

MIL-B-62364A(AT)
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SUPERSEDING
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MILITARY SPECIFICATION

BRAKE, ELECTROMAGNETIC, NORMALLY ENGAGED

This specification is approved for use by US Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers two types of electromagnetic brake assemblies. Each, when electrically energized, releases a shaft for motion. When de-energized, the electromagnetic brake assemblies apply braking to the driving shaft to arrest its motion or to hold it stationary.

1.2 Classification. The electromagnetic brake assembly shall be one of the types listed below:

Type I	Part number 12265502-1	Brake, Slew
Type II	Part number 12265502-2	Brake, Track

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC N/A

FSC 2530

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

STANDARDS
MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130	- Identification Marking of US Military Property.
MIL-STD-202	- Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454	- Standard General Requirements for Electronic Equipment.
MIL-STD-810	- Environmental Test Methods and Engineering Guidelines.
MIL-STD-889	- Dissimilar Metals.
MIL-STD-1275	- Characteristics of 28 Volt DC Electrical Systems in Military Vehicles.
MIL-STD-45662	- Calibration Systems Requirements.

2.1.2 Other Government documents, drawings, and publications. The following documents, drawings, and publications form a part of this specification to the extent specified herein.

DRAWINGS
ARMY

12265502	- Brake, Electromagnetic, Energize, to Release (Fail-Safe).
12265895	- Housing, Mechanical Drive, Gearbox.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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3. REQUIREMENTS

3.1 First article. Unless otherwise specified (see 6.2), the contractor shall furnish samples of the electromagnetic brake assembly which shall be subjected to first article inspection (see 4.4). First article inspection samples, properly marked with identifying information, shall be representative of the unit to be furnished to the Government. All subsequent brake assemblies delivered to the Government shall conform to these samples in all of their pertinent physical and performance attributes.

3.2 Materials. Materials used shall be as specified herein and on Drawing 12265502. Materials shall be free from defects and be entirely adequate for the intended purpose under the performance and environmental conditions imposed by this specification (see 4.7.1).

3.2.1 Metals and finishes. All metals shall be corrosion resistant or shall be suitably protected against corrosion internally and externally during normal service life. Particular attention shall be paid to the metal and finish in contact with the friction brake material to assure under operating conditions that the friction material does not become contaminated by foreign particles of metal or protective finish residues which will alter performance of the brake. Dissimilar metals shall be in accordance with MIL-STD-889 (see 4.7.1).

3.2.2 Fungus. Only materials that are non-nutrients, as identified by MIL-STD-454, requirement 4, shall be used where possible (see 4.7.1).

3.3 Design and construction. Design and construction shall conform to Drawing 12265502, all applicable specifications, and as specified herein. The brake assembly shall be designed to mount on a gearbox, and to apply frictional braking to the output shaft by means of brake pads. The brakes will be utilized under the conditions of free convection and conduction, and shall be capable of operating in any position (see 4.7.1 and 4.7.2).

3.3.1 Torque. The brake assembly shall be designed in such a manner that the adjustment of torque requirements can be accomplished at the factory or depot repair level (see 4.7.1).

3.4 Performance.

3.4.1 Voltage. The brake assembly shall function and meet the performance requirements of this specification with input voltage of 18 to 30 V dc (see 4.7).

3.4.2 Voltage transient. The brake assembly shall be able to withstand transient voltages permitted by MIL-STD-1275 for fault-free, battery only and single fault conditions in the operating and non-operating conditions (see 4.7.4).

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3.4.3 Braking torque.

3.4.3.1 Static torque. The brake shall apply static friction to resist motion of the brake shaft when it is under torsional load. The friction level shall be set so that incipient creep shall occur when the shaft is torqued as follows (see 4.7.6.1).

Part number 12265502-1	55 inch pounds [6.2 newton meters (N m)] + 10 percent
Part number 12265502-2	85 inch pounds (9.6 N m) ± 10 percent

3.4.3.2 Sliding torque. When the torque applied to a braked stationary shaft is increased to the specified static torque value, the brake shall begin to slip, and the shaft shall begin to rotate smoothly. Torque shall not exceed the specified static torque while the shaft is rotated through 15 to 30 revolutions (see 4.7.6.2).

