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MIL-G-81322E
 22 JANUARY 1992
 SUPERSEDING
 MIL-G-81322D
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MILITARY SPECIFICATION

GREASE, AIRCRAFT, GENERAL PURPOSE,
 WIDE TEMPERATURE RANGE

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

1. SCOPE

1.1 Scope. This specification covers the requirements for two grades of grease. Grade A is formulated for the lubrication of aircraft accessories and aircraft related equipment. Grade B grease is formulated for the lubrication of aircraft arresting gear and other equipment that operate under high contact loads and high sliding speeds. Both grades of grease are formulated to withstand operations at high speeds and temperatures of -54° to 177°C (-65° to 350°F) (see 6.1). Grade A grease is identified by NATO Code G-395 and Military Symbol WTR (see 6.7).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards 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

MILITARY

MIL-P-5431	Plastic, Phenolic, Graphited Sheets, Rods, Tubes, and Shapes
MIL-G-23549	Grease, General Purpose

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Warfare Center, Aircraft Division Lakehurst, Systems Requirements Department (Code SR3), Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-G-81322E

STANDARDS

FEDERAL

- FED-STD-313 Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
- FED-STD-791 Lubricants, Liquid Fuels, and Related Products; Methods of Testing

MILITARY

- MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-290 Packaging of Petroleum and Related Products

(Unless otherwise indicated, copies of federal and military specifications, standards and handbooks may be obtained from the Naval Publications and Printing Service, Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094).

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

Code of Federal Regulations (CFR):

- 29 CFR 1910.1200 Occupational Safety and Health Standards - Hazard Communications

(Application for copies of the above listed document should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402).

Naval Air Engineering Center Document

Material and Process Requirement

- MPR 400 Graphited Phenolic Material, MIL-P-5431A(AS):
Modification of Requirements for Sheets Used in
Arresting Gear and Catapult Applications

(Application for copies of the above listed document should be addressed to the Commanding Officer, Naval Air Warfare Center, Aircraft Division Lakehurst, Systems Requirements Department (Code SR46), Lakehurst, NJ 08733-5092).

MIL-G-81322E

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z129.1 American National Standard for Hazardous Industrial Chemicals – Precautionary Labeling

(Application for copies of the above listed document should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 150/B 150M	Aluminum Bronze, Rod, Bar, and Shapes
ASTM D 217	Cone Penetration of Lubricating Grease
ASTM D 235	Standard Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)
ASTM D 740	Methyl Ethyl Ketone
ASTM D 942	Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
ASTM D 1264	Water Washout Characteristics of Lubricating Greases
ASTM D 1478	Low-Temperature Torque of Ball Bearing Greases
ASTM D 1743	Corrosion Preventive Properties of Lubricating Greases
ASTM D 2265	Dropping Point of Lubricating Grease Over Wide Temperature Range
ASTM D 2266	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)
ASTM D 2595	Evaporation Loss of Lubricating Greases Over Wide Temperature Range
ASTM D 2596	Measurement of Extreme Pressure Properties of Lubricating Grease (Four-Ball Method)
ASTM D 2714	Calibration and Operation of the Falex Block-on-Ring Friction and Wear Testing Machine

MIL-G-81322E

ASTM D 3336	Performance Characteristics of Lubricating Greases in Ball Bearings at Elevated Temperatures
ASTM D 4048	Detection of Copper Corrosion from Lubricating Grease by the Copper Strip Tarnish Test
ASTM D 4057	Manual Sampling of Petroleum and Petroleum Products

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187).

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

Aerospace Materials Specification (AMS)

AMS 6294	Steel Bars and Forgings, Carburizing 1.8Ni-0.25Mo(0.17-0.22C) (SAE 4620)
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(Application for copies should be addressed to SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001).

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

3. REQUIREMENTS

3.1 Qualification. The greases furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.4 and 6.3). Any change in the formulation of a qualified product will necessitate its requalification. The material supplied under contract shall be identical, within manufacturing tolerances, to the product receiving qualification

3.2 First article. When specified (see 6.2.1), a sample shall be subjected to first article inspection (see 4.5 and 6.4).

3.3 Materials. The grease shall consist essentially of a wide temperature range liquid lubricant and a jelling agent with a high melting point. Compositions containing base oils radically different from those in greases currently listed on the Qualified Products List shall be compatible with the listed greases (see 4.4.2).

3.4 Physical properties. Physical properties of the grease shall be in accordance with Table I, when tested as specified in Table II.

MIL-G-81322E

TABLE I. Physical properties.

