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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-G-81827

Issued MAY 2001

Grease, Aircraft, High Load Capacity, Wide Temperature Range

NOTICE

This document has been taken directly from U.S. Military Specification MIL-G-81827A, Notice 1, and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-G-81827A, Notice 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this SAE technical document.

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1. SCOPE:

This specification covers the requirements for one grade of grease for use as a lubricant on heavily loaded sliding steel surfaces.

2. APPLICABLE DOCUMENTS:

The following publications, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

QQ-C-465	Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630 and 642), Rod, Flat Products with Finished Edges, (Flat Wire, Strip and Bar), Shapes and Forgings
MIL-M-7866	Molydenum Disulfide, Technical, Lubricant Grade
MIL-G-23549	Grease, General Purpose
FED-STD-313	Material Safety Data Sheets Preparation and Submission of
FED-STD-791	Lubricants, Liquid Fuels and Related Products, Methods of Testing
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-290	Packaging of Petroleum and Related Products

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 217	Cone Penetration of Lubricating Grease
ASTM D 235	Petroleum Spirits (Mineral Spirits)
ASTM D 270	Sampling Petroleum and Petroleum Products
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 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 Alpha Model LFW-1 Friction and Wear Testing Machine

2.2 (Continued):

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

2.3 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.

3. REQUIREMENTS:

3.1 Qualification:

The grease furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.4 and 6.3).

3.2 First article:

When specified (see 6.2.1), a sample shall be subjected to first article inspection (see 4.5 and 6.6).

3.3 Material:

The grease shall consist essentially of a suitable liquid lubricant, a gelling agent and molybdenum disulfide. The molybdenum disulfide shall be a powder in the 4 - 10 micron particle size range and of a purity and grade suitable for general lubricating use. Use of improved fluids such as synthetic hydrocarbons may be required as base oil constituents to meet the requirements of this specification.

3.4 Physical properties:

Physical properties of the grease shall be in accordance with table I.

3.5 Toxicity:

The grease shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.6 Workmanship:

The grease, when examined visually, shall be a smooth and homogenous 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 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 the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspection:

The inspection requirements specified herein are classified as follows:

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

4.3 Inspection conditions:

4.3.1 Test conditions: Test conditions shall be 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 conducted on unworked grease.

4.4 Qualification inspection:

Qualification inspection shall consist of a review of the 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 also reserves the right to conduct wheel bearing or actuator or compatibility tests.

4.4.1 Qualification inspection sample: The qualification inspection sample shall consist of 10 pounds of grease. The sample shall be forwarded to the Aircraft and Crew Systems Technology Directorate, Code 60612, Naval Air Development Center, Warminster, PA 18974. The sample shall be plainly identified by a securely attached durable tag or label marked with the following information:

Sample for qualification inspection.
GREASE, AIRCRAFT, HIGH LOAD CAPACITY, WIDE TEMPERATURE RANGE.
Name of manufacturer.
Product code number.
Batch number.
Date of manufacture.
Submitted by (name) (date) for qualification inspection in accordance with MIL-G-81827A under authorization of (reference authorizing letter) (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 sample. Location and identity of the plant which produced the sample tested shall also be supplied. Material safety data sheets on toxicity shall be prepared and submitted to the qualifying laboratory (see 4.4.1) in accordance with FED-STD-313 (see 3.5).

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 determine 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 10 pound sample of grease taken from 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 3.6 and the 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.

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 6.7).

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 an acceptable quality level (AQL) of 2.5 percent defective.

4.6.2.2 For tests: The sample for tests shall consist of two five-pound samples of grease taken at random from filled containers from each lot of grease. For users who obtain grease in large containers, two five-pound samples shall be taken in accordance with ASTM D 270. 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 any of the tests specified in 4.7.2.

4.7 Methods of examinations and tests:

4.7.1 Examinations: Each of the filled containers, selected in accordance with 4.6.2.1, shall be examined for defects of the container and closure, for evidence of leakage and for unsatisfactory markings to determine conformance with 5.1. Each sample container shall also be weighed to determine the amount of 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 6.5).

b. Measuring magnifier glass, with metric or English unit calibration with a precision of 0.05 mm (0.002 in.), or equivalent.

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 4620 steel having a Rockwell hardness of C58 to C63. The ring shall have a ground face 8.15 ± 0.127 mm (0.321 ± 0.005 in.) wide and diameter of 35, +0.0025, -0.0127 mm (1.3775, +0.0001, -0.0005 in.) having an eccentricity between the inner and outer surface no greater than 0.038 mm (0.0015 in.). The surface finish range of the outside diameter surface of the ring shall be 0.102 to 0.381 micro m rms (5 to 15 micro in. rms) in the direction of the motion.

4.7.3.3 Test block: The test block shall be made of copper alloy conforming to QQ-C-465, alloy 642 with the test surface 6.35, +0.012, -0.000 mm (0.250, +0.0005, -0.0000 in.) wide and 15.7 ± 0.127 mm (0.620 ± 0.005 in.) long. The height of the test block shall be 10.16 ± 0.051mm (0.400 ± 0.002 in.). The Rockwell hardness shall be B88 ± 3. Each block shall have a test surface polished to a surface finish of 0.102 to 0.203 micro m rms (4 to 8 micro in. rms), being perfectly square with all outside edges.

