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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 3053

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Submitted for recognition as an American National Standard

GREASE, WATER RESISTANT
Polyalphaolefin Base

1. SCOPE:

1.1 Form:

This specification covers a water resistant lubricant in the form of grease procured in inch/pound units.

1.1.1 MAM 3053 is the metric version of this AMS.

1.2 Application:

This grease has been used typically for lubrication of high speed main shaft bearings of missiles and turbine engines, but usage is not limited to such applications.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2825 Material Safety Data Sheets

2.2 ASTM Publications:

Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-0001.

ASTM D 217 Cone Penetration of Lubricating Grease
ASTM D 942 Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
ASTM D 1193 Reagent Water
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 3336 Life of Lubricating Greases in Ball Bearings at Elevated Temperatures
ASTM D 4048 Detection of Copper Corrosion from Lubricating Grease
ASTM D 4057 Manual Sampling of Petroleum and Petroleum Products
ASTM D 4170 Fretting Wear Protection by Lubricating Grease

2.3 U.S. Government Publications:

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

FED-STD-791 Lubricant, Liquid Fuel, and Related Products; Methods of Testing
MIL-STD-290 Packaging of Petroleum and Related Products

3. TECHNICAL REQUIREMENTS:

3.1 Material:

Grease shall consist of a polyalphaolefin base fluid with additives formulated to meet the requirements of 3.2.

3.2 Properties:

Shall be as shown in Table 1.

TABLE 1 - Properties

Paragraph	Property	Requirement	Test Method
3.2.1	Odor	No odor of rancidity, perfume, or free alcohol	
3.2.2	Dirt, particles per 0.061 cubic inch grease, max		FED-STD-791, Method 3005
	984 to 2953 microinches diameter	1000	
	Over 2953 microinches diameter	None	
3.2.3	Dropping Point, min	385 °F	ASTM D 2265
3.2.4	Worked Penetration	265 to 320	ASTM D 217
3.2.5	Corrosiveness (copper strip), max	1 b	ASTM D 4048
3.2.5.1	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 1 b compared with the ASTM copper strip corrosion standards.		
3.2.6	Oxygen Stability at 210 °F ± 5, pressure drop in 500 hours, max	84 psi	ASTM D 942
3.2.7	Water Resistance at 106 °F ± 2, max	15%	ASTM D 1264
3.2.8	High Temperature Spindle Performance (4 test runs at 347 °F ± 9), min	500 hours	ASTM D 3336
3.2.9	Evaporation, weight loss in 22 hours at 212 °F ± 5, max	5%	ASTM D 2595
3.2.10	Oil Separation, weight loss in 24 hours at 212 °F ± 5, max	8%	FED-STD-791 Method 321
3.2.11	Low-Temperature Torque at -65 °F ± 2, max		ASTM D 1478
	Starting torque	101,260 x 10^{-5} pound-feet	
	Running torque	20,250 x 10^{-5} pound-feet	
3.2.12	Steel on Steel Wear, average scar wear, max	0.039 inch	ASTM D 2266
3.2.13	Corrosion Prevention:		ASTM D 1743
	ASTM D 1193, Type III, water	#1 pass	
3.2.14	Fretting Wear, max	212 ounces	ASTM D 4170
3.2.15	Storage Stability, penetration: Worked (change from original), max	30	FED-STD-791, Method 3467
3.2.16	Dynamic Grease Stability, penetration increase, max	20%	4.4.1
3.2.17	Extreme Pressure Performance, min		4.4.2
	At 122 °F ± 2	180 pounds force	
	At 176 °F ± 2	112 pounds force	
3.2.18	High-Temperature Bearing Performance, Min	25 Hours	4.4.3

3.3 Quality:

Grease, as received by purchaser, shall be uniform in quality and condition, and free from foreign materials and from other contaminants detrimental to usage of the grease.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of grease shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the grease conforms to the requirements of this specification.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Dirt (3.2.2), worked penetration (3.2.4), water resistance (3.2.7), oil separation (3.2.10), and quality (3.3) are acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Odor (3.2.1), dropping point (3.2.3), corrosiveness (3.2.5), oxygen stability (3.2.6), and low-temperature torque (3.2.11) are periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.3 Sampling and Testing:

4.3.1 For Acceptance Tests:

Shall be in accordance with ASTM D 4057 and 4.3.1.1.

4.3.1.1 Sufficient grease shall be selected at random from each lot to perform all required tests. The number of determinations for each requirement shall be as specified in the applicable test procedure or, if not specified therein, not less than three.

4.3.1.2 A lot shall be all grease made from the same batch of compound processed in one continuous run and presented for vendor's inspection at one time.

