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METRIC

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PERFORMANCE 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 one grade of general purpose, aircraft grease formulated to withstand operations at high speeds and a wide temperature range of -54 to 177 °C (-65 to 350 °F).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100 or emailed to thomas.omara@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

AMSC N/A

FSC 9150

2.2 Government documents.

2.2.1 Specifications and standards. The following specification forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

FED-STD-791	-	Lubricants, Liquid Fuels, and Related Products; Methods of Testing

(Copies of this document are available on line at http://assist.daps.dla.mil/quicksearch/ or www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) INTERNATIONAL

ASTM-B150M	-	Aluminum Bronze Rod, Bar, and Shapes [Metric], Standard Specification for. (DoD adopted)
ASTM-D130	-	Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test, Standard Test Method for. (DoD adopted)
ASTM-D217	-	Cone Penetration of Lubricating Grease, Standard Test Methods for. (DoD adopted)
ASTM-D942	-	Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method, Standard Test Method for. (DoD adopted)
ASTM-D1264	-	Determining the Water Washout Characteristics of Lubricating Greases, Standard Test Method for. (DoD adopted)
ASTM-D1478	-	Low-Temperature Torque of Ball Bearing Grease, Standard Test Method for. (DoD adopted)
ASTM-D1743	-	Determining Corrosion Preventive Properties of Lubricating Greases, Standard Test Method for. (DoD adopted)

ASTM-D2265	-	Dropping Point of Lubricating Grease Over Wide Temperature Range, Standard Test Method for. (DoD adopted)
ASTM-D2266	-	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method), Standard Test Method for. (DoD adopted)
ASTM-D2595	-	Evaporation Loss of Lubricating Greases Over Wide Temperature Range, Standard Test Method for. (DoD adopted)
ASTM-D2596	-	Measurement of Extreme Pressure Properties of Lubricating Grease (Four-Ball Method), Standard Test Method for. (DoD adopted)
ASTM-D3336	-	Life of Lubricating Greases in Ball Bearings at Elevated Temperatures, Standard Test Method for. (DoD adopted)
ASTM-D3704	-	Wear Preventive Properties of Lubricating Greases Using On the (Falex) Block On Ring Test Machine in Oscillating Motion, Standard Test Method for. (DoD adopted)
ASTM-D4048	-	Detection of Copper Corrosion from Lubricating Grease, Standard Test Method for (DoD adopted)
ASTM-D4057	-	Manual Sampling of Petroleum and Petroleum Products, Standard Practice for. (DoD adopted)
ASTM-D4289	-	Compatibility of Lubricating Grease and Fluids, Elastomers, Standard Test Method for. (DoD adopted)

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

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. The grease furnished under this specification shall be a product that is authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.2 Materials. The grease shall consist of a liquid lubricant and a jelling agent that when formulated results in a compound meeting the wide temperature range of this specification. There shall be no change in the formulation of a qualified product (see 6.3)

3.3 Physical properties. Physical properties of the grease shall conform to table I when tested in accordance with table II.

TABLE I. Physical properties.

Property	Requirement
Corrosiveness (copper strip)	1-b, max. The grease shall show no green color in that portion contacting the copper strip. Any corrosion produced on the surface of the copper shall be less than 1-b when compared with ASTM-D130 (see 6.8)
Dirt 25 to74 µm 75 µm or larger	 1000 particles per milliliter of grease, max. None
Dropping point	232 °C, min.
High temperature performance, at 177 ±3 °C	400 hours, min. (average of four test runs)
Load carrying capacity (Load wear index)	30.0 min.
Low temperature torque, at -54 °C Starting Running, after 60 minutes	 0.98 Newton-meter (Nm), max. 0.098 Nm, max.
Odor	No odor of rancidity, perfume, or free alcohol
Oil separation, after 30 hours at 177 ± 3 °C	2.0 - 8.0 percent weight loss
Oscillation Friction and wear after 35,000 cycles	 6.35 mm width of wear scar, max.
Oxidation stability, at 99 °C In 100 hours In 500 hours	 83 kilopascals (kP) pressure drop, max. 172 kP pressure drop, max.
Rust preventive properties, ASTM-D1743 rating	Pass Based on the pass or fail rating of at least two of three bearings.
Steel on steel wear	0.8 millimeter (mm), max. Based on the average wear scar diameter on the three balls.
Storage stability, penetration: Unworked Separation of crystalline material Worked	 200, min. None ± 30, max.
Swelling of synthetic rubber, NBR-L (see 6.6), after 168 ± 0.5 hours at 70 ± 1 °C	10.0 percent, max.
Water washout, at 41 ± 1 °C	20 percent loss, max.
Worked penetration	265-320
Worked stability, penetration, after 100,000 double strokes	350, max.

