METRIC

MIL-PRF-7870E
05 November 2015

SUPERSEDING
MIL-PRF-7870D
30 April 2010

PERFORMANCE SPECIFICATION

LUBRICATING OIL: GENERAL PURPOSE, LOW-TEMPERATURE (NATO O-142)

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

Comments, suggestions, or questions on this document should be addressed to AFPET/PTPS, 2430 C Street, Building 70, Area B, Wright-Patterson AFB, OH 45433-7631 or e-mailed to AFPA.PTPS@us.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

AMSC N/A FSC 9150

1. SCOPE

1.1 Scope. This specification covers one grade of general purpose, low temperature lubricating oil. This lubricating oil is identified by NATO Code Number O-142 (see 6.7).

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.

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 cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

QQ-S-698 - Steel, Sheet and Strip, Low Carbon

FEDERAL STANDARDS

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-680 - Degreasing Solvent

(Copies of these documents are available online at http://quicksearch.dla.mil.)

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 of these documents are those cited in the solicitation or contract.

DEFENSE STANDARDIZATION PROGRAM OFFICE

SD-6 - Provisions Governing Qualification

(Copies of this document are available online at http://quicksearch.dla.mil.)

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 are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM D91 - Standard Test Method for Precipitation Number of Lubricating Oils

ASTM D92	-	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	-	Standard Test Method for Pour Point of Petroleum Products
ASTM D445	-	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D664	-	Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration
ASTM D972	-	Standard Test Method for Evaporation Loss of Lubricating Greases and Oils
ASTM D1500	-	Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
ASTM D1748	-	Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet
ASTM D4636	-	Standard Test Method for Corrosiveness and Oxidation Stability of Hydraulic Oils, Aircraft Turbine Engine Lubricants, and Other Highly Refined Oils
ASTM D5949	-	Standard Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
ASTM D6547	-	Standard Test Method for Corrosiveness of Lubricating Fluid to Bimetallic Couple
ASTM E29	-	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

(Copies of these documents are available from http://www.astm.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, 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 lubricating oil furnished under this specification shall be a product that is 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 oil shall be formulated to meet the requirements of this specification, and contain additive materials to impart corrosion-protective and oxidation-resistant properties.

3.3 Limiting values. The following applies to all specified limits in this specification: For purposes of determining conformance with these requirements, an observed value or a calculated value shall be rounded off in the last right-hand digit used in expressing the specification limit using the Rounding Method of ASTM E29.

3.4 Properties. Products shall conform to the requirements as specified in Table I and 3.5 through 3.11 when tested as specified in section 4.

TABLE I. Properties of the finished oil.

Property	Qualification	Conformance	Min	Max	Requirement	Test Method	
						ASTM	FED-STD-791
Viscosity (mm^2/s)	x	x			3.4	D445	
at 38 °C			10				
at -40 °C				4000			
Pour Point, (°C)	x	x		-57	3.4	D97, D5949	
Flash Point, (°C)	x	x	130		3.4	D92	
Precipitation number, (mL)	x	x		0	3.4	D91	
Acid number, (mg of KOH/g) [1]	x	X			3.4	D664	
Corrosiveness and Oxidation Stability [2]	x	x			3.5	D4636	
Change in acid number (mg KOH/g)				0.2			
Metal specimen mass change, (mg/cm^2)							
Aluminum				0.2			
Cadmium plated steel				0.2			
Copper				0.2			
M-50 Steel				0.2			
Magnesium				0.2			
Percent change in viscosity at 38°C			-5	+20			
Sludge, (mL)				0.0			
Low temperature stability [3]	x	x	pass		3.6		3458
Evaporation loss, (mass %) [4]	x	x		25	3.7	D972	
Corrosiveness (Bimetallic Couple) [5]	x		pass		3.8	D6547	
Color, (ASTM Color)	x			5.0	3.9	D1500	
Protection of panels	x		pass		3.10	see 4.4.3	
Workmanship	x	x	pass		3.11		

NOTES:
1. Report only.
2. The test shall be run for 168 hours at 121 °C ± 1 °C. Use Alternative Procedure 2.
3. The test shall be run at or below -54 °C for 72 hours.
4. The test shall be run at 100 °C ± 0.5 °C.
5. The test shall be run at 27 °C ± 1 °C.