Properties	Limits
Odor	No objectional odor of rancidity, perfume or free alcohol
Dirt particles per milliliter (ml) of grease, maximum (max.)	
25-74 microns (μm) diameter	1000
75 microns (μm) diameter or larger	None
Dropping point, minimum (min.)	232°C (450°F)
Worked penetration	
Grade A	265 - 320
Grade B	300 - 330
Corrosiveness (copper strip) <u>1/</u>	1b, max.
Oxidation stability, at 99°C (210°F), pressure drop, max.:	
In 100 hours (hrs.)	0.083 MPa (12.0 psi)
In 500 hrs.	0.172 MPa (25.0 psi)
Water resistance, at 40° - 42°C (103° - 107°F), max.	20 percent
High temperature performance, at 174° - 180°C (345° - 355°F) <u>2/</u>	400 hrs, min.
Evaporation, weight loss, in 22 hours, at 174° - 180°C (345° - 355°F), max.	12.0 percent
Oil separation, weight loss in 30 hours at 174° - 180°C (345° - 355°F), max	10.0 percent
Load carrying capacity, (Load wear index), min.	30.0
Rubber swell, max.	10.0 percent
Low temperature torque, max.:	
(newton-meter (N-m) (inch-pound (in-lb)))	
Starting	0.98 N-m (8.70 in-lb)
Running (after 60 minutes), at -54°C (-65°F)	0.098 N-m (0.87 in-lb)
Steel on steel wear, max <u>3/</u>	1.3 mm (0.05 in.)

MIL-G-81322E

TABLE I. Physical properties - Continued.

Properties	Limits
Worked stability (penetration), max., after 100,000 double strokes	350
Rust preventative properties, ASTM rating	Pass <u>4</u> /
Gear wear, mg/1000 cycles, max.:	
Under 2.27-kg (5 pound (lb.)) load	2.5
Under a 4.54-kg (10-lb.) load	3.5
Oscillation:	
Friction and wear after 35,000 cycles, width of wear scar, max.	6.35 mm (0.25 in.)
Storage stability, penetration, min.:	
Unworked	200
Separation of crystalline material	None
Worked, max.	
Grade A, change from original	± 30
Grade B, change from original	± 20
Friction coefficient (Grade B only)	
Initial, max.	0.23
Steady state	0.10
Frictional heating (Grade B only), max.	195°C (383°F)

- 1/ The grease shall show no green color in that portion contacting the copper strip. The copper strip shall not tarnish more than a classification of 1b when compared with the ASTM copper strip corrosion standards.
- 2/ Average of four test runs.
- 3/ Based on the average diameter of wear scars on the three steel balls.
- 4/ Based on the pass or fail rating as determined by at least two of three bearings.

3.5 Toxicity. The grease furnished under this specification shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to the effects of this grease shall be referred by the contracting agency to the appropriate departmental medical service. The departmental medical service will act as advisor to the contracting agency (see 4.4.2 and 6.10). Material safety data sheets shall be prepared and submitted in accordance with 3.6.

MIL-G-81322E

3.6 Material safety data sheets. Material safety data sheets (MSDS) shall be prepared and submitted in accordance with FED-STD-313 and shall be in accordance with the requirements of 29 CFR 1910.1200. When FED-STD-313 is in variance with the CFR, 29 CFR 1910.1200 shall take precedence, modify, and supplement FED-STD-313. One copy of the MSDS shall accompany the samples being submitted to the qualifying activity for testing (see 4.4.2).

3.7 Workmanship. The grease, when examined visually, shall be a smooth and homogeneous mixture, free from lumps and extraneous materials.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) 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 any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspections set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of the manufacturing operation, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. Qualification inspection (4.4).
- b. First article inspection (see 4.5).
- c. Quality conformance inspection (4.6).

4.3 Inspection conditions. Unless otherwise specified, all test conditions shall be performed in accordance with 4.7 and the physical values specified in Table I apply to the average of determinations made on the sample. Unless otherwise specified, all tests shall be performed on unworked grease.

MIL-G-81322E

4.4 Qualification inspection. Qualification inspection shall consist of a review of the manufacturer's test report (see 4.4.2) to determine that the qualification inspection sample (see 4.4.1) complies with all the requirements for the physical properties specified in Table I when tested in accordance with the inspection methods specified in Table II. In order to determine the suitability of the grease for specific service applications, the qualifying activity reserves the right to conduct wheel bearing, actuator or compatibility tests.

4.4.1 Qualification inspection sample. The qualification inspection sample shall consist of 6.81-kg (15.0-lb.) of grease. The sample shall be forwarded to the Commander, Naval Air Warfare Center, Aircraft Division Warminster, Aircraft and Crew Systems Technology Directorate, Code 6061, Warminster, PA 18974. The sample shall be plainly identified by a securely attached, durable tag or label containing the information listed below:

- Qualification test sample.
- GREASE, AIRCRAFT, GENERAL PURPOSE, WIDE TEMPERATURE RANGE.
- Grade (A or B, as applicable).
- Manufacturer's name.
- Manufacturer's product number.
- Batch number.
- Date of manufacture.
- Submitted by (name and date), for qualification inspection in accordance with MIL-G-81322E, under authorization of (reference authorization letter).