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

3.5 Compatibility. The grease shall be compatible with all previously qualified greases when tested in accordance with 4.5.3. Immediately after mixing, and after undisturbed storage for seven days, the mixture shall not form resinous gums, sludge, or insoluble solid materials and shall comply with the worked penetration and worked stability requirements (see table I). In the event of failure, the previously qualified grease (unmixed with other greases) shall be tested to verify that it meets the worked penetration and worked stability requirements under the conditions specified in 4.5.3. If the previously qualified sample fails to meet the worked penetration or worked stability requirement, a fresh sample shall be obtained and the compatibility test repeated. Additional mix ratios of 90 percent previously qualified and 10 percent new and vice versa may be used during qualification testing (see 4.3.1).

3.6 Toxicity. The grease furnished under this specification shall have no adverse effect on the health of personnel when used for its intended purpose. The grease shall not cause any environmental problems during waste disposal (see 4.5.5).

4. VERIFICATION

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

a. Qualification inspection (see 4.3).
b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the conditions specified in tables I and II on unworked grease. The physical values specified in table I apply to the average of determinations made on the sample.

4.3 Qualification inspection. Qualification inspection shall consist of all the tests specified in table II.

4.3.1 Sampling. Qualification test samples shall consist of a minimum of 6.81 kg (15.0 lb.) of grease for which qualification is desired.

4.4 Conformance inspection. The conformance inspection shall consist of the following tests specified in table II: worked penetration, worked stability, steel on steel wear, oil separation, odor, low temperature torque, load carrying capacity, evaporation, dropping point, dirt, corrosiveness (copper strip), and workmanship. The inspection shall be conducted on samples taken in accordance with 4.4.1.

4.4.1 Sampling for tests. Select two 2.95 kg (6.5 lb.) containers of grease, taken at random from each filled lot (see 6.4). For users who obtain grease in large containers, samples shall be selected in accordance with ASTM-D4057. One sample shall be used for tests and the other shall be retained. If any test result does not comply with the stated requirement, the test in question shall be repeated on the retained sample: if the sample fails again, the lot shall be rejected.

4.5 Test methods. The properties of the grease shall be tested in accordance with the test methods and paragraphs specified in table II.

TABLE II. Examinations and test methods.

PROPERTIES	TEST METHOD OR PARAGRAPH
Corrosiveness (copper strip)	ASTM-D4048
Dirt	FED-STD-791, method 3005
Dropping point	ASTM-D2265
Evaporation	ASTM-D2595
High temperature performance	ASTM-D3336
Load carrying capacity	ASTM-D2596
Low temperature torque 1/	ASTM-D1478
Oil separation	FED-STD-791, method 321
Oscillation Friction and wear	 4.5.1
Oxidation stability	ASTM-D942
Rust preventive properties	ASTM-D1743
Steel on steel wear	ASTM-D2266
Storage stability	4.5.2
Swelling of synthetic rubber, NBR-L	ASTM-D4289
Water washout	ASTM-D1264
Worked penetration	ASTM-D217
Worked stability	FED-STD-791, method 313
Workmanship	Visual
Compatibility	4.5.3
Odor	4.5.5

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

4.5.1 Oscillation - friction and wear. Oscillation - friction and wear shall be determined in accordance with ASTM-D3704 and the following:

Time: 35,000 cycles
Angle of oscillation: 90 °
Test ring: Type S-10

The test block shall be an ASTM-B150M, alloy C64200 having a Rockwell B hardness of HRB 88 ±3 with dimensions and surface finish the same as those specified for H-30 or H-60 blocks.

4.5.2 Storage stability. The storage stability shall be in accordance with FED-STD-791, Method 3467, and the following:

Temperature of 38 ±3 °C (100 ±5 °F) to be maintained for 6 months. After determination of unworked penetration, the unworked penetration sample shall be stored at 38 ±3 °C (100 ±5 °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.

4.5.3 Compatibility. Fill standard grease cups with equal volumes of the grease being tested and previously qualified greases. The cup shall be filled by alternately adding 60 grams of each of the two greases being tested, until the cup is full (approximately 454 grams). Mix the two greases by working the sample for 60 double strokes in accordance with the worked penetration procedure of ASTM-D217 and then let the mixture stand undisturbed for seven days at 18.0 to 29.5 °C (65 to 85 °F) and 50 ±10 percent relative humidity. Examine the worked penetration and then the worked stability in accordance with table II, using the same sample of grease mixture for both tests. Small amounts of fresh grease may be added to the worker cup just prior to the worked stability test, as needed to maintain a full cup for testing.

