-in. with rated voltage
b) Reverse drive polarity (plug reversed in accordance with 3.4.7) at rated voltage for a 2 second period with 640 oz-in. load and rated voltage applied
c) Repeat steps (a) and (b) for 30 cycles

3.4.9 Inertia (motor). Inertia of the rotating parts shall be no more than 1.26 pound-inch squared ($lb\text{-}in^2$) (7.65 kilogram-meter square ($kg\text{-}m^2$)) at the output shaft (see 4.5.11).

3.4.10 Operating voltage. The motor shall operate over the input voltage range of 18 to 30 V dc with the output as specified in 3.4.2 through 3.4.7, and 3.4.8 inclusive, in direct proportion to the voltage specified (see 4.5.12).

3.4.11 Insulation resistance. The motor shall have an insulation resistance of not less than 12 megaohms initially, prior to installation of the electromagnetic interference (EMI) filter (see 4.5.13).

3.4.12 Dielectric withstanding voltage. The motor shall be capable of initially withstanding 500 V root mean square (rms), 60 Hertz (Hz) for 1 minute (or 600 V rms, 60 Hz for 1 second) between armature winding and frame, prior to installation of the EMI filter by the manufacturer. There shall be no breakdown or degradation of insulation (see 4.5.14).

3.4.13 Electromagnetic interference. The motor shall comply with the conducted and radiated emissions requirements for Army Ground Electrical/Electronic Equipment (see 4.5.15).

3.4.13.1 Conducted emissions. Conducted emissions shall not exceed the values given in CE102 of MIL-STD-461 (see 4.5.15.1).

3.4.13.2 Radiated emissions. Electric field emissions shall not be radiated in excess of the limits for Army ground applications in RE102 of MIL-STD-461 (see 4.5.15.2).

3.4.14 Voltage transient. The motor shall withstand voltage transients as specified in operating and non-operating modes (see 4.5.16).

3.4.14.1 Operating mode.

3.4.14.1.1 Combined generator-battery power supply.

3.4.14.1.1.1 Steady-state voltage. Circuit steady-state voltage shall be between 25 and 30 V.

3.4.14.1.1.2 Ripple. The upper and lower peaks of ripple voltage (see figure 1), shall be less than 2 V. The frequency components of the ripple shall be within the range of 50 Hz to 200 kHz.

3.4.14.1.1.3 Surges. All surges resulting from system operation shall fall within the loci shown in figure 2.

3.4.14.1.1.4 Spikes. All spikes resulting from system operation shall fall within the loci shown in figure 3.

3.4.14.1.1.5 Starting disturbances. Fully charged battery shall be used (battery drawing less than 5 A from a 28 V charging source with electrolyte temperature between 81 degrees Fahrenheit (°F) and 100 °F (27 degrees Celsius (°C) and 38 °C).

3.4.14.1.1.5.1 Initial engagement surges. During this disturbance, the voltage shall not be below 6 V and the duration shall not exceed 1 second.

3.4.14.1.1.5.2 Cranking level. The steady voltage during cranking shall not be below 16 V (no more than 3 cranking attempts of 30 seconds each with 2-minute cranking level pauses between attempts). This characteristic applies to starting the second engine of a multi-engine vehicle, or slave starting another vehicle.

3.4.14.1.2 Generator only (no battery, single fault condition).

3.4.14.1.2.1 Steady-state voltage. The voltage shall be less than 33 V.

3.4.14.1.2.2 Ripple. The upper and lower peaks of ripple voltage (see figure 1) shall each be less than 7 V. The frequency components of the ripple shall be within the range 50 Hz to 200 kHz.

3.4.14.1.2.3 Surges. All surges resulting from system operation shall fall within the loci shown in figure 4. (A lower steady-state limit of 23 V shall be used to establish the recovery time of negative-going surges.)

3.4.14.1.2.4 Spikes. All spikes resulting from system operation shall fall within the loci shown in figure 5.

3.4.14.2 Non-operating.

3.4.14.2.1 Battery only condition.

3.4.14.2.1.1 Steady-state voltage. Circuit steady-state voltage shall be between 20 and 27 V.

3.4.14.2.1.2 Ripple. The upper and lower peaks of ripple (see figure 1) shall each be less than 2 V. The frequency components of the ripple shall be within the range 50 Hz to 200 kHz.

3.4.14.2.1.3 Spikes. All spikes resulting from system operation shall fall within the loci shown in figure 3.

3.4.14.2.1.4 Starting disturbances. Fully charged battery shall be used (battery drawing less than 5 A from a 28 V charging source with electrolyte temperature between 81 °F and 100 °F (27 °C and 38 °C)).

3.4.14.2.1.4.1 Initial engagement surges. During this disturbance, the voltage shall not fall below 6 V and the duration shall not exceed 1 second.

3.4.14.2.1.4.2 Cranking level. The steady voltage during cranking shall not be below 16 V (no more than 3 cranking attempts of 30 seconds each with 2-minute cranking level pauses between attempts).

3.4.15 Environmental.

3.4.15.1 Temperature.

3.4.15.1.1 High (operating). The motor shall meet the performance requirements contained herein when operating at a high ambient temperature of +140 °F (+60 °C) (see 4.5.17.1.1).

3.4.15.1.2 High (non-operating). The motor shall not be damaged nor performance impaired after extended exposure at a temperature of +160 °F (+71 °C) (see 4.5.17.1.2).

3.4.15.1.3 Low (operating). The motor shall meet the performance requirements contained herein when operating at a low ambient temperature of -25 °F (-32 °C) (see 4.5.17.1.3).

3.4.15.1.4 Low (non-operating). The motor shall not be damaged nor performance impaired after extended exposure at a temperature of -65 °F (-54 °C) (see 4.5.17.1.4).

3.4.15.2 Humidity (non-operating). The motor shall not be damaged nor performance impaired after exposure to relative humidity ranges from up to 100 percent (%) at 86 °F (30 °C) to not less than 2% at 155 °F (68 °C) (see 4.5.17.2).

3.4.15.3 Atmospheric pressure.

3.4.15.3.1 Operating. The motor shall meet the performance requirements contained herein when operating at an atmospheric pressure equivalent to an altitude of 8000 feet (ft) (2438 meters (m)) (see 4.5.17.3.1).