The qualification test sample shall be forwarded to the laboratory designated in the letter of authorization (see 6.3).

4.4.2 Test reports. Two copies of the manufacturer's test report, containing complete test data showing that material submitted for qualification conforms to the requirements of this specification, shall be submitted with the qualification inspection sample. Location and identity of the plant which produced the qualification inspection sample shall be supplied. Material safety data sheets on toxicity shall be prepared and submitted to the qualifying laboratory (see 4.4.1) in accordance with 3.6.

4.4.3 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the manufacturer shall verify by certification to the qualifying activity that the manufacturer's product complies with the requirements of this specification. The time of periodic verification by certification shall be in two-year intervals from the date of original qualification. The Government reserves the right to re-examine the qualified product whenever deemed necessary to ensure that the product continues to meet any or all of the specification requirements.

4.5 First article inspection. The manufacturer shall submit to the qualifying laboratory (see 4.4.1) a 4.54-kg (10.0-lb.) sample of grease taken from the first production lot of grease processed under the first contract or order, after the product has passed the qualification inspection (see 6.3). The tests shall be limited to the requirements of 3.4 and 3.7 and the test methods of 4.7.2. Delivery of the grease shall not be delayed pending completion of testing on the first article sample by the qualifying laboratory.

MIL-G-81322E

TABLE II. Inspection methods.

Tests	Method	
	FED-STD-791	ASTM
Dirt	3005	--
Dropping point	--	D 2265
Worked penetration	--	D 217
Corrosiveness (copper strip)	--	D 4048
Oxidation stability	--	D 942
Water resistance	--	D 1264
High temperature performance	--	D 3336
Evaporation	--	D 2595
Oil separation	321	--
Load carrying capacity	--	D 2596
Rubber swell <u>1/</u>	3603	--
Low temperature torque <u>2/</u>	--	D 1478
Steel on steel wear	--	D 2266
Worked stability	313	--
Rust preventive properties	--	D 1743
Gear wear	335	--
Oscillation: Friction and wear <u>3/</u>	--	--
Storage stability <u>4/</u>	3467	--
Friction coefficient <u>5/</u>	--	--
Frictional heating <u>5/</u>	--	--

1/ Use standard rubber NBR-L (see 6.5) within 6 months of date of manufacture.

2/ Observation for skidding or ball sliding shall be made during test run.

3/ Tests shall be conducted in accordance with 4.7.3 through 4.7.3.7.

4/ Temperature of $38^{\circ} \pm 3^{\circ}\text{C}$ ($100^{\circ} \pm 5^{\circ}\text{F}$) to be maintained for 6 months. After determination of unworked penetration, the unworked penetration sample shall be stored at $38^{\circ} \pm 3^{\circ}\text{C}$ ($100^{\circ} \pm 5^{\circ}\text{F}$) for an additional 6 months. The sample shall be covered in such fashion to provide an air space above the grease and to prevent the surface of the grease from being disturbed. The sample shall then be examined for presence of crystalline material.

5/ Tests shall be conducted in accordance with 4.8 through 4.8.2.1.

MIL-G-81322E

TABLE III. Quality conformance tests.

<u>Inspection</u>	<u>Paragraph</u>	
	<u>Requirement</u>	<u>Test Method</u>
Odor	3.4	---
Dirt	3.4	4.7.2
Dropping point	3.4	4.7.2
Worked penetration	3.4	4.7.2
Corrosiveness (copper strip)	3.4	4.7.2
Evaporation	3.4	4.7.2
Oil separation	3.4	4.7.2
Load carrying capacity	3.4	4.7.2
Low temperature torque	3.4	4.7.2
Steel on steel wear	3.4	4.7.2
Worked stability	3.4	4.7.2
Examination of filled containers	5.1	4.7.1
Workmanship	3.7	---

4.6 Quality conformance inspection. The quality conformance inspection of the grease shall consist of tests of samples from 4.6.2.2 in accordance with Table III and an examination of samples from 4.6.2.1 for conformance with 4.7.1. Samples shall be labeled completely with the information identifying the purpose of the sample, name of product, specification number, lot and batch number, date of sampling and contract number.

4.6.1 Lot formation. A lot shall consist of all the grease produced by one manufacturer, at one plant, from the same materials and under essentially the same conditions, provided the operation is continuous and does not exceed a 24-hour period. In the event the process is a batch operation, each batch shall constitute a lot (see 6.8).

