METRIC

MIL-PRF-27617F
17 February 1998
SUPERSEDING
MIL-G-27617E
15 April 1994

PERFORMANCE SPECIFICATION

GREASE, AIRCRAFT AND INSTRUMENT, FUEL AND OXIDIZER RESISTANT

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 greases resistant to hydrocarbon fuel and liquid oxygen and for use as lubricants in aircraft, aerospace vehicles, and supporting equipment (see *6.1*). These greases are identified by NATO code numbers as follow (see *6.6*):

TYPE	NATO NUMBER
I	G-397
II	G-398
III	G-399
IV	G-1350.

1.2 Classification. Use will be of the following types, as specified (see *6.1*):

Type I	-54°C to 149°C (-65°F to 300°F) operating temperature
Type II	-40°C to 204°C (-40°F to 400°F) operating temperature
Type III	-34°C to 204°C (-30°F to 400°F) operating temperature
Type IV	-73°C to 204°C (-100°F to 400°F) operating temperature
Type V	-73°C to 232°C (-100°F to 450°F) operating temperature.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASC/ENSI, Bldg 560, 2530 Loop Road West, Wright-Patterson AFB OH 45433-7101, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

AMSC: N/A

FSC 9150

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 documents cited in *sections 3* and *4* of this specification, whether or not they are listed.

2.2 Government documents

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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

FEDERAL

P-D-680	Dry Cleaning Solvent
O-E-751	Ether, Petroleum, Technical-Grade

MILITARY

MIL-M-7866	Molybdenum Disulfide, Technical, Lubrication Grade
MIL-S-7952	Steel, Sheet and Strip, Uncoated, Carbon (1020 and 1025) Aircraft Quality

STANDARDS

FEDERAL

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Defense Printing Service Detachment Office, 700 Robbins Avenue, Building 4D, Philadelphia PA 19111-5094, phone (215) 697-2667.)

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

DEPARTMENT OF LABOR (DOL)

OSHA 29 CFR 1910.1200 -	Federal Register, Part IV, Department of Labor, OSHA Hazardous Communication: Final Rule

(Application for copies should be addressed to the OSHA Publication Office, Room S-4203, 200 Constitution Avenue NW, Washington DC 20210.)

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 the documents that 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 SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D130	Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test

ASTM D942	Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
ASTM D1264	Water Washout Characteristics of Lubricating Greases
ASTM D1403	Cone Penetration of Lubricating Grease Using One-Quarter and One-Half Scale Cone Equipment
ASTM D1478	Low Temperature Torque of Ball Bearing Greases
ASTM D2266	Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)
ASTM D2512	Compatibility of Materials with Liquid Oxygen (Impact Sensitivity Threshold Technique)
ASTM D2595	Evaporation Loss of Lubricating Greases Over Wide-Temperature Range
ASTM D2596	Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)
ASTM D3336	Test Method for Performance Characteristics of Lubricating Greases in Ball Bearings at Elevated Temperatures

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.4 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for related associated detail specifications, specification sheets on MS standards), the text of this specification takes precedence. Nothing in this specification, 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 which has been authorized by the qualifying activity for listing on the applicable Qualified Products List (QPL) before contract award (see 4.2 and 6.3).

3.2 Materials. The grease shall be a smooth, homogeneous compound that consists essentially of a gelling agent and a suitable liquid lubricant. It shall be of uniform consistency and appearance and be essentially free of separated fluid when examined visually. Type V may be formulated with a sufficient concentration of additional additive(s), such as molybdenum disulfide as specified in *MIL-M-7866*, to enhance the extreme pressure and antiwear properties and shall not contain graphite.

3.3 Chemical and physical requirements. Products shall conform to the requirements as specified in *table I* and *3.4* through *3.7*.

3.4 Resistance to fuel

3.4.1 Solubility in fuel. When tested as specified in *4.4.1*, the grease solubility in fuel shall be not greater than 20 percent by weight for type II, type III, and type IV.

3.4.2 Resistance to fuel. When tested as specified in *4.4.1*, a layer of grease on an aluminum test panel shall not be visibly affected by immersion in fuel. The fuel shall not cause swelling, blistering, or cracking of the grease, nor shall the adhesion of the grease to the metal be weakened.