3.4.15.3.2 Non-operating. The motor shall not be damaged nor performance impaired after exposure to an atmospheric pressure equivalent to an altitude of 40 000 ft (12 192 m) (see 4.5.17.3.2).

3.4.15.4 Sand and dust.

3.4.15.4.1 Operating. The motor shall meet the performance requirements contained herein when operating in a sand and dust environment containing particle sizes of 0.0001 to 1 mm) (see 4.5.17.4).

3.4.15.4.2 Non-operating. The motor shall not be damaged nor performance impaired after exposure to sand and dust, particle size 0.0001 to 1 mm (see 4.5.17.4).

3.4.15.5 Salt fog (non-operating). The motor shall not be damaged nor performance impaired after exposure to 0.015 oz per square inch (psi) per year (3 grams (g) salt per square meter (m^2)) per year (see 4.5.17.5).

3.4.15.6 Fungus. Materials used in the motor shall be fungus resistant (see 4.5.17.6).

3.4.15.7 Vibration (non-operating). The motor shall not be damaged nor performance impaired when subjected to simple harmonic motion in 3 mutually perpendicular directions (see 4.5.17.7).

3.4.15.8 Shock (non-operating). The motor shall not be damaged, nor performance impaired, when subjected to half-sine wave shock impulses of not less than 25 gravity units (g) for 11 ms (see 4.5.17.8).

3.4.16 Lead strength. The motor shall not be damaged when subjected to a 5-pound (lb) (22.5 Newton (N)) pull in any direction for 1 minute at the motor or filter end (see 4.5.18).

3.5 Identification and marking. Each motor unit shall be marked in accordance with ANSI/SAE AS478 (see 4.5.2).

3.6 Workmanship. Workmanship shall be in accordance with MIL-HDBK-454 guidelines (see 4.5.2).

4. VERIFICATION

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

a) First article inspection (see 4.3)
   1) Preproduction inspection (see 4.3.1)
   2) Initial production inspection (see 4.3.2)
b) Conformance inspections (see 4.4)
   1) Examination (see 4.4.2)
   2) Tests (see 4.4.3)

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

a) Air temperature: 73 ±18 °F (23 ±10 °C).
b) Barometric pressure: 28.5 (+2, -3) inches of mercury (Hg) (725 (+50, -75) kilopascals (kPa)).
c) Relative humidity: 50 ±30 percent.

4.3 First article inspection. First article inspection shall be performed on preproduction or initial production samples as specified herein (see 4.1).

4.3.1 Preproduction inspection. When specified (see 6.2), the preproduction sample shall consist of two motors. Preproduction inspection shall consist of inspection as specified in table I.

4.3.2 Initial production inspection. Unless otherwise specified (see 6.2), the Government shall select two motors, from the first twenty motors produced under the production contract for initial production inspection. Initial production motors shall be inspected as specified in table I.

4.4 Conformance inspection.

4.4.1 Sampling.

4.4.1.1 Lot formation. Each lot shall consist of all motors, of one type and part number, from an identifiable production period, from one manufacturer, submitted at one time for acceptance.

4.4.1.2 Sampling for examination. Samples of motor gearhead for conformance examination and test shall be in accordance with ANSI/ASQC Z1.4. A lot shall be accepted when zero (0) defects are found and rejected when 1 or more defects are found.

4.4.2 Examination. Samples selected in accordance with 4.4.1.2 shall be examined for defects as specified in table II.

4.4.3 Tests. Unless otherwise specified herein, each assembly shall be subjected to the tests specified in table I.

TABLE I. Classification of inspections.

Title	Requirement	Inspection	First article	Conformance	
				Examination	Tests
Materials and construction	3.2 thru 3.3.4	4.5.1	X		
Defects	3.3, 3.5 and 3.6	4.5.2	X	X	
Rotation of output shaft	3.4.1	4.5.3	X		X
No load speed	3.4.2	4.5.4	X		X 1/
Zero torque current	3.4.3	4.5.5	X		X 1/
Speed and current at 640 oz-in. (4.52 N-m)	3.4.4	4.5.6	X		X
Speed and current at 950 oz-in. (6.71 N-m)	3.4.5	4.5.7	X		X 1/
Stall torque and current	3.4.6	4.5.8	X		X
Plug reversal	3.4.7	4.5.9	X		X
Duty cycle	3.4.8	4.5.10	X		X 1/
Inertia (motor)	3.4.9	4.5.11	X		X
Operating voltage	3.4.10	4.5.12	X		X
Insulation resistance	3.4.11	4.5.13	X		X
Dielectric withstanding Voltage	3.4.12	4.5.14	X		X
Electromagnetic interference	3.4.13	4.5.15	X		X
Voltage transient	3.4.14	4.5.16	X		X
Temperature					
High (operating)	3.4.15.1.1	4.5.17.1.1	X		
High (non-operating)	3.4.15.1.2	4.5.17.1.2	X		
Low (operating)	3.4.15.1.3	4.5.17.1.3	X		
Low (non-operating)	3.4.15.1.4	4.5.17.14	X		
Humidity (non-operating)	3.4.15.2	4.5.17.2	X		
Atmospheric pressure					
Operating	3.4.15.3.1	4.5.17.3.1	X		
Non-operating	3.4.15.3.2	4.5.17.3.2	X		
Sand and dust					
Operating	3.4.15.4.1	4.5.17.4	X		
Non-operating	3.4.15.4.2	4.5.17.4	X		
Salt fog (non-operating)	3.4.15.5	4.5.17.5	X		
Fungus	3.4.15.6	4.5.17.6	X		
Vibration (non-operating)	3.4.15.7	4.5.17.7	X		
Shock (non-operating)	3.4.15.8	4.5.17.8	X		
Lead strength	3.4.16	4.5.18	X		

1/ Sample only in accordance with ANSI/ASQC Z1.4.

TABLE II. Classification of defects.

Category	Defect	Method of examination
Critical	None	
Major:		
101	Dimensions affecting interchangeability, out of tolerance (see 3.3).	SIE 1/
102	Improper identification marking (see 3.5).	Visual
103	Improper workmanship, affecting performance (see 3.6).	Visual
Minor:		
201	Dimensions not affecting interchangeability, out of tolerance (see 3.3).	SIE
202	Improper workmanship affecting appearance (see 3.6).	Visual

1/ SIE = Standard Inspection Equipment.