4.6.2 Sampling.

4.6.2.1 For examination of filled containers. A random sample of filled containers, fully prepared for delivery, shall be selected from each lot of grease in accordance with MIL-STD-105, inspection level I with acceptable quality level (AQL) of 2.5 percent defective.

MIL-G-81322E

4.6.2.2 For tests. The sample for tests shall consist of two 2.27-kg (5.0-lb.) samples of grease, taken at random from filled containers of each lot of grease. For users who obtain grease in large containers, two 2.27-kg (5.0-lb.) samples shall be taken in accordance with ASTM D 4057. One sample shall be tested for all the tests specified in 4.7.2; the other sample shall be retained. If a test result does not comply with the requirements of any of the tests specified in 4.7.2, the test in question shall be repeated using the retained sample. The lot shall be unacceptable if the average of both test results fails to comply with requirements specified in 4.7.2.

4.7 Methods of examinations and tests.

4.7.1 Examinations. To ensure conformance with 5.1, each filled container, selected in accordance with 4.6.2.1, shall be examined for defects in the container, closure, and marking. Each sample container shall also be weighed to determine the amount of the contents. If the number of defective containers exceeds the acceptance number of the sampling plan specified in 4.6.2.1, the lot shall be rejected.

4.7.2 Tests. Tests shall be performed in accordance with Table II and 4.7.3 through 4.7.3.7 to determine conformance with the requirements specified in 3.4.

4.7.3 Oscillation - friction and wear test.

4.7.3.1 Apparatus. The apparatus used consists of the following:

- a. Falex model number 1 ring and block test machine, or equivalent, equipped with an oscillatory drive mechanism, load cell transducer and a transducer amplifier/indicator (see 6.6).
- b. Measuring magnifier glass, with metric calibration (precision of 0.05 mm).
- c. Analytical balance, capable of weighing to the nearest 0.1 mg.

4.7.3.2 Test ring. The test ring shall be made of SAE/AISI 4620 alloy steel (AMS 6294) and have a hardness (Rockwell) of 58 to 63 HRC. The ring shall have a ground face width of 8.15 ± 0.13 mm (0.321 ± 0.005 in.) and a diameter of 35.0 mm (1.375 in.). The eccentricity between the inner and outer surface shall be no greater than 38 μ m (1.5 mil). The outside diameter of the ring shall have a finished surface of 0.10 to 0.38 μ m (5.0 to 15.0 μ in.) root mean square (rms), in the direction of the motion.

4.7.3.3 Test block. The test block shall be made of copper alloy, conforming to ASTM B150/B150M, alloy 64200, with the test surface dimensions as follows: 6.35 mm (0.25 in.) wide and 15.70 ± 0.13 mm (0.620 ± 0.005 in.) long. The height of the block shall be 10.16 ± 0.05 mm (0.400 ± 0.002 in.). The block shall have a hardness (Rockwell) of 85 to 91 HRB. Each block shall have a test surface polished to a finish of 0.1 to 0.2 μ m (4 to 8 μ in.) rms, being perfectly square with all outside edges.

4.7.3.4 Calibration of apparatus. The apparatus shall be calibrated in accordance with ASTM D 2714.

MIL-G-81322E

4.7.3.5 Reagents. The reagents used are:

- a. Heptane (ACS grade).
- b. Methyl ethyl ketone conforming to ASTM D 740.
- c. Petroleum spirits conforming to ASTM D 235.

4.7.3.6 Preparation of apparatus. Before each test, thoroughly clean the specimen holder, threaded section, locknut and lockwasher. The heptane shall be used as the cleaning agent and methyl ethyl ketone as the rinse. A new test ring and block shall be used for each test. Each test ring and block shall be cleaned for each test, using the following procedure:

- a. Immerse in petroleum spirits and scrub with lint-free cloth.
- b. Rinse in a second bath of petroleum spirits.
- c. Suspend in the vapor of boiling heptane for 30 seconds.
- d. Immerse in boiling methyl ethyl ketone for 30 seconds.
- e. Allow part to drip dry.
- f. When part has dried, suspend it in vapor of boiling heptane for 30 seconds.
- g. Allow part to air dry.
- h. Weigh each test ring and block to the nearest 0.1 mg.
- i. Store specimens in desiccator until ready to use.