3.5 Resistance to aqueous solutions. When tested as specified in *4.4.1*, the grease shall not disintegrate nor dissolve in distilled water or in a 50-percent solution of alcohol in distilled water.

3.6 Film stability and corrosion on steel. When tested as specified in *4.4.4*, a film of the grease shall withstand exposure to 100°C (212°F) for one week without forming a hard, resinous deposit and there shall be no evidence of corrosion on the steel panels.

3.7 Storage stability. When stored for eight months as specified in *4.4.1*, penetration requirements will comply with *table II*. Slight separation of oil from thickener shall not be cause for rejection.

TABLE I. Chemical and physical requirements.

REQUIREMENTS	TYPE I	TYPE II	TYPE III	TYPE IV	TYPE V
Unworked penetration (min)	290	200	200	225	260-310
Worked penetration	290-340	265-310	265-310	235-310	270-300
Corrosion on copper (max)	2b[1/]	2b[1/]	2b[1/]	2b[1/]	2e[1/]
High temperature bearing performance		500[2/] hours	500[2/] hours	500[2/] hours	600[3/] hours
Evaporation, percent (max)	25.0[4/]	15.0[5/]	12.0[5/]	15.0[5/]	3.0[6/]
Oil separation at 204°C (400°F) 30 hours, percent (max)	-	15	20	20	12
Antiwear, scar diameter mm (maximum) 40 Kg load 52100, 75°C (167°F) 52100, 204°C (400°F)	 - -	 - -	 - -	 1.0 1.3	 1.25 3.0
Extreme pressure weld, Kg (min)	-	-	-	500	600
Solubility in fuel, percent (max)	-	20	20	20	-
Liquid oxygen impact sensitivity 20 impacts at 1100 mm (43.3 inches)	No reaction	No reaction	No reaction	No reaction	
Water washout characteristics	-	20% max	-	-	-
Oxidation stability - pressure drop, psi (max)	-	5	-	-	-
Low temperature torque gm-cm at: -62°C (-80°F) (min)	-	-	-	Start 800 Run 300	-
Low temperature torque gm-cm at: -73°C (-100°F) (min)	-	-	-	Start 2800 Run 800	Start 3000 Run 2000
Molybdenum disulfide content, percent (min)	-	-	-	-	5.0
Dirt count 25-74 micron diameter (max) 75 micron diameter and over	 1000 0	 1000 0	 1000 0	 1000 0	

1/ *ASTM D130 rating, no pitting or etching under minimum 30× magnification*
2/ *10,000 revolutions per minute at 204°C (400°F)*
3/ *10,000 revolutions per minute at 232°C (450°F)*
4/ *22 hours at 149°C (300°F)*
5/ *Test conditions: 22 hours at 204°C (400°F)*
6/ *72 hours at 232°C (450°F)*

TABLE II. Penetration requirements.

REQUIREMENTS	TYPE I	TYPE II	TYPE III	TYPE IV	TYPE V
Unworked penetration (min)	290	200	200	225	280
Change in worked penetration (units max)	30	30	30	30	30

4. VERIFICATION

4.1 Classification of inspections. The examination and testing of the grease shall be classified as follows:

a. Qualification inspection (see *4.2*).

b. Periodic qualification re-evaluation (see *4.2.4*).

c. Quality conformance inspection (see *4.3*).

4.2 Qualification inspection

4.2.1 Qualification inspection. The qualification inspection performed by the qualification laboratory shall consist of a review for approval of the submitted manufacturer's report and subjecting the qualification sample to examination and testing to determine conformance to this specification.

4.2.2 Qualification sample. The qualification sample shall consist of a minimum of three pounds of grease. The sample shall be properly identified and forwarded to the activity responsible for inspection as specified in the letter of authorization from that activity (see *6.3*).

4.2.3 Retention of qualification. In order to retain qualification of approval for listing on the 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 the product continues to meet any or all of the specification requirements.

4.2.4 Periodic qualification re-evaluation. The grease shall pass a qualification re-evaluation of a one-pound sample taken from the first lot of grease processed under a contract or order after the product has passed the qualification inspection, and at intervals as considered necessary to verify the consistency of production quality.