4.5.4 Odor. The odor of the grease shall be observed immediately upon opening the test container for conformance to table I.

4.5.5 Toxicity. To determine conformance to 3.6, the grease shall be evaluated via a Health Hazard Risk Assessment(HHRA) which will be performed by the Navy Environmental Health Center (NEHC) (see 6.2 and 6.9).

5. PACKAGING

5.1 Packaging. . For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The grease covered by this specification is military unique because it is intended to lubricate military aircraft equipment subject to extreme marine conditions and

operate in the wide temperature range of -54 to 177 °C (-65 to 350 °F). Commercial equipment is not exposed to these extreme conditions. It is intended for use in military aircraft wheel bearings and internal brake wheel assemblies, antifriction bearings, gearboxes, and plain bearings.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.

b. Quantity desired.

c. When toxicity evaluation is required (see 3.6, 4.5.5, and 6.9).

d. Packaging requirements (see 5.1 and 6.2.1).

6.2.1 Marking. Containers should be marked in accordance with MIL-STD-290, "Packaging of Petroleum and Related Products." All unit and intermediate packs of toxic and hazardous chemicals and materials should also be labeled in accordance with the applicable laws, statutes, regulations, and ordinances, including federal, state, and municipal requirements. Unit and intermediate containers should be marked in accordance with ANSI-Z129.1, "Precautionary Labeling of Hazardous Industrial Chemicals."

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-81322 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the Commander, Attn.: Code 4.3.4.1, Building 2188, Naval Air Warfare Center Aircraft Division, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161.

6.3.1 Submission of qualification samples and additional information. When authorizing the forwarding of qualification samples, the qualifying activity will require the manufacturer to submit for review and approval, along with the samples, two copies of the manufacturer's test report (which includes the sample's material safety data sheet (MSDS) (see 6.5), the location and identity of the plant which produced the sample, and the item composition report. The samples should be plainly and durably marked with the following information:

Sample for Qualification Test

- GREASE, AIRCRAFT, GENERAL PURPOSE, WIDE TEMPERATURE RANGE
- Specification MIL-PRF-81322G
- Manufacturer's name.

- Manufacturer's product number.
- Batch number.
- Date of manufacture.
- Submitted by (name and date), for qualification inspection in accordance with MIL-PRF-81322G, under authorization of (reference authorization letter).

6.3.2 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (QPL), the Government will require the manufacturer to 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 will be in two-year intervals from the date of original qualification and will be initiated by the Government. 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.

6.3.3 Requailification. Any change in the formulation of a qualified product will necessitate re-qualification.

6.4 Lot and batch. Unless otherwise specified a lot consists of 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. A batch is the 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.

6.5 Material Safety Data Sheets (MSDSs). MSDSs for items supplied to the government are required to conform to FED-STD-313, "Material Safety Data, Transportation Data and Disposal Data For Hazardous Materials Furnished to Government Activities."

6.6 Standard rubber samples. Samples of the standard synthetic rubber NBR-L (see table I) may be obtained from the Akron Rubber Co., Akron, OH.

6.7 International standardization agreements. This specification implements AIR-STD-15/1, "Interchangeability Chart of Standardized Aviation Fuels, Lubricants and Allied Products" and STANAG 1135, "Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations." When amendment, revision, or cancellation of this specification is proposed, the preparing activity must coordinate the action with the U.S. National Point of Contact for the international standardization agreement, as identified in the ASSIST database at http://www.dodssp.daps.mil.

6.8 ASTM-D130 availability. ASTM-D130 adjunct, available from ASTM as number 12-401300-00.

6.9 Toxicity evaluation. Questions concerning toxicity and requests for Health Hazard Risk Assessments (HHRA) should be addressed to Commanding Officer, Navy Environmental Health Center, 2150 Walmer Avenue, Norfolk, Virginia 23513-2617, Attention: C.I.H./NEHC-34. Upon receipt of the HHRA performed by the NEHC, a copy should be provided to Commander, Attn.: Code 4.3.4.1, Building 2188, Naval Air Warfare Center Aircraft Division, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161.

6.10 Subject term (key word) listing.

High melt point
Lubricant

6.11 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

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

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

International interest:
NATO

Preparing activity:
Navy - AS
(Project 9150-1303)

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