Lubricate the quarter segment of the specimen holder and the threaded section with grease conforming to MIL-G-23549. Apply the grease to be tested to the test ring surface, ensuring that the entire wear surface is completely covered with test grease. Mount the test block in the quarter segment (clean, lint-free, cotton gloves should be used in handling the specimens) and position both in the specimen holder, ensuring that the quarter segment and block are securely positioned in the cylindrical slot. While holding the test block mount, tighten to 28.2 N-m (250 in-lb), using a torque wrench. Apply additional test grease to the area of the test block which overlaps the ring on both sides of the block. Place a 454-g (1.0-lb.) weight in position on the bale rods. Align the two reference markers by adjusting the turnbuckle on the friction rod. Tighten locknuts on the turnbuckle. Position the friction force cut-off such that the level is set to 177.9 Newtons for a maximum coefficient of friction of 0.44. Adjust the amplitude of oscillation for a 90 degree arc

4.7.3.7 Procedure. With the revolution counter set to zero, start machine and adjust the oscillating speed to 87.5 cycles per minute (cpm), ensuring that the reference markers are aligned. When 60 cycles is reached, add a 454-g (1.0-lb.) weight. When 120 cycles is reached, add another 454-g (1.0-lb.) weight. Run this test for 35,000 cycles or until failure, due to excessive friction (cut-off coefficient of friction of 0.44), is encountered. After reaching 35,000 cycles, dismount and clean test block. Measure wear scar width, in accordance with ASTM D 2714. The maximum width of wear scar shall be in accordance with Table I.

MIL-G-81322E

4.8 Friction coefficient and frictional heating.

4.8.1 Apparatus. The apparatus used for this test (see Figure 1) consists of the following:

- a. The phenolic sample consists of material conforming to MIL-P-5431, with the modifications specified in MPR 400. The phenolic sample is affixed to a motor-driven table capable of rotating at 3600 revolutions per minute (rpm).
- b. The aluminum specimen consists of material conforming to alloy 7075-T6, with a Brinnel hardness of 150 Hg. The aluminum specimen remains stationary and is fitted into a larger brass fixture. The aluminum specimen is diagramed in Figure 2. Grease grooves are cut into the surface of the aluminum specimen and the sides of the inner cavity of the phenolic disk are sloped toward the interface to ensure a flow of grease to the interface area of the aluminum and phenolic test pieces (see Figures 2 and 3).
- c. A thermocouple, located 1.6 mm from the sliding interface within the aluminum specimen, is used to measure the near-interface temperatures.

4.8.2 Procedure. A constant volume of grease is to be packed into the cavity area (see Figure 1) and a light coating of grease is to be applied to the sliding surfaces of both the aluminum and phenolic test pieces prior to all testing. The test pieces are then brought together and the test begun. The test is initiated with the rotating table and phenolic test piece being rotated at 3600 rpm with no applied load. The load is then applied and incrementally increased every 60 seconds, 38.6-kilopascal (kPa) at a time, until a maximum load of 546-kPa is achieved. The sliding speed for the test is 5.54 meters per second and the average contact stress is 581 mm².

4.8.2.1 After the maximum contact load of 546-kPa is achieved, the rotation is stopped and the system is allowed to cool to room temperature. After cooling, a new supply of grease is injected into the cavity through the grease fitting and the test sequence is repeated. This sequence is repeated until the total number of test sequences is three (3). Using the thermocouple, the system temperature is to be continuously monitored during the test. The maximum allowable frictional heating value is listed in Table I. The friction coefficient is determined by measuring the friction force caused by the torque arm and dividing that by the normal load. The maximum allowable friction coefficient is listed in Table I.

5. PACKAGING

5.1 Packaging and packing. The grease shall be packaged and packed in accordance with MIL-STD-290. The type and size of the containers and the level of packaging and packing shall be as specified by the procuring activity (see 6.2).

5.1.1 Marking. All unit, intermediate and shipping containers shall be marked in accordance with MIL-STD-290. Any additional special marking shall be as specified by the procuring activity (see 6.2). All unit and intermediate packs of toxic and hazardous chemicals and materials shall also be labeled in accordance with the applicable laws, statutes, regulations, and ordinances, including federal, state, and municipal requirements. In addition, unit and intermediate containers, including unit containers that serve as shipping containers, such as pails and drums, shall be marked with the applicable precautionary information detailed in ANSI Z129.1.

MIL-G-81322E

6. NOTES

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

6.1 Intended use. The greases covered by this specification are intended for use as lubricating greases in applications where the operating temperatures fall between -54° and 177°C (-65° and 350°F). Grade A is specifically designed for aircraft wheel bearings in internal brake wheel assemblies, anti-friction bearings, gear boxes, and plain bearings. Grade B is specifically formulated for use in the lubrication of aircraft arresting gear sheave spacers and other equipment that operate under high contact loads and high sliding speeds.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should 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 2.1 and 2.2).
- c. Grade of grease desired (A or B)
- d. Quantity desired (in kilograms).
- e. Whether first article inspection is required (see 3.2 and 4.5).
- f. Type and size of the container (see 5.1).
- g. Applicable levels of packaging and packing (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards may be made only for products which are, at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List (QPL-81322), whether or not such products have actually been so listed by that date. The contractor's attention is called to this requirement. Manufacturers are urged to arrange having the products they propose to offer to the Government tested for qualification, so that they may be eligible for award of contract(s) or order(s) for material covered by this specification. The activity responsible for the Qualified Products List is the Commander, Naval Air Systems Command, AIR-5304, Department of the Navy, Washington, DC 20360; however, information pertaining to qualification of products and letter of authorization for submittal may be obtained from the Commander, Naval Air Warfare Center, Aircraft Division Warminster, Aircraft and Crew Systems Technology Directorate, Code 6061, Warminster, PA 18974. In the event that the grease furnished under contract is found to deviate from the composition of the approved product, or that the product fails to perform satisfactorily, approval of such products will be subject to immediate withdrawal from the Qualified Products List.