4.5 Methods of inspection.

4.5.1 Materials and construction. Conformance to 3.2 through 3.3.4, 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.

4.5.2 Defects. Conformance to 3.3, 3.5 and 3.6, shall be determined by examination for defects listed in table II. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

4.5.3 Rotation of output shaft. To determine conformance to 3.4.1, the motor shaft shall rotate in a counterclockwise direction when viewed from the shaft end with positive voltage applied to the + (positive) terminal of the filter and negative voltage applied to the - (negative) terminal of the filter. Reverse lead polarity stated above and verify clockwise shaft rotation.

4.5.4 No load speed. To determine conformance to 3.4.2, the motor output shaft speed measured with no load applied shall be no more than 36 rpm in both directions of rotation.

4.5.5 Zero torque current. To determine conformance to 3.4.3, the current drawn by the motor under the condition of no load applied to the output shaft, shall be measured and shall not exceed 0.5 A dc.

4.5.6 Speed and current at 640 oz-in. (4.52 N-m)). To determine conformance to 3.4.4, the motor output shaft shall be connected to a loading device such as a dynamometer and a speed-indicating device such as a tachometer. The loading shall then be adjusted to not less than 640 oz-in., and the resultant speed and current shall be measured for each direction of rotation. The speed shall be no less than 22 rpm, and the current shall be no more than 1.5 A dc.

4.5.7 Speed and current at 950 oz-in. (6.71 N-m). To determine conformance to 3.4.5, the motor output shaft shall be connected to a loading device such as a dynamometer and a speed-indicating device such as a tachometer. The loading shall then be adjusted to not less than 950 oz-in., and the resultant speed and current shall be measured for each direction of rotation. The speed shall be no less than 15 rpm and the current shall be no more than 2.5 A dc.

4.5.8 Stall torque and current. To determine conformance to 3.4.6, the motor output shaft shall be connected to a loading device such as a dynamometer and the starting current measured by an oscilliscope. With the motor energized at 24 Vdc, the stall torque shall be no less than 1590 oz-in. (11.23 N-m) and the stall current at stall torque shall be no more than 7 A dc. The motor shall not be damaged nor performance impaired after the stall.

4.5.9 Plug reversal. To determine conformance to 3.4.7, the motor shall be connected to a power source through a switching circuit as described by 3.4.7. The motor shall then be energized at 30 ±0.1 Vdc and with the output shaft rotating at not less than 22 nor more than 36 rpm, the motor shall be plug reversed by applying a polarity opposite the back emf described in 3.4.7. At the conclusion of the plug reversal test, the motor shall meet the requirement of 3.4.4 and 3.4.5.

4.5.10 Duty cycle. To determine conformance to 3.4.8, the motor shall be connected to a power source through a switching circuit as described by 3.4.7. The motor shall then be subjected to the following:

a. On for 2 seconds at not less than 640 oz-in. (4.52 N-m) with 24 ±0.5 Vdc applied.
b. Reverse drive polarity (plug reverse in accordance with 3.4.7) with 24 ±0.5 Vdc applied for a 2-second period at not less than 640 oz-in.
c. Repeat steps a and b for 30 cycles. At the conclusion of the duty cycle test, the motor shall meet the requirements of 3.4.4 and 3.4.5.

Motor performance shall remain within specifications when the direction of drive is reversed (plug reversal) with rated voltage and 640 oz-in. load applied.

4.5.11 Inertia. To determine conformance to 3.4.9, the inertia shall be measured at the output shaft.

4.5.12 Operating voltage. When specified (see 6.2), tests of 4.5.4 through 4.5.8 and 4.5.10 shall be repeated except the input voltage shall be 18 ±1 Vdc followed by test input voltage of 30 ±1 Vdc. Motor performance shall be in accordance with 3.4.10.

4.5.13 Insulation resistance. To determine conformance to 3.4.11, the insulation resistance of the motor shall be measured prior to installation of the EMI filter. Insulation resistance shall be in accordance with MIL-STD-202, method 302, condition B, conducted at 500 Vdc measured between winding and frame.

4.5.14 Dielectric withstanding voltage. To determine conformance to 3.4.12, prior to installation of the EMI filter, the motor shall be subjected initially to dielectric withstanding voltage in accordance with MIL-STD-202, method 301. The voltage shall be 500 V rms, 60 Hz for 1 minute or 600 V rms, 60 Hz applied for 1 second between winding and frame. There shall be no breakdown or degradation of insulation.

4.5.15 Electromagnetic interference.

4.5.15.1 Conducted emissions. To determine conformance to 3.4.13.1, the motor shall be tested to verify it meets the requirements of CE102 of MIL-STD-461.

4.5.15.2 Radiated emissions. To determine conformance to 3.4.13.2, the motor shall be tested to verify it meets the requirements for Army ground applications given in RE102 of MIL-STD-461.

4.5.16 Voltage transient. To determine conformance to 3.4.14, the motor shall be tested to verify meeting the requirements of figures 1 through 5.

4.5.17 Environmental.

4.5.17.1 Temperature.

4.5.17.1.1 High (operating). To determine conformance to 3.4.15.1.1, the motor shall be tested in accordance with MIL-STD-810, method 501.3, procedure II, except temperature shall be raised to +140 °F (+60 °C).

4.5.17.1.2 High (non-operating). To determine conformance to 3.4.15.1.2, the motor shall be tested in accordance with MIL-STD-810, method 501.3, procedure I, except temperature shall be raised to +160 °F (+71 °C).

4.5.17.1.3 Low (operating). To determine conformance to 3.4.15.1.3, the motor shall be tested in accordance with MIL-STD-810, method 502.3, procedure II, except temperature shall be lowered to -25 °F (-32 °C).

4.5.17.1.4 Low (non-operating). To determine conformance to 3.4.15.1.4, the motor shall be tested in accordance with MIL-STD-810, method 502.3, procedure I, except temperature shall be lowered to -65 °F (-54 °C).

4.5.17.2 Humidity (non-operating). To determine conformance to 3.4.15.2, the motor shall be tested in accordance with MIL-STD-810, method 507.3, procedure I.