3.4.3.3 Dynamic torque. When an initial coasting speed and inertial load are as specified in table I, the de-energized brake shall bring a rotating shaft to a complete stop within the time specified in table I (see 4.7.6.3).

TABLE I. Stopping time.

Part Number	Inertia pound-inch-second ² (newton-meter-second ²)	Initial speed rpm	Stopping time (seconds)
12265502-1	0.0145 (0.0016)	6242	0.40
12265502-2	0.0387 (0.0043)	1892	0.25

3.4.3.4 Drag torque. Drag torque is the torque required to rotate the brake shaft with the coil energized. The brake(s) shall have a drag torque of not more than 3 inch pound (0.34 N m) on the rotational brake shaft (see 4.7.6.4).

3.4.4 Air gap. When the coil is energized, the air gap between the brake pads and the brake disk shall be adjusted to not less than 0.005 inch (in) [0.127 millimeter (mm)] (see 4.7.6.5).

3.4.5 Engagement time. The friction brake pads shall make contact with the brake disk within 100 milliseconds (ms), from the moment that the coil is de-energized (see 4.7.6.6).

3.4.6 Release time. The friction brake pads shall release from contact with the brake disk within 100 ms from the moment that the coil is energized (see 4.7.6.6).

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3.4.7 Insulation resistance. Insulation resistance shall be not less than 100 megohms from the coil terminals connected together and the case when 500 V dc is applied (see 4.7.7).

3.4.8 Dielectric-withstanding voltage. The brake assembly shall withstand 500 V root-mean-square (rms), 60 hertz (Hz) for 1 minute, or 600 V rms for 1 second, between terminals connected together and the case. After initial test, the brakes shall be capable of withstanding repeated tests at 450 V rms 60 Hz (see 4.7.8).

3.4.9 Coil duty. Coil insulation shall be adequate for continuous operation at 24 volts (V) direct current (dc) when stabilized at 40 degrees Fahrenheit ($^{\circ}$ F) [60 degrees Celsius ($^{\circ}$ C)] when installed on an aluminum gearbox part number 12265895 (see 4.7.5).

3.4.10 Polarity. The brake assembly shall not be polarity sensitive (see 4.7.3).

3.4.11 Operating life. The electromagnetic brake assembly shall perform a minimum of 34 560 on-off cycles when applying and releasing the brake pads under static conditions and in accordance with 3.4.3.3, a minimum of 4410 cycles of stopping and releasing the brake disk under dynamic conditions. The brake assembly shall be capable of performing the specified number of cycles under any environmental condition specified herein without failure, adjustment, or replacement of any component (see 4.7.9).

3.5 Environmental.

3.5.1 Environmental requirements. The design, materials, and construction of the brake assembly shall enable the unit to operate as specified in the environmental conditions called out in this paragraph. The brake assembly shall meet the performance requirements of this specification during exposure to those environments designated as operating. The unit shall not be damaged nor its performance impaired after exposure to those environments designated as non-operating (see 4.7.10 through 4.7.10h):

a. High Temperature:

Operating 140 $^{\circ}$ F (60 $^{\circ}$ C)
Non-operating 158 $^{\circ}$ F (70 $^{\circ}$ C)

b. Low Temperature:

Operating -26 $^{\circ}$ F (-32 $^{\circ}$ C)
Non-operating -65 $^{\circ}$ F (-54 $^{\circ}$ C)

c. Humidity:

Operating:
Maximum 100 percent relative humidity (rh), at
85 $^{\circ}$ F (29.4 $^{\circ}$ C)
Minimum 5 percent rh at 125 $^{\circ}$ F (51.7 $^{\circ}$ C)

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Non-operating:

Maximum 100 percent rh at 80°F (26.7°C)

Minimum 2 percent rh at 155°F (68.3°C)

d. Sand and dust:

Operating and non-operating:

Particle size 3.937×10^{-6} to 3.937×10^{-2} in
(0.0001 to 1.0 mm)

e. Salt fog:

Non-operating: 0.0098 ounces/ft²/year
(3 grams/square meter/year)

f. Vibration:

Non-operating:

Type: Simple harmonic motion in 3 mutually
perpendicular axes.