4.3 Quality conformance inspection. Quality conformance inspection shall consist of examination of the sample-filled containers (see *4.4.4*) and testing the sample against all requirements specified in *section 3* except for high temperature performance, storage stability, and shock sensitivity with liquid oxygen. Samples shall be labeled completely with information that identifies the purposes of the sample, name of the product, specification number, lot and batch number (see *6.4*), date of sampling, and contract number.

4.3.1 Sampling. Sampling shall be in accordance with *FED-STD-791, Method 8001*.

4.3.2 Ozone depleting chemicals (ODCs). The contractor shall certify that ODCs were not used in the production or processing of the grease.

4.4 Method of inspection and tests

4.4.1 Inspection. Inspection shall be in accordance with *FED-STD-791, Method 9601*; and *4.4.4* of this specification.

4.4.2 Inspection tests. The tests of this specification shall be conducted in accordance with test methods of *FED-STD-791* and as specified in *table III* and *4.4.3* of this specification.

4.4.3 Examination of product. The sample grease shall be inspected visually and a suitable portion shall be worked with a spatula on a glass surface. After working, the grease shall be spread with a straight edge and observed for uniformity as indicated by a smooth surface.

TABLE III. Test methods.

TEST	TEST METHOD NUMBER	
	FED-STD-791	***ASTM***
Penetration		*D1403*
Corrosion in copper	*5309*[1/]	
High temperature performance		*D3336*
Evaporation		*D2595*
Oil separation	*321*	
Resistance to fuel, fuel solubility	*5414*	
Resistance to aqueous solutions	*5415*	
Storage stability	*3467*[2/]	
Water resistance		*D1264*[2/]
Oxidation stability		*D942*[3/]
Shock sensitivity with liquid oxygen		*D2512*[4/]
Wear preventive characteristics		*D2266*
Extreme pressure properties of lubricating grease		*D2596*
Low temperature torque of ball bearing greases		*D1478*
Molybdenum disulfide analysis	*3722*	
Dirt count	*3005*	

1/ *Except the copper strip shall be prepared and polished in accordance with ASTM D130 method.*
2/ *Test temperature shall be 38°C ± 3°C (100°F ± 5°F).*
3/ *Test conditions shall be 100 hours at 121°C (250°F).*
4/ *Use perchloroethylene instead of trichlorotrifluoroethane.*

4.4.4 Film stability and corrosion on steel. Surface ground test panels of 1020 steel which conform to *MIL-S-7952* and measure 0.32 cm x 5.08 cm x 10.16 cm (1/8 in. x 2 in. x 4 in.) shall be employed. Aluminum shims that measure 0.04 cm x 2.54 cm x 5.08 cm (1/64 in. x 1 in. x 2 in.) shall be employed as spacers. The test panels shall be cleaned in hot, dry cleaning solvent that conforms to type I of *P-D-680*, followed by immersion in petroleum ether (ligroine) that conforms to *O-E-751*. One of the shims shall be placed at each end of a panel to provide a test area that measures approximately 5 cm x 5 cm. Approximately 2 gm of the grease shall be placed in the center of the test panel. Another panel shall be placed on top and two panels shall be pressed together and clamped to form the test assembly. Grease that exudes from the test assembly shall be cleaned off with a spatula. The test assembly shall then be placed in an oven maintained at 100°C (212°F) for one week. Upon removal from the oven, the test assembly shall be dismantled and the grease shall be examined for indications of hardening, separation, and evident changes other than color. The area of the test panels that were in contact with the grease shall be examined for evidence of corrosion.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity with the Military Department or Defense Agency, or within the Military Department's System Command. 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The fuel resistant grease is intended for use in the lubrication of taper plug valves, gaskets, and bearings in fuel systems of aircraft and ground support equipment. It is also suitable for use in the presence of liquid oxygen as a lubricant for valves, threads, and bearings in aerospace vehicles and supporting equipment. This material may not be suitable for aluminum or magnesium dynamic bearing lubrication because of possible ignition hazards.

6.2 Acquisition data. 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 *2.2.1*).

c. Quantity desired.

d. Applicable levels of packaging and packing (see *5.1*).

e. Type and capacity of containers (see *5.1*).