4.5.17.3 Atmospheric pressure.

4.5.17.3.1 Operating. To determine conformance to 3.4.15.3.1, the motor shall be tested by placing in a chamber and stabilizing at a temperature of +125 °F (+52 °C) and a pressure

equivalent to an altitude of 8000 ft (2438 m) for not less than 2 hours before the start of the test. After not less than 6 hours in this stabilized condition, and with no change in temperature or pressure, the test article shall meet functional test.

4.5.17.3.2 Non-operating. To determine conformance to 3.4.15.3.2, the motor shall be tested in accordance with MIL-STD-810, method 500.3, procedure I, including test for pressure equivalent to 40 000 ft (12 192 m).

4.5.17.4 Sand and dust. To determine conformance to 3.4.15.4, the motor shall be tested in accordance with MIL-STD-810, method 510.3, procedure I, except temperature during step 5 shall be limited to +140 °F (+60 °C).

4.5.17.5 Salt fog (non-operating). To determine conformance to 3.4.15.5, the motor shall be tested in accordance with MIL-STD-810, method 509.3, procedure I.

4.5.17.6 Fungus. To determine conformance to 3.4.15.6, the motor shall be tested in accordance with MIL-STD-810, method 508.4.

4.5.17.7 Vibration (non-operating). To determine conformance to 3.4.15.7, the motor while non-operating shall be subjected to the vibration amplitude, frequency range and duration as specified in 4.5.17.7.1, 4.5.17.7.2 and 4.5.17.7.3, respectively (see figure 6). There shall be no damage or performance degradation as a result of this test.

4.5.17.7.1 Amplitude. The motor shall be subjected to a simple harmonic motion having an amplitude of either 0.06 in. double amplitude (maximum total excursion) or 10 gravity units (g peak), whichever is less. The tolerance on vibration amplitude shall be ±10% (see table III).

4.5.17.7.2 Frequency range. The vibration frequency shall be verified logarithmically between the limits of 5 to 200 Hz (see table III).

4.5.17.7.3 Sweep time and duration. The entire frequency range of 5 to 200 Hz and return to 5 Hz shall be traversed in 6 minutes. This cycle shall be performed 12 times in each of three mutually perpendicular directions (total of 36 times), so that the motion shall be applied for a total period of approximately 9 hours. Interruptions are permitted provided the requirements for rate of change and test duration are met. Completion of cycling within any separate band is permissible before going to the next band.

TABLE III. Vibration conditions.

Frequency (Hz)	Amplitude
5 to 6.2	0.5 inch (12.7 mm) double amplitude (da)
6.2 to 25	1 g
25 to 200	0.5 g

4.5.17.8 Shock (non-operating). To determine conformance to 3.4.15.8, the motor whenever possible, shall have the test load distributed uniformly on the platform in order to

minimize the effects of unbalanced load. There shall be no damage or degradation as a result of this test.

4.5.17.8.1 Test conditions. Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen (18 shocks). If the test specimen is normally mounted on vibration isolators, the isolators shall be functional during the test. The specified test pulse of half-sine shall be in accordance with figure 7, and shall have a duration and peak value in accordance with 4.5.17.8.2.

4.5.17.8.2 Test values. During test the peak gravity (g value) shall be 25 for 11 ms; with a half-sine wave form and a velocity change of 6.8 feet per second (ft/sec) (see figure 7).

4.5.18 Lead strength. To determine conformance to 3.4.16, the motor or filter end shall be attached to a spring scale and a force of 5 lbs (22.2 N) shall be applied for 1 minute. The test is to be applied at random directions with respect to the exit location of the wire from the motor and the attachment of wire to the filter.

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 motor covered by this specification is intended for use in a military vehicle to operate Remote Arming Device.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a) Title, number, and date of this specification.
b) 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 other than as specified test conditions are required (see 4.2).
e) If preproduction inspection is required (see 4.3.1).
f) If initial production inspection is required (see 4.3.2).
g) If specific tests are required (see 4.5.12).
h) Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Gearing
No load speed
Remote arming device (RAD)
Stall torque

6.4 International Standardization Agreement. Certain provisions of this specification (see 3.2.4) are the subject of international standardization agreement, STANAG 1135. When amendment, revision, or cancellation of this specification is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels, including departmental standardization offices, to change the agreement or make other appropriate accommodations.