Condition:

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

g. Shock:

Non-operating: Wave form = half sine wave
Peak value = 25 g minimum
Duration = 11 milliseconds
Applied along 3 mutually
perpendicular axes

h. Fungus growth: Environmental conditions conducive to fungus growth shall not impair brake performance or operation (see 4.7.10h).

3.6 Identification/marking. The brake assemblies shall be identified as specified in Drawing 12265502 and marked in accordance with MIL-STD-130 (see table III).

3.7 Workmanship. All parts shall be fabricated and assembled in a thorough workmanshiplike manner to applicable drawing requirements. They shall be free from burrs, chips, sharp edges, cracks, unblended radii, surface defects, dirt, grease, rust, corrosion products and other foreign matter that would affect appearance or performance (see 4.7.2).

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4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order (see 6.2), the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform or witness any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 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 percent of the measurement tolerance. Calibration of inspection equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspection:

- a. First article inspection (see 4.4).
 1. Preproduction inspection (see 4.4.1).
 2. Initial production inspection (see 4.4.2).
- b. Quality conformance inspections (see 4.5).
 1. Examinations (see 4.5.2).
 2. Tests (see 4.5.3).

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be conducted under the following conditions:

- a. Air temperature $23 + 10^{\circ}\text{C}$
- b. Barometric pressure $725 + 50\text{mm Hg}$
- 75
- c. Relative humidity $50 + 30$ percent

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 electromagnetic brake assemblies 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 electromagnetic brake assemblies. Preproduction inspection shall consist of inspection as specified in table II.

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

4.4.3 First article inspection failure. Test item deficiencies during, or as a result of, the first article test shall be cause for rejection of the items until evidence has been provided by the contractor that corrective action has been taken to eliminate the deficiency. Any deficiency found during, or as a result of, the first article test shall be evidence that all items already produced prior to completion of the first article test are similarly deficient unless contrary evidence satisfactory to the contracting officer is furnished by the contractor. Such deficiencies on all items shall be corrected by the contractor. The Government shall not accept products until first article testing is completed to the satisfaction of the Government.

TABLE II. Classification of inspections.

Title	Requirement	Inspection	First article	Quality conformance	
				Examination	Test (100%)
Materials and construction	3.2 thru 3.3.3	4.7.1	X		
Defects (see table III)	3.3.1, 3.3, 3.6 and 3.7	4.7.2		X	
Voltage transient	3.4.2	4.7.4	X		
Static torque	3.4.3.1	4.7.6.1	X		X
Sliding torque	3.4.3.2	4.7.6.2	X		X
Dynamic torque	3.4.3.3	4.7.6.3	X		X
Drag torque	3.4.3.4	4.7.6.4	X		X
Air gap	3.4.4	4.7.6.6	X		X
Engagement time	3.4.5	4.7.6.6	X		X
Release time	3.4.6	4.7.6.6	X		X
Insulation resistance	3.4.7	4.7.7	X		X
Dielectric-withstanding voltage	3.4.8	4.7.8	X		X
First article Acceptance		4.7.8.1	X		
		4.7.8.2	X		
Coil duty	3.4.9	4.7.5	X		X
Polarity	3.4.10	4.7.3	X		X
Operating life	3.4.11	4.7.9	X		

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TABLE II. Classification of inspections - Continued.

Title	Requirement	Inspection	First article	Quality conformance	
				Examination	Test (100%)
Temperature, high	3.5.1a	4.7.10a	X		
Temperature, low	3.5.1b	4.7.10b	X		
Humidity	3.5.1c	4.7.10c	X		
Sand and dust	3.5.1d	4.7.10d	X		
Salt fog	3.5.1e	4.7.10e	X		
Vibration	3.5.1f	4.7.10f	X		
Shock	3.5.1g	4.7.10g	X		
Fungus	3.5.1h	4.7.10h	X		

4.5 Quality conformance inspections.4.5.1 Sampling.

4.5.1.1 Lot formation. An inspection lot shall consist of all the brake assemblies 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 quality conformance examination shall be selected in accordance with general inspection level II of MIL-STD-105.

4.5.1.3 Sampling for acceptance tests. Samples for acceptance tests shall be selected in accordance with level II of MIL-STD-105.