6.4 First article. When a first article inspection is required, the item will be tested and should be a sample selected from the first production lot. The first article should consist of a 4.54-kg (10.0-lb.) sample of grease. The contracting officer should include specific instructions for examinations, tests and approval of the first article.

6.5 Standard rubber samples. Samples of the standard synthetic rubber NBR-L for the test specified in Table II may be obtained from Wynn's Precision Company, 708 West 22nd Street, Tempe, AZ 85282.

MIL-G-81322E

6.6 Source for Falex test machine. The Falex model number 1 ring and block test machine (see 4.7.3.1) is available from Falex Corporation, 2055 Comprehensive Drive, Aurora, IL 60505.

6.7 International standardization agreements. Certain provisions of this specification (see 1.1) are the subject of international standardization agreement, ASCC Air Standard 15/1, and NATO STANAG NAT-STD-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.

6.8 Batch. A batch is defined as that quantity of material which has been manufactured by some unit chemical process and subjected to some physical mixing operation intended to make the final product substantially uniform.

6.9 Subject term (keyword) listing.

Lubricant
High melt point
Wide temperature range

6.10 Part numbers. Part numbers for cataloging purposes under this specification are coded as follows:

<u>M81322E</u> Specification Identifier	-	<u>X</u> A = Grade A B = Grade B
--	---	---

6.11 Material safety data sheets (MSDS). Contracting officers will identify those activities requiring copies of completed MSDS (see 3.6). The pertinent government mailing addresses for submission of data are listed in Appendix B of FED-STD-313.

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

Custodians:
Army - ME
Navy - AS
Air Force - 11

Preparing Activity:
Navy - AS
Project No. 9150-1002

Review activities.
Army - AR, AV, EA, MI
Navy - OS, SH
Air Force - 68
DLA - GS

International interest:
NATO (see 6.7)