3.5 Corrosiveness and oxidation stability. When tested as specified in 4.4, the change in weight of cadmium-plated steel, copper, steel, aluminum alloy, and magnesium alloy, subjected to the action of the oil for 168 hours at 121 °C ± 1 °C, shall not be greater than 0.2 mg per cm^2 of surface for each strip. There shall be no pitting, etching, or visible corrosion on the surface of any of the metals when viewed under magnification of 20 diameters. Slight discoloration of the surface of the copper will be permitted, but dark brown, gray, or black stain shall be cause for rejection.

3.5.1 Resistance to oxidation. The oil shall not have changed more than -5 to +20 percent from the original viscosity in mm^2/s at 38 °C after the Corrosiveness and Oxidation Stability test. The acid number increase shall not be greater than 0.2 mg KOH/g after oxidation. There shall be no sludge (0.0 mL) after oxidation.

3.6 Low temperature stability. When tested as specified in 4.4 at or below -54 °C for 72 hours, there shall be no gelling or separation of solid or liquid phases. The presence of a dense cloud, which does not “settle out”, shall not be the cause for rejection.

3.7 Evaporation loss. When tested as specified in 4.4, there shall be no more than 25 percent by weight evaporation loss after the oil has been subjected to the test conditions at 100 °C.

3.8 Corrosiveness of Lubricating Fluid to Bimetallic Couple. When tested as specified in 4.4 and the oil has been subjected to the test conditions at 27 °C ± 1 °C, the test areas of two of the three discs shall show no evidence of corrosion, pitting, or other attack. The third disc may show no more than three spots within the area covered by the clip.

3.9 Color. When tested as specified in 4.4, the oil shall not be darker than 5.0 ASTM Color.

3.10 Protection of panels. When tested as specified in 4.4.3, not more than one panel out of five panels shall fail after being covered with a film of lubricating oil for 100 hours. If more than one panel fails, the product shall be retested by repeating the same test with an additional 10 panels. No more than 4 panels shall fail out of the total 15 panels (5 on the original test, 10 on retest).

3.11 Workmanship. The oil shall be clear, transparent, homogeneous, and free of lumps of un-dissolved additive, water, dirt, lint, or sediment. Prior to final packaging, the oil shall be filtered through a 5.0 micrometer pore-size filter.

3.12 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life-cycle costs.

4. VERIFICATION

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

a. Qualification inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 Qualification inspection. Qualification inspection shall consist of testing to the requirements specified in 3.5 thru 3.11 and Table I. When required by the qualifying activity, additional evaluations may be required on candidate formulations.

4.2.1 Qualification process. The general outline of the qualification process (see 6.3) is described in the SD-6.

4.2.2 Qualification sample(s). The qualification sample(s) shall consist of a one gallon container of finished oil, and if requested by the qualifying activity, one pint of base stock (before the additive agents) and one ounce of compounds used for improving the oxidation stability and corrosion protection. In the event that the additives are supplied as concentrated solutions, an equivalent quantity of the solution shall be furnished. The qualifying activity will request data as noted in 6.3 prior to authorizing submission of the qualification sample(s).

4.2.3 Retention of qualification. In order to retain qualification of approval for listing on the QPL, the manufacturer shall verify, by certification (DD Form 1718) to the Qualifying Activity that the manufacturer's product complies with the requirements of this specification. The manufacturer shall also provide a recent Certificate of Analysis (COA) to include all conformance inspection requirements (see 4.3). 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 Requalification. Requalification shall be required when any change is made in the source of manufacture, purity, or composition of the fluid's base stock or additives. A minor change in the fluid formulation may be made without requalification testing, but only after notification to, and approval by the qualifying activity (see 6.3). The qualifying activity may, at its discretion, waive complete requalification or may require only partial requalification testing to determine the significance and acceptability of the proposed formulation change.

4.3 Conformance inspection. Conformance inspection shall consist of examination of the sample-filled containers for conformance to workmanship (see 3.11) and testing the sample against conformance requirements specified in Table I. Samples shall be labeled with complete 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.

4.4 Method of inspection.

4.4.1 Inspection. Unless otherwise specified, inspection testing shall be performed in accordance with 4.4.2 and the contractual requirements (see 6.2).

4.4.2 Test methods. The oil properties shall be determined in accordance with the applicable methods specified in Table I and 4.4.3. Physical and chemical values specified in section 3 apply to the arithmetic average of the determinations made on the samples for those values that fall within any stated repeatability or reproducibility limits of the applicable test method.