4.5.2 Quality conformance examinations.

4.5.2.1 Acceptable quality level. Each sample selected in accordance with 4.5.1.2 shall be examined to determine conformance to the following acceptable quality levels (AQL) on the basis of percent defective:

<u>Classification</u>	<u>AQL</u>
Major	1.0
Minor	2.5

4.5.2.2 Classification of defects. For examination purposes, defects shall be classified as listed in table III.

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TABLE III. Classification of defects.

Category	Defect	Method of examination
Critical	None	
<u>Major</u>	<u>AQL 1.0% Defective</u>	
101	Incomplete assembly (see 3.1).	Visual
102	Incorrect dimensions affecting interchangeability (see 3.3).	SIE 1/
103	Improper routing of safety wire (see 3.3).	Visual
<u>Minor</u>	<u>AQL 2.5% Defective</u>	
201	Incorrect dimensions not affecting interchangeability (see 3.3).	SIE
202	Improper identification marking (see 3.6).	Visual
203	Faulty workmanship (see 3.7).	Visual

1/ SIE = Standard Inspection Equipment.

4.5.3 Test (100 percent). Each electromagnetic brake assembly shall be subjected to the conformance tests specified in table II.

4.6 Failure. Failure of any electromagnetic brake assembly to pass any of the specified acceptance or control inspections shall be cause for the Government to refuse acceptance of the production quantity represented, until action taken by the contractor to correct defects and prevent recurrence has been approved by the Government.

4.7 Methods of inspection. Unless otherwise specified herein, all tests specified herein shall be conducted with input voltages as specified in 3.4.1.

4.7.1 Materials and construction. Conformance to 3.2 and 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 3.1, 3.3, 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 Polarity. To conform to 3.4.10, the brake assembly shall be tested for polar sensitivity.

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4.7.4 Voltage transient. Compliance with 3.4.2 will be verified by successful completion of voltage transient tests in operating and non-operating conditions in accordance with MIL-STD-1275.

4.7.5 Coil duty. To determine conformance to 3.4.9, when stabilized, energize with 24 V dc for not less than 18 hours. There shall be no deterioration of the brake coil following this test.

4.7.6 Fixture tests. The tests described below shall be conducted in a test fixture that will simulate the actual operating environment of the brake system. The test setup shall include an appropriately configured motor shaft with integral specified inertial loads (see table I), a variable speed drive, electrical power and control for the electromatic brake, and instrumentation to measure speed, torque, and time.

4.7.6.1 Static torque. To determine conformance to 3.4.3.1, use torque measuring equipment, to determine static torque values. Peak torque values, measured at the initiation of shaft motion shall be used. The frictional torque resistance will decrease once shaft rotation has begun.

4.7.6.2 Sliding torque. To determine conformance to 3.4.3.2, engage the brake and apply increasing torque to the motor shaft. The shaft shall begin to rotate at the measured torque values in 4.7.6.1. The shaft shall continue to rotate slowly through 15 to 30 complete revolutions at applied torque not greater than the specified torque. Motion shall be smooth and continuous.

4.7.6.3 Dynamic torque. To determine conformance to 3.4.3.3, stopping performance under conditions of table I shall be measured. With the brake coil energized, the motor shaft with integral inertia load and the brake rotor shall be brought to the specified speed. The shaft with inertia load shall be released and then the brake coil shall be de-energized. Stopping time shall be measured from when power is removed from the brake coil until the brake rotor comes to a complete stop.

4.7.6.4 Drag torque. To determine conformance to 3.4.3.4, the brake assembly shall be tested for the amount of drag torque. This shall be determined by comparing rotational torque values of the brake shaft without the brake assembly installed versus the torque values with the brake assembly installed in the fixture.

4.7.6.5 Air gap. To determine conformance to 3.4.4, with the coil energized and using a feeler gage, check the clearance between the brake pads and the brake disk.

4.7.6.6 Engagement and release time. To determine conformance to 3.4.5 and 3.4.6, measure the amount of time required for the brake pads to engage and disengage from the moment the coil is energized and de-energized.

4.7.7 Insulation resistance. To verify conformance to 3.4.7, the insulation resistance between coil terminals connected together and the case at 500 V dc shall be tested as specified in MIL-STD-202, method 302, test condition B.

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4.7.8 Dielectric - withstanding voltage. To conform to 3.4.8, first article and acceptance tests shall be performed in accordance with MIL-STD-202, method 301. There shall be no degradation of performance (4.7.6.2 through 4.7.7) following these tests.