6.3 Qualification. With respect to products that require qualification, awards will be made only for products that are, at the time of award of contract, qualified for inclusion in *Qualified Products List* (*QPL*) *No. 27617* 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 have the products 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 AFRL/MLSE, BLDG 652, 2179 Twelfth Street, Room 122, Wright-Patterson AFB OH 45433-7718, and information pertaining to qualification of products may be obtained from that activity.

6.3.1 List of qualified products. Products considered acceptable under this specification are listed in *QPL-27617* and subsequent revisions thereto.

6.3.2 Qualification information. It is understood the material furnished under this specification to final approval will be of the same composition and will be equal to products upon which approval was originally granted. In the event the fluid 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 subjected to immediate withdrawal from the QPL.

6.3.3 Data to accompany qualification samples. The samples will be accompanied by a test report that contains complete information from the manufacturer or a commercial laboratory as to the following: source and type of base stock and additive materials used, the formulation and composition of the finished fluid, and laboratory data showing actual, quantitative results of all tests required by this specification except storage stability. Separate qualification inspections will be required for each base stock used. Submission of the Material Safety Data Sheet (MSDS) is a requirement. One copy of the MSDS will be sent with each sample submitted for test. The samples, MSDS, and reports will be forwarded to the Air Force Research Laboratory, Materials Directorate, System Support Division, AFRL/MLSE, BLDG 652, 2179 Twelfth Street, Room 122, Wright-Patterson AFB OH 45433-7718. The samples will be plainly identified by securely attached, durable tags or labels marked with the following information:

Sample for Qualification Inspection

GREASE, AIRCRAFT AND INSTRUMENT, FUEL AND OXIDIZER RESISTANT

Name of ingredient (for ingredient material)

Name of manufacturer

Product code number

Date of manufacture

Submitted by (Name) and (date) for qualification inspection in accordance with the requirements of *MIL-PRF-27617* under authorization of (reference authorizing letter)". (See *6.3*)

6.3.3.1 Formulation sheets. An example of a satisfactory form for the formulation sheet, indicating the percent by weight and purpose of each ingredient, is as follows:

Base oil(s) (composition and source)	percent
Antiwear additive (composition and source)	percent
Oxidization inhibitor (composition and source)	percent
Other additives (composition and source)	percent.

6.4 Definitions

6.4.1 Bulk lot. By definition, a bulk lot is an indefinite quantity of a homogeneous mixture of material offered for acceptance in a single, isolated container; or manufactured by a single plant run not to exceed 24 hours through the same processing equipment, with no change in ingredient material.

6.4.2 Packaged lot. By definition, a packaged lot is an indefinite number of 55-gallon drums, or smaller unit packages of identical size and type, offered for acceptance and filled with a homogeneous mixture of material from one isolated container; or filled with a homogeneous mixture of material manufactured by a single plant run through the same processing equipment with no change in ingredient material.

6.5 Subject term (key word) listing.

corrosion
fuel resistant grease
liquid oxygen resistant
grease
lubricant
oxidation

6.6 International standardization agreements. Certain provisions of this specification (*1.1*) are the subject of international standardization agreements *STANAG 1135* and *AIR STD 15/9*. When amendment, revision, or cancellation of this specification is proposed that 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.

6.7 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. The changes are due to Acquisition Reform initiatives requiring Government specifications to be performance-based.

Custodians:
Army – CR4
Navy - AS
Air Force - 11

Review activities:
Army - AR, EA, MI, MR, SM
Navy - SH
DLA - GS

Preparing activity:
Air Force - 11

(Project 9150-0827)

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 f documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waiver any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER **MIL-PRF-27617F**	2. DOCUMENT DATE (YYMMDD) **98/02/17**

3. DOCUMENT TITLE
GREASE, AIRCRAFT AND INSTRUMENT, FUEL AND OXIDIZER RESISTANT

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, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (include Zip Code)	d. TELEPHONE (Include Area Code (1) Commercial (2) AUTOVON *(If applicable)*	e. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME ASC/ENSI Air Force Code 11	b. TELEPHONE (Include Area Code (1) Commercial (937) 255-0175	(2) AUTOVON 785-0175
c. ADDRESS *(Include Zip Code)* 2530 Loop Road West Wright-Patterson AFB OH 45433-7101	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	