6.5 Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

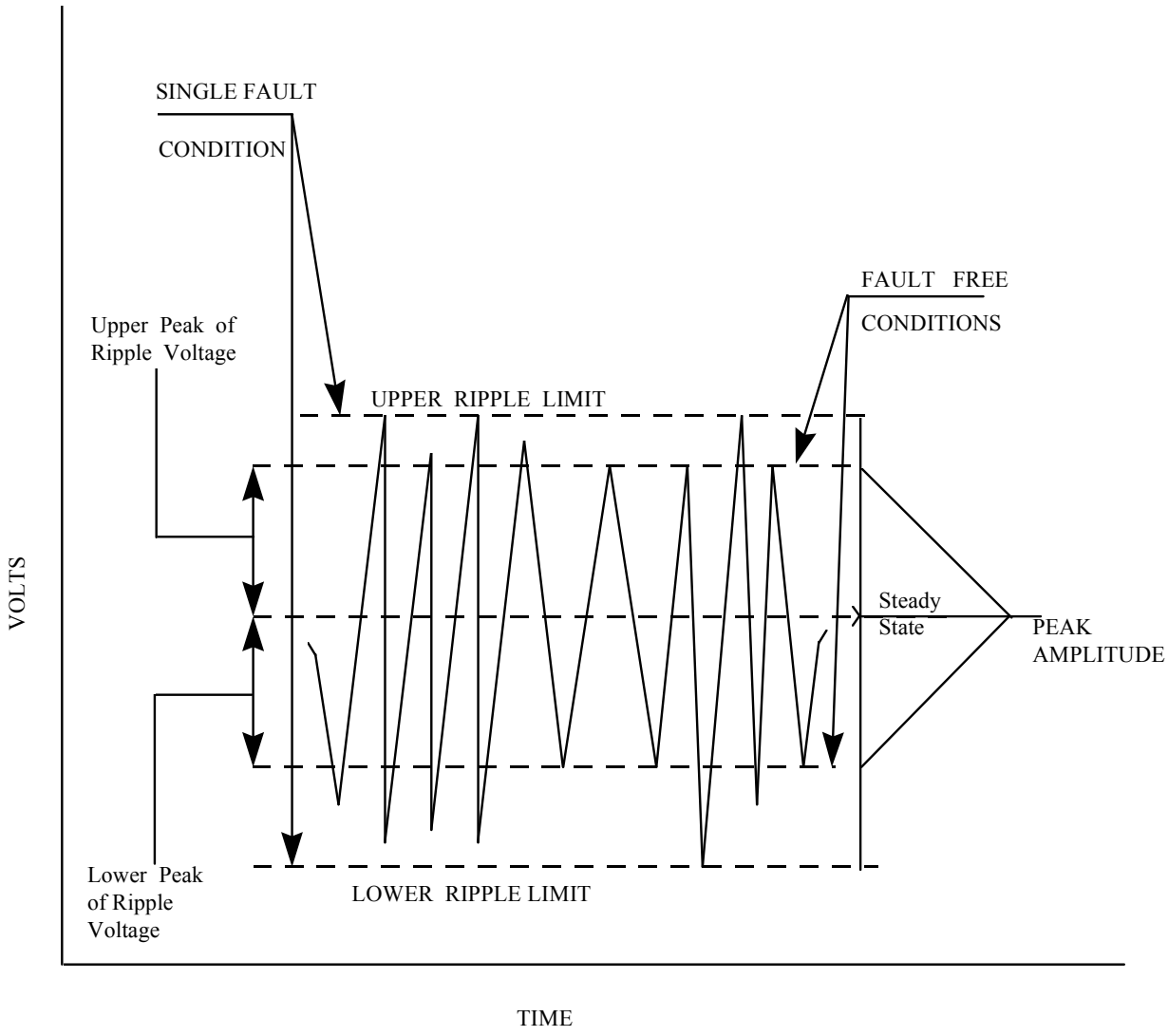


FIGURE 1. Enlarged view of ripple.

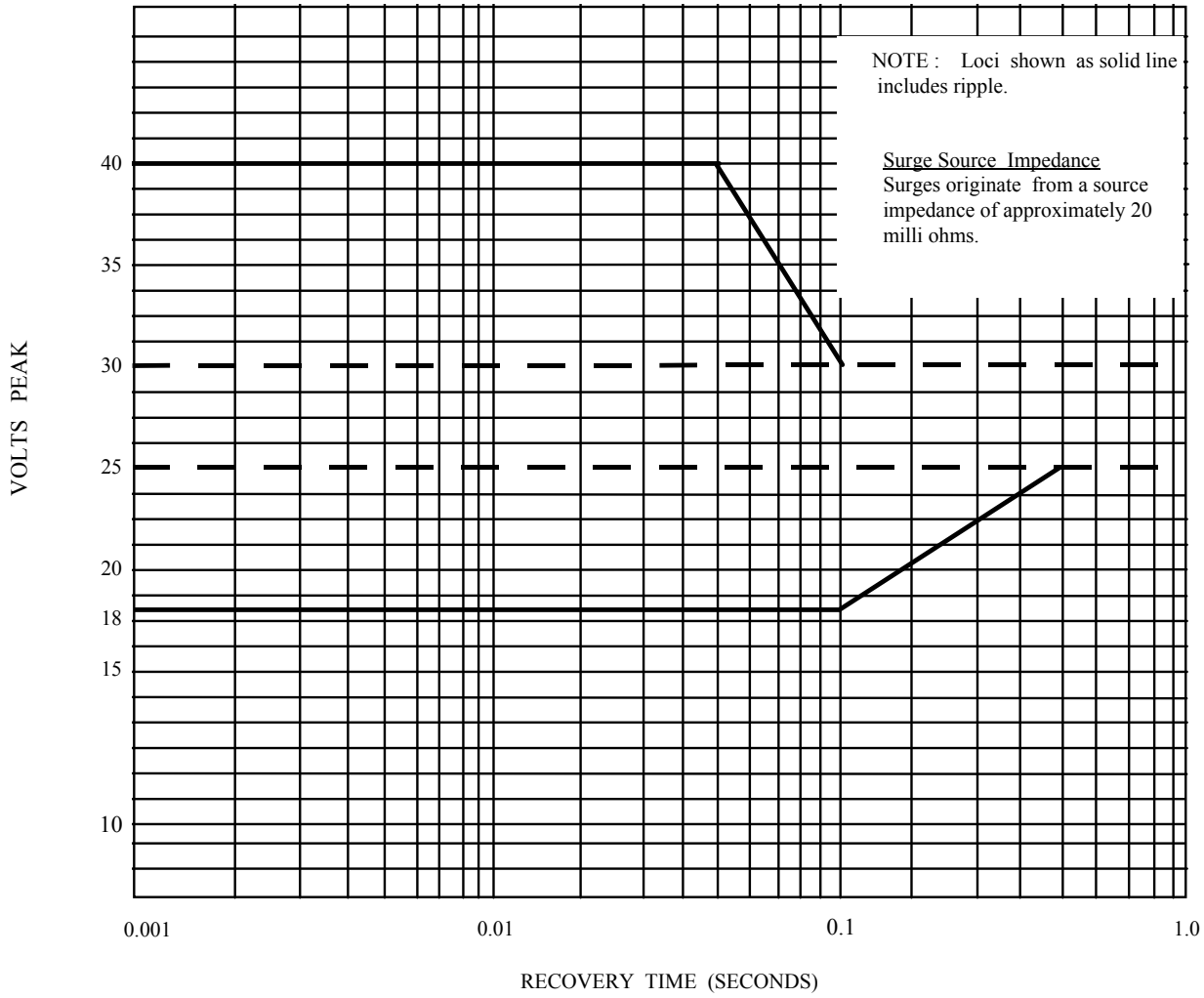


FIGURE 2. Loci of surges fault free condition.