4.4.3 Protection of panels test.

4.4.3.1 Preparation of panels. The following procedures shall be conducted:

a. Cut five panels from steel that conform to QQ-S-698.

b. Size the panels and locate the holes as shown in Figure A1.7, "Significant Area of Test Panel," of ASTM D1748. Remove all burrs, sharp edges, and corners, including the edges of the holes.

c. Highly polish the panel with No. 3/0 emery paper prior to use. Next, wash and clean the panel in a solvent conforming to MIL-PRF-680, Type II. Then drain thoroughly and agitate in boiling 95 percent methanol.

d. After cleansing, cool the panels in a desiccator. Care must be taken during cleaning and preparation to ensure that the surfaces are not contaminated by fingerprints. Handle the panels only with tongs during the cleaning operation and only with hooks during and after dipping.

4.4.3.2 Procedure. These steps shall be conducted:

a. Dip five panels in a suitable sample of lubricating oil which is maintained at 25 °C ± 2 °C. Remove and allow to drain for 2 hours at that temperature from glass, Monel™, or stainless steel supports.

b. At the end of this period, suspend the panels in a humidity cabinet conforming to ASTM D1748 for a period of 100 hours, and in such a manner that the condensate from the supports will not fall onto the panels. Maintain the humidity within the cabinet at 100 percent relative humidity and at a dry-bulb temperature of 49 °C ± 2 °C for a 100-hour exposure period.

c. Remove the panels from the cabinet, clean them with naphtha, and examine. Panels have failed the protection test if at the end of the test period one of the following conditions exists in the significant areas of the panels as defined by ASTM D1748, considering both sides of the panel:

(1) A corroded area of 2 mm diameter or larger.

(2) Two or more spots of between 1 mm and 2 mm maximum diameter. If more than one panel in five panels fails the protection test as defined above, a retest will be permitted. Retests shall consist of repeating the protection test using ten additional panels. Reject the lubricating oil if more than four panels fail the test (adding failures of both test and retest).

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 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 activities 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The oil covered by this specification is intended for use in military aircraft and equipment where a general purpose, low-temperature, lubricating oil is required.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. Type and size of containers.
c. Quantity.
d. Packaging requirements (see 5.1).
e. When a variation of the quality conformance tests to be performed on a sample is required (see 4.4.1).

6.3 Qualification. With respect to products requiring qualification, contract awards will be made only for such products that are, at the time of award of contract, qualified for inclusion in the Qualified Products List QPL No. 7870 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 AFPET/PTPS, 2430 C Street, Building 70, Area B, Wright-Patterson AFB OH 45433-7631. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.dla.mil.

6.3.1 Qualification information. It is understood that the material furnished under this specification subsequent to final approval will be of the same composition and will be equal to products on which approval was originally granted. In the event that oil 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 at the discretion of the approving activity.

6.3.2 Qualification process. Clarification information concerning submitting a test sample to the Air Force Petroleum Office for qualification to MIL-PRF-7870 follows.

6.3.2.1 Requesting qualification/re-qualification. At the initiation of the qualification process, prospective suppliers must forward a written request for such action to the qualifying activity, Air Force Petroleum Office, AFPET/PTPS, 2430 C Street, Building 70, Area B, Wright-Patterson AFB, OH 45433-7631. This request should contain general information on the proposed candidate material. The qualifying activity will reply in writing outlining the required information to be submitted, the governing regulations for qualified products, and the cost of testing. The required information to be submitted includes:

a. Letter stating the company will adhere to the appropriate provisions of the SD-6.

b. Complete formulation of the candidate product, including chemical composition in weight percent, the manufacturer and trade name, the purity, and use of each component.

c. Safety Data Sheet (SDS) for each component and final product. The SDS should not be older than 5 years.

d. Certified laboratory test data from the manufacturer, a commercial laboratory, or combination thereof showing quantitative results of all tests required by this specification.

e. Verification that the System for Award Management (SAM) (CAGE Codes for the corporate office and each plant) is current. This can be viewed at https://www.sam.gov.

f. Identification of the manufacturing site of the specific batch of test sample to be submitted.

6.3.2.2 Proceed authorization notification. Upon successful review of the submitted information, the Air Force Petroleum Office will issue authorization to ship the qualification sample(s) for testing.

6.3.3 Qualification samples. Upon receiving authorization from the Air Force Petroleum Office, qualification sample(s) may be shipped to the qualification activity, as detailed in the authorization letter. Sample(s) will be accompanied by an SDS and a copy of the authorization letter. Each sample will be plainly identified by securely attached durable tags or labels marked with the following information:

a. QUALIFICATION SAMPLE
b. Lubricating Oil: General Purpose, Low Temperature
c