MIL-G-81322E

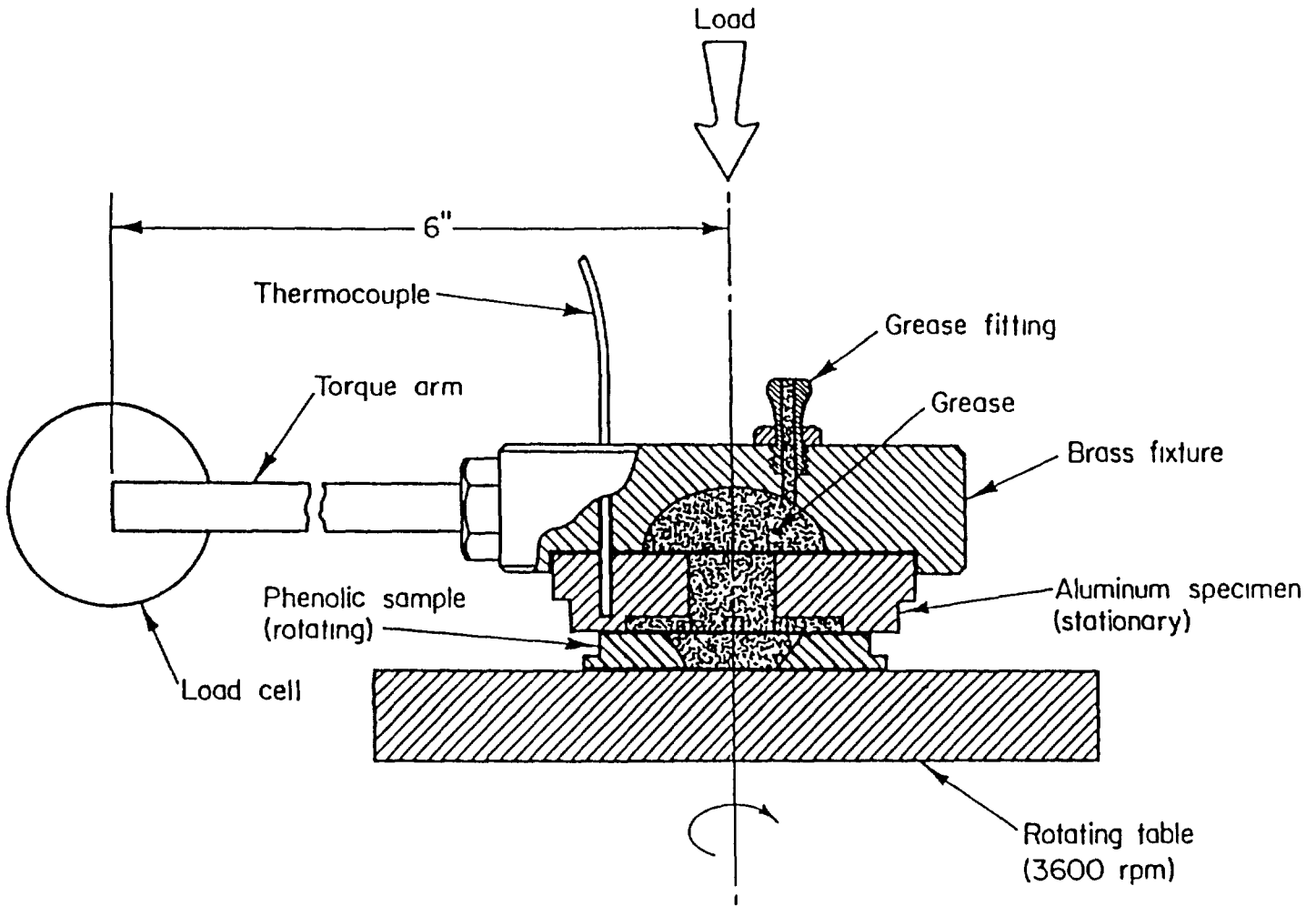


FIGURE 1. Test apparatus.