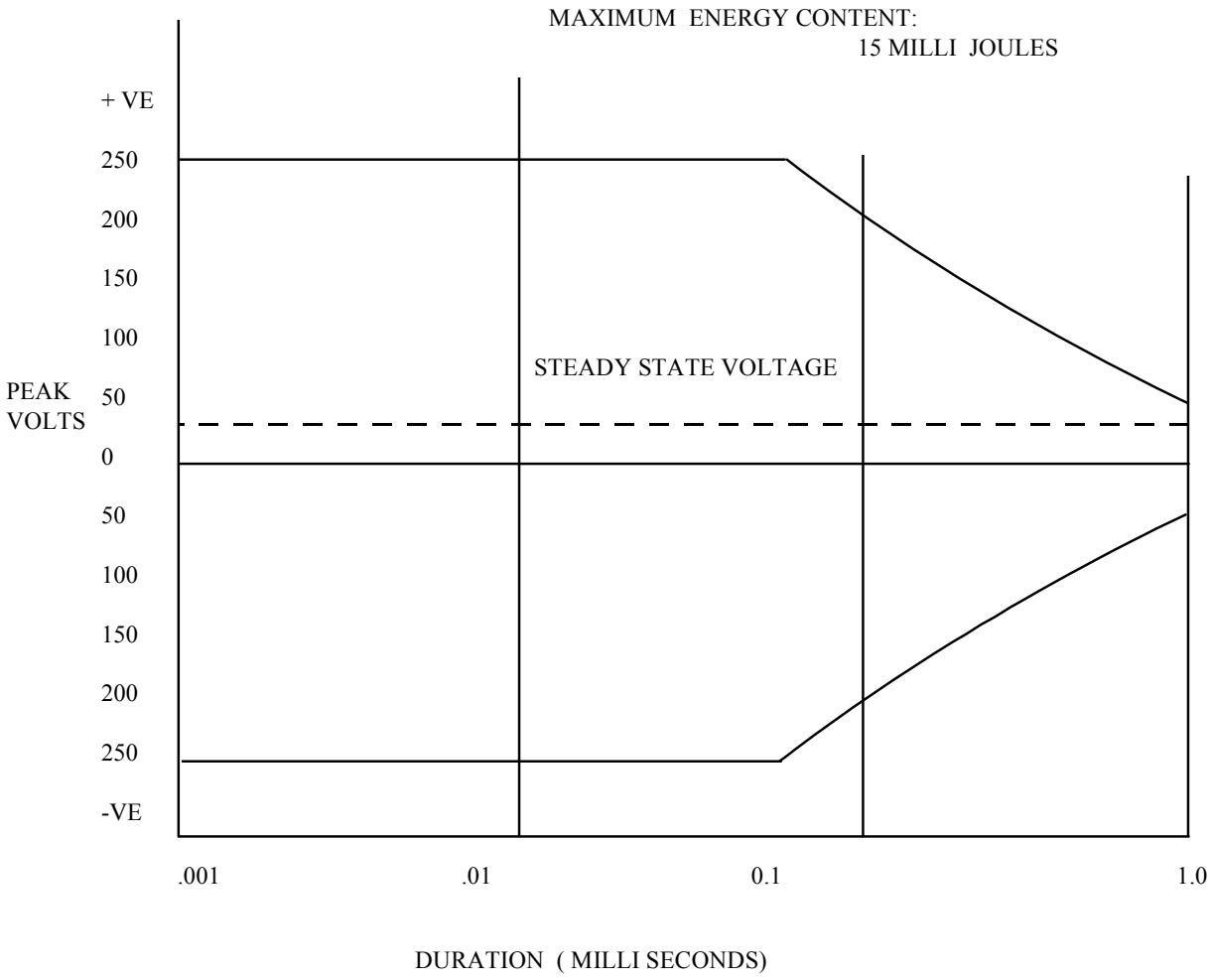


FIGURE 3. Loci of spikes fault free condition.