4.7.8.1 First article test. Apply 500 V rms, 60 Hz, for one (1) minute, or 600 V rms, 60 Hz, for one (1) second between terminals connected together and the case.

4.7.8.2 Acceptance test. Apply 450 V rms, 60 Hz, for one (1) minute and repeat at least 3 times.

4.7.9 Operating life. To determine conformance to 3.4.11, the brake assembly shall be subjected to dynamic conditions at the rate of 6 per hour or greater (see 3.4.3.3). There shall be no indication of brake assembly deterioration. At conclusion of the dynamic test, time to stop shall conform to table I, and static torque shall conform to 3.4.3.1. During the test, the ambient temperature shall be cycled between 140°F and -26°F (60°C and -32°C). The temperature cycle shall be such that the first 1470 cycles shall be at 140°F (60°C) followed by 1470 cycles at -26°F (-32°C), and the last 1470 cycles at 140°F (60°C). The cycle rate of torque may be applied at any rate to satisfy the total number of required cycles. During the operating life test, there shall be no adjustments or replacement of any component. Dynamic tests shall be conducted on the test fixture specified in 4.7.6.

4.7.10 Environmental.

4.7.10.1 Environmental test conditions. To determine conformance to 3.5.1a through 3.5.1h, the resistance of the brake assembly to the effects of natural and induced environments specified in paragraphs 4.7.6.1 through 4.7.8 shall be conducted under the operating conditions and after the non-operating conditions specified below.

- a. To determine conformance to 3.5.1a, tests shall be conducted at the high temperatures specified herein and applied in accordance with MIL-STD-810, method 501.2, procedure II.
- b. To determine conformance to 3.5.1b, tests shall be conducted at the low temperatures specified herein and applied in accordance with MIL-STD-810, method 502.2, procedure II.
- c. To determine conformance to 3.5.1c, tests shall be conducted to determine the resistance of the brake assemblies to the effects of exposure to warm highly humid atmospheres. The tests shall be conducted in accordance with MIL-STD-810, method 507.2, procedure I.

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- d. To determine conformance to 3.5.1d, tests shall be conducted to ascertain the ability of the brake assemblies to resist the effects of a dry dust laden atmosphere. The tests shall be conducted in accordance with MIL-STD-810, method 510.2, procedure I, except the temperature shall be limited to 140°F (60°C) during step 5 (see 3.5.1d).
- e. To determine conformance to 3.5.1e, tests shall be conducted to determine the ability of the brake assemblies to resist the effects of a salt atmosphere. The tests shall be conducted in accordance with MIL-STD-810, method 509.2, procedure I.
- f. To determine conformance to 3.5.1f, tests shall be conducted to determine if the brake assemblies will withstand expected dynamic vibrational stresses and to ensure that performance degradations or malfunctions will not be produced by the service vibration environment. The tests shall be conducted in accordance with MIL-STD-202, method 204c, condition c.
- g. To determine conformance to 3.5.1g, tests shall be conducted to determine the ability of the brake assemblies to withstand expected dynamic shock stresses and that performance degradations or malfunctions will not be produced by the service shock environment expected in handling, transportation, and service use. The brake assemblies shall be tested in accordance with MIL-STD-202, method 213b, condition J.
- h. To determine conformance to 3.5.1h, fungus tests shall be conducted in accordance with MIL-STD-810, method 508.3. Certification by the manufacturer that only non-nutrients have been utilized per MIL-STD-454 may be submitted in lieu of testing.

5. PACKAGING

5.1 Preservation, packaging, packing, and marking. Preservation, packaging, packing, and marking for the desired level shall be in accordance with the applicable packaging standard or packaging data sheet specified by the contracting authority (see 6.2).

6. NOTES

6.1 Intended use. The electromagnetic brake assembly described in this specification is intended for use in a weapon control system to provide braking and holding action.

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6.2 Ordering data. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Drawing number of brake assembly required (see 1.2).
- c. Preproduction inspection, if required (see 4.4.1).
- d. Initial production inspection, if not required (see 4.4.2).
- e. Operating life test (see 4.7.9).
- f. Selection of method and applicable level of preservation and packaging and level of packing of referenced specification (see 5.1).

Custodian:
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Preparing activity:
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