MIL-G-81322E

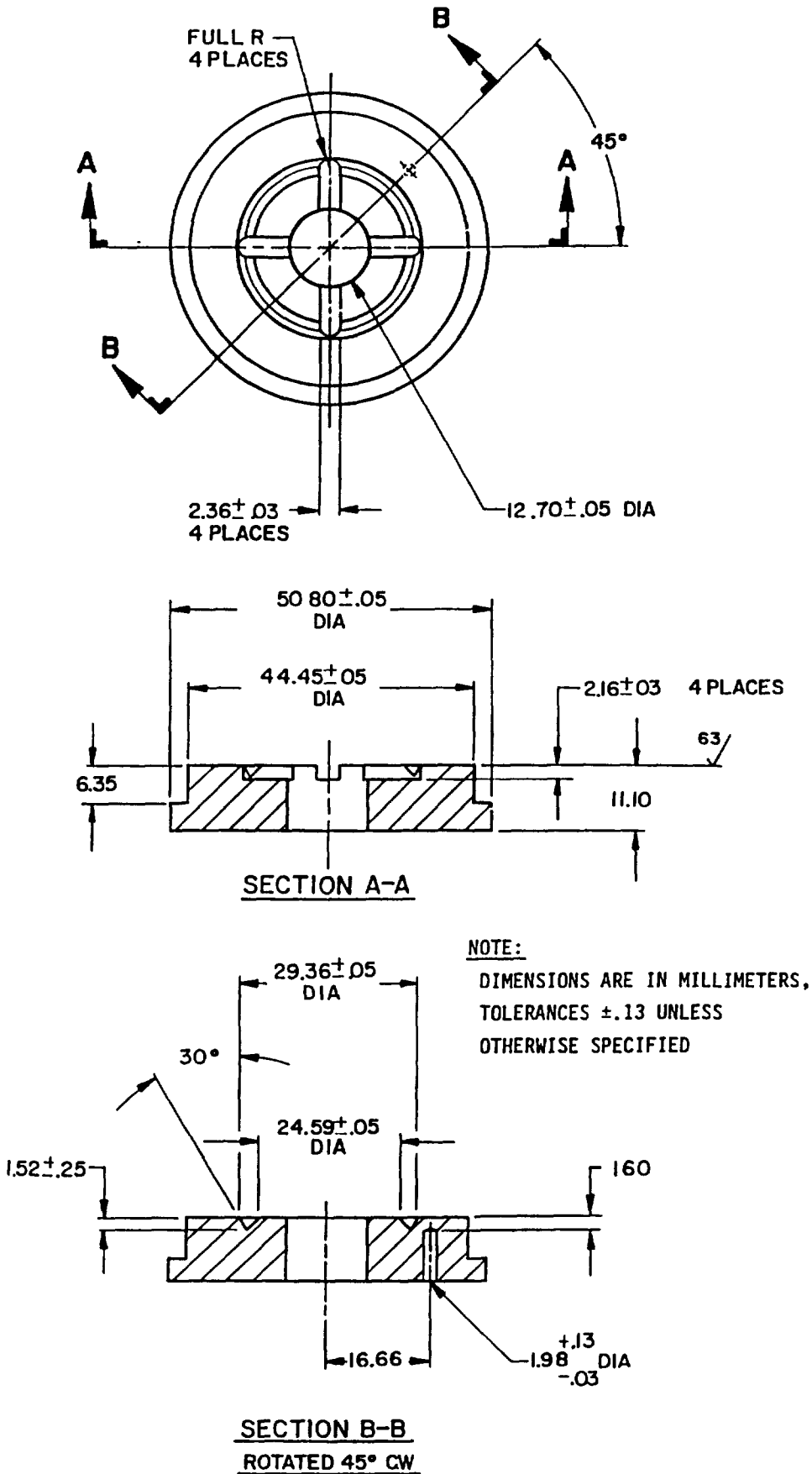
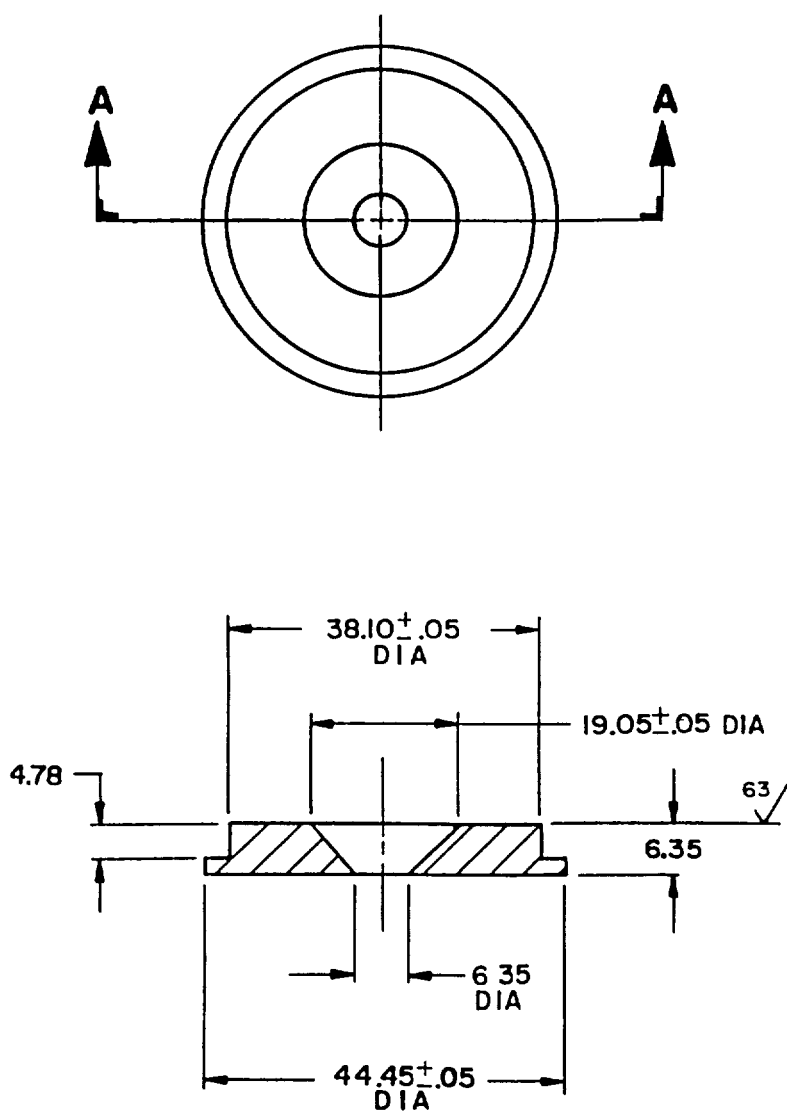


FIGURE 2. Aluminum specimen.

MIL-G-81322E



SECTION A-A

NOTE:

DIMENSIONS ARE IN MILLIMETERS,
TOLERANCES ±.13 UNLESS
OTHERWISE SPECIFIED

FIGURE 3. Phenolic sample.

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, 6, 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-G-81322E

2. DOCUMENT DATE (YYMMDD)
920122

3. DOCUMENT TITLE

GREASE, AIRCRAFT, GENERAL PURPOSE, WIDE TEMPERATURE RANGE

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
COMMANDING OFFICER
NAVAL AIR WARFARE CENTER
AIRCRAFT DIVISION LAKEHURST

b. TELEPHONE (Include Area Code)
(1) Commercial (2) AUTOVON
(908) 323-7488 624-7488

c. ADDRESS (Include Zip Code)
SYSTEMS REQUIREMENTS DEPARTMENT
CODE SR3
LAKEHURST, NJ 08733-5100

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