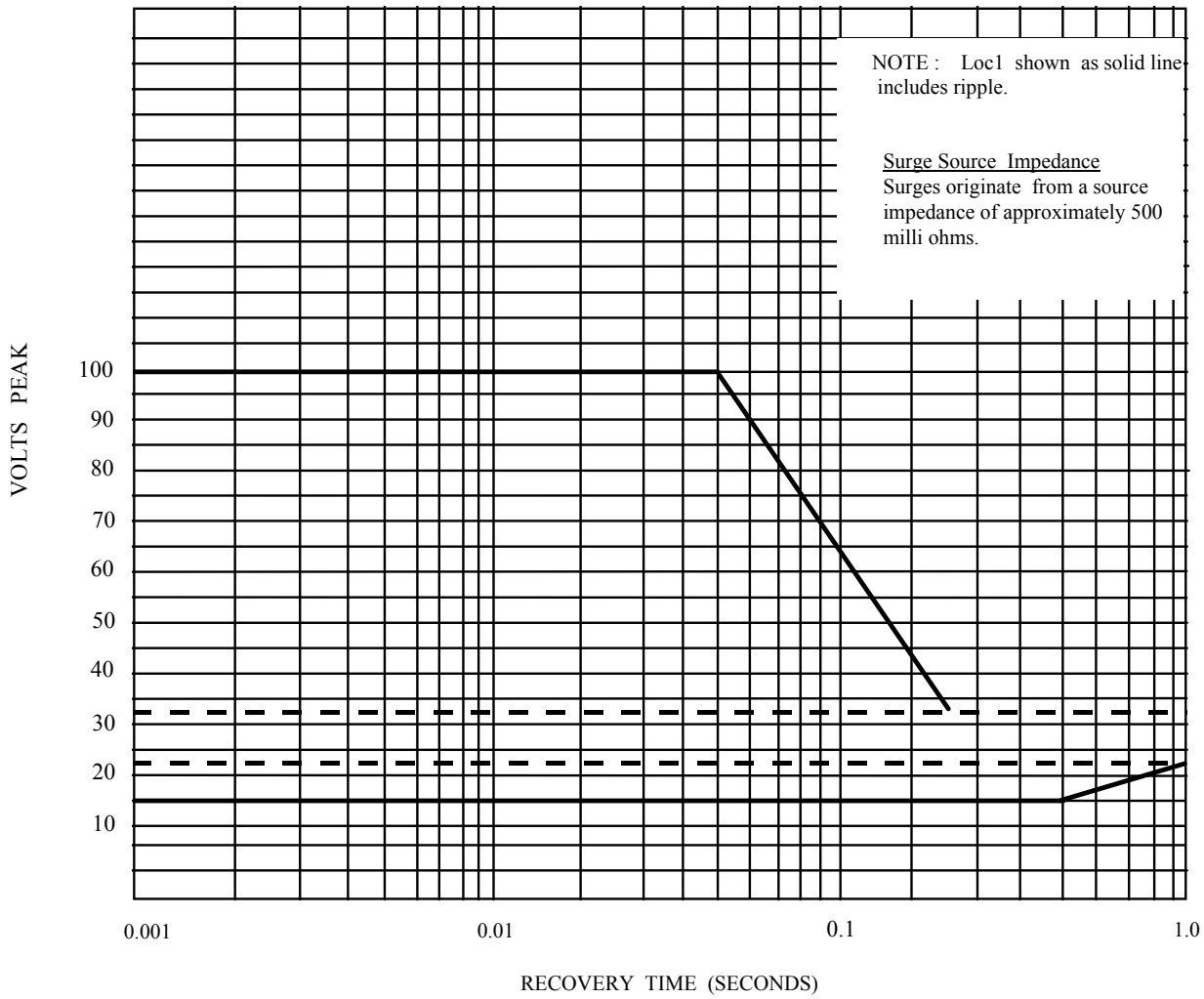


FIGURE 4. Loci of surges single fault condition.