4.7.3.4 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.

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

4.7.3.6 Preparation of apparatus: Before each test, thoroughly clean the specimen holder, threaded section, locknut and lockwasher. Use heptane as the cleaning agent and rinse with methyl ethyl ketone. Clean a new test ring and block 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.

4.7.3.6 (Continued):

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, making sure 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 making sure that the quarter segment and block are securely positioned in the cylindrical slot. With one hand holding the test block mount, tighten with a torque wrench to 28.2 nm (250 in-lbs). Apply the additional test grease to the area of the test block which overlaps the ring on both sides of the block. Place a 454 gram (g) (one pound) weight in position on the bale rods. Align the two reference markers by adjusting the turn buckle on the friction rod. Tighten locknuts on the turn buckle. Position the friction force cut-off level. The cut-off level is set at 177.9N (40 lbf) for a 0.44 coefficient of friction. Adjust the amplitude of oscillation for a 90 degree arc.

4.7.3.7 Procedure: With the revolution counter set at zero start the machine and adjust the oscillating speed to 87.5 cpm making sure at this point that the reference markers are perfectly aligned. Add a 454 g weight at 60 cycles and another 454 g weight at 120 cycles. Run until failure is encountered due to excessive friction (cut-off 0.44 coefficient of friction) or to 35,000 cycles. After reaching 35,000 cycles, dismount and clean test block. Measure wear scar width in accordance with ASTM D 2714. The wear scar width shall conform to table I.

5. PACKAGING:

5.1 Packaging, packing and marking:

The grease shall be packaged, packed and marked 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 acquiring activity (see 6.2.1).

6. NOTES:

6.1 Intended use:

The grease covered by this specification is intended for use as a lubricant for heavily loaded accessory splines, sliding surfaces and anti-friction bearings operating through a wide temperature range -54°C (-65°F) to 177°C (350°F) where molybdenum disulfide will delay or prevent seizure in the event of inadequate lubrication. This grease is compatible with elastomeric seals.

6.1.1 Surface use: This grease shall not be used for other than steel surfaces without prior performance evaluation.

6.1.2 Acquisition requirements: Acquisition documents should specify the following:

a. Title, number and date of this specification.

b. Quantity desired in pounds.

c. Whether first article inspection is required (see 3.2 and 4.5).

d. Size and type of container for grease (see 5.1).

e. Applicable levels of packaging and packing and other options (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 Qualified Products List (QPL-81827) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Commander, Naval Air Systems Command, Attn: AIR-5304, Washington, DC 20361; however, information pertaining to qualification of products and letter of authorization for submittal of sample may be obtained from the Aircraft and Crew Systems Technology Directorate, Code 60612, Naval Air Development Center, Warminster, PA 18974.

6.3.1 Qualification information: It is understood that the grease furnished under this specification subsequent to final approval should be of the same composition and shall be equal to products upon which approval was originally granted. In the event that the grease furnished under contract is found to deviate from the composition of the approval product, or that the product fails to perform satisfactorily, approval of such products will be subject to immediate withdrawal form the Qualified Products List.

6.4 Standard rubber samples:

Samples of the standard synthetic rubber NBR-L (see table I) for the test specified in table II may be obtained from the Precision Rubber Products Corp. Aerospace Division, 1217 South 26 Place, Phoenix, AZ 85035.

6.5 Source for Falex test machine:

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

6.6 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 10 pound sample of grease. The contracting officer should include specific instructions for examinations, tests and approval of the first article.

6.7 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.

6.8 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.

PREPARED UNDER THE JURISDICTION OF AMS COMMITTEE “M”

TABLE I. Physical properties

Characteristics	Limits
Dropping point, °C (°F), minimum	232 (450)
Penetration:	
Unworked, minimum	200
Worked	265 - 320
Oxidation stability:	
Bomb oxidation, pressure drop, MPa (psi), in 500 hours, maximum	0.172 (25)
Corrosiveness (copper strip), maximum 1/	1b
Water resistance, percent, maximum	20
Evaporation, percent, weight loss in 22 hrs at 177° ± 3°C (350° ± 5°F), maximum	12
Oil separation, percent, weight loss in 30 hrs, at 177° ± 3°C (350° ± 5°F),	10.0
Low temperature torque:	
Starting, Nm (gram-cm), maximum	0.98 (10,000)
Running (after 60 minutes), at -54°C (-65°F), Nm (gram-cm), maximum	0.098 (1,000)
Extreme pressure properties (load-wear index), minimum	50
High temperature performance, at 177°C (350°F), minimum 2/	400 hours
Worked stability, penetration, after 100,000 double strokes maximum	350
Rust preventative properties, ASTM rating, maximum	2
Molybdenum disulfide content, percent	4.5 to 5.5
Gear wear, mg/1,000 cycles, maximum:	
under a 5 lb load	2.5
under a 10 lb load	3.5