4.3.1.3 A statistical sampling plan, acceptable to purchaser, may be used in lieu of sampling as in 4.3.1 and the report of 4.5 shall state that such plan was used.

4.3.2 For Periodic Tests: Shall be acceptable to purchaser.

4.4 Test Methods:

4.4.1 Dynamic Grease Stability:

4.4.1.1 Apparatus: Stability shall be determined using a suitable electric motor capable of operating at 1750 rpm, a Marlin Rockwell Corporation double-shielded, single-row, deep-grooved, super-conrad type S bearing, or equivalent, and a clamping device to hold the bearing outer face stationary during the test.

4.4.1.2 Procedure: Determine and record the worked penetration of the grease to be tested. Pack the grease using the full pack technique into the test bearing that has been ultrasonically cleaned using precipitation naphtha. Install the bearing shields, one of which shall have a 1/16 inch vent hole. Place the bearing on the motor and run at 1750 rpm for 20 hours. After the 20-hour test period, allow the bearing and grease to cool to 68 to 86 °F. Determine the 1/4 scale penetration on the grease. Report the percent penetration change determined by Equation 1:

$$\% \ Change = \frac{C\ (A-B)}{A} \qquad \text{(Eq. 1)}$$

where:

A = Worked penetration of grease before test
B = Worked penetration of grease after test
C = 100

4.4.2 Extreme Pressure Performance:

4.4.2.1 Apparatus: Shall consist of an Optimol SRV testing machine, or equivalent, which uses a 10 mm steel ball oscillating under load on a lapped steel disk. The steel balls shall be SAE E52100 aircraft-bearing-quality steel with a hardness of 60 to 63 HRC.

4.4.2.2 Procedure: Clean the test specimens using a solvent mixture of equal proportions of a suitable solvent and isopropyl alcohol. Preheat the test specimens to 175 °F ± 2 and maintain temperature during the test. Using the Optimol SRV test machine at an oscillating frequency of 50 cycles per second, apply an 11.2-pound force break-in load for 30 seconds. After break-in, increase the load to 22.5 pounds force for two minutes. Continue increasing the load in 22.5-pound force increments, holding for two minutes at each loading or until the metal specimens seize. Report the highest load prior to seizure.

4.4.3 High Temperature Bearing Performance:

4.4.3.1 Apparatus: Performance shall be determined in a Marlin Rockwell 1000 °F grease testing unit developed for the CRC L-54 research technique, or equivalent, using ASTM D 3336 test method with the following modifications: A variable-speed electric drive motor shall be installed with a large balanced pulley and a lightweight flat belt to rotate a spindle supported by two ball bearings. The rig shall be modified to accommodate a 0.67 inch bore size 203 test ball bearing located at the opposite end of the spindle from the drive pulley. This bearing shall be

4.4.3.1 (Continued)

made of M-50 tool steel and phenolic resin with aluminum side plates fastened with rivets. Dished side shields shall be used to retain additional lubricant. The spindle support bearing located next to the pulley shall be Marlin Rockwell type 204 S-17, or equivalent, with races and balls made of M-50 tool steel and bore diameters of 0.80 inch, or equivalent. The ball retainer shall be a stamped ribbon type made of silver plated beryllium copper. A thermocouple in contact with the outer race of the test bearing shall be connected to a temperature controller, a recorder, and a data logger. An oven capable of maintaining the test temperature is required. An air cylinder connected to a steel cable is required to apply thrust load to the test bearing housing.

4.4.3.2 Procedure: Prior to testing, the side shields of the 203 test bearing shall be removed and all the bearing components cleaned thoroughly with a suitable solvent. The bearing shall be packed with 0.535 gram ± 0.050 of test grease and 0.625 gram ± 0.050 of grease in each of the two shields. The shields shall then be carefully replaced. After installing on the tester, the test bearing shall be run at 30,000 rpm, thrust loaded at 395 pounds force ± 2, and at a temperature of 240 °F ± 4. A running time of not less than 25 hours is required.

4.5 Reports:

The vendor of grease shall furnish with each shipment a report showing the results of tests on each lot to determine conformance to the acceptance test requirements, and, when performed, to the periodic test requirements. This report shall include the purchase order number, lot number, AMS 3053, vendor's compound number, form, and quantity.

4.5.1 A material safety data sheet conforming to AMS 2825, or equivalent, shall be supplied to each purchaser prior to, or concurrent with, the report of preproduction test results or, if preproduction testing be waived by purchaser, concurrent with the first shipment of grease for production use. Each request for modification of grease formulation shall be accompanied by a revised data sheet for the proposed formulation.

4.6 Resampling and Retesting:

If any specimen used in the above tests fails to meet the specified requirements, disposition of the grease may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the grease represented. Results of all tests shall be reported.