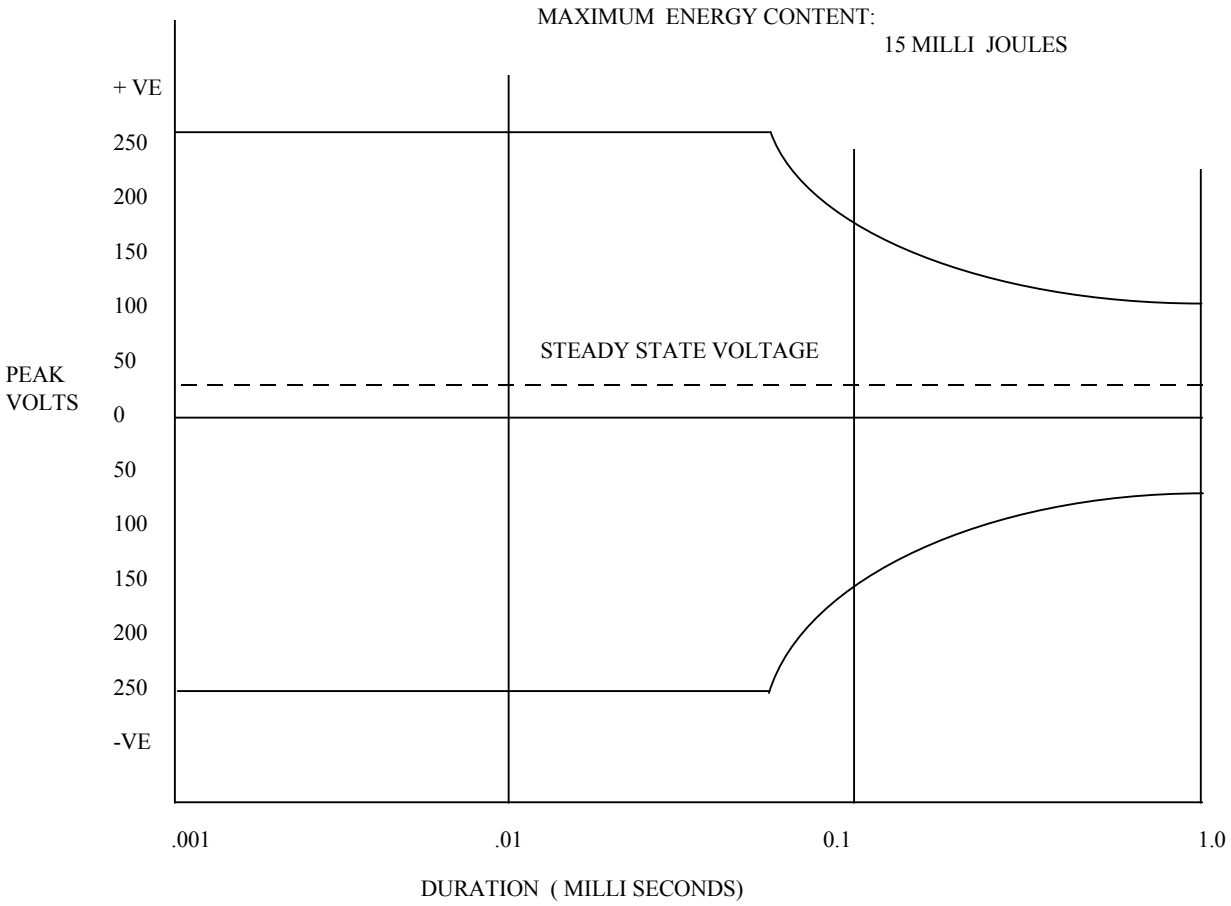
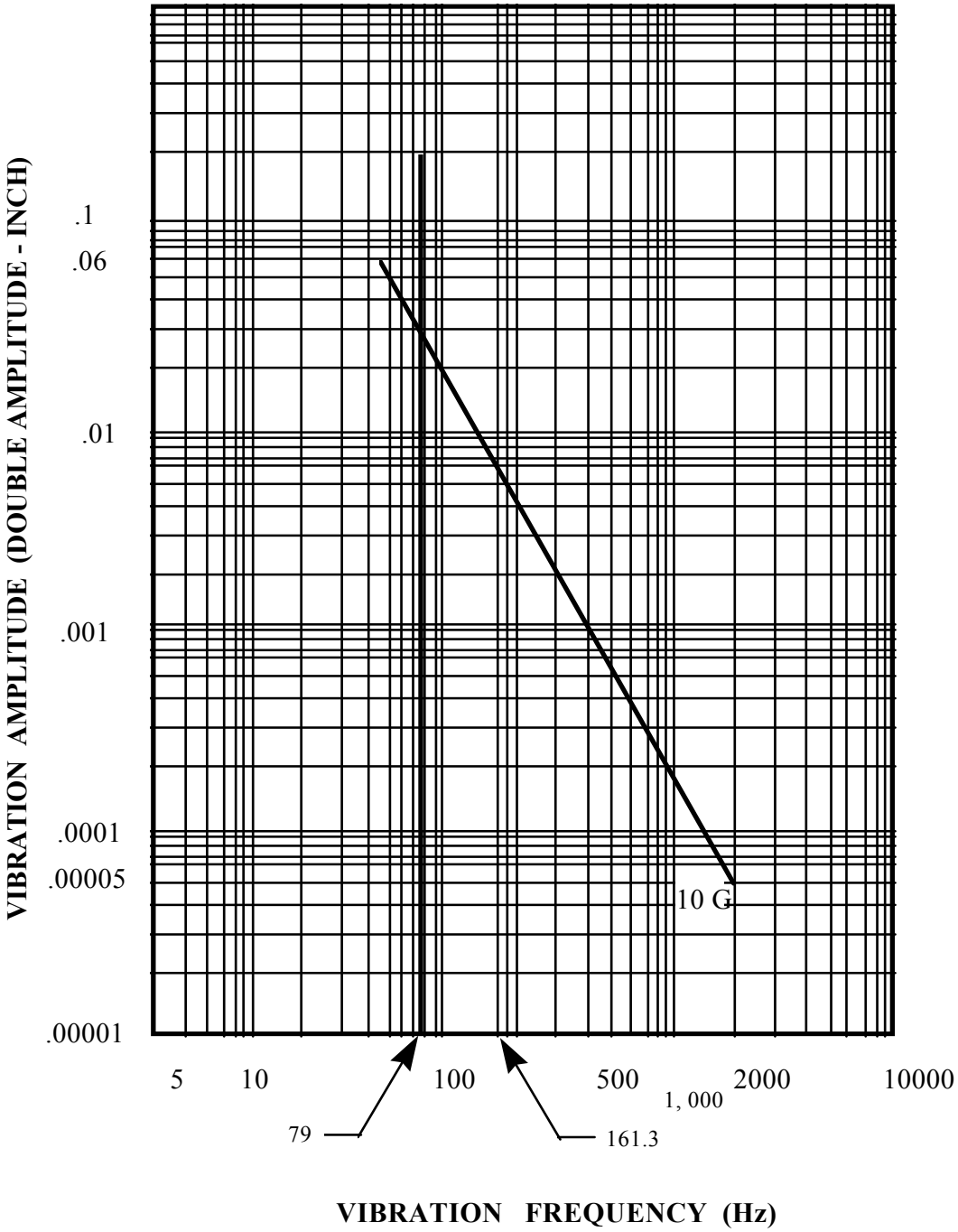
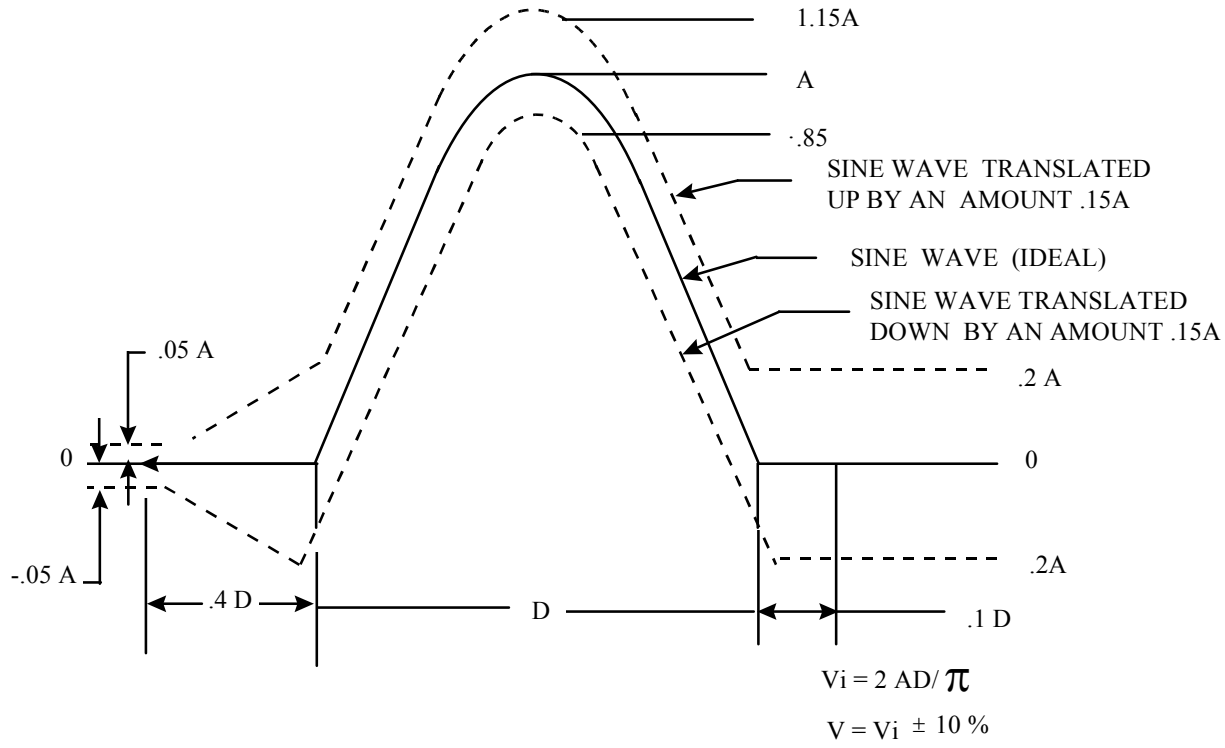


FIGURE 5. Loci of spikes single fault condition.



$G = 0.0512f^2DA$ (f = frequency in Hertz, DA = double amplitude in inches).

FIGURE 6. Vibration-test curves.



NOTE: The oscillogram should include a time about 3D long with the pulse located approximately in the center. The integration to determine velocity change should extend from 0.4D before the pulse to 0.1D beyond the pulse. The acceleration amplitude of the ideal half-sine pulse is A and its duration is D. Any measured acceleration pulse which can be contained between the broken line boundaries is a nominal half-sine pulse of nominal amplitude A and nominal duration D. The velocity-change associated with the measured acceleration pulse is V.

FIGURE 7. Tolerances for half-sine shock pulse.

Custodian:
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Preparing Activity:
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(Project 6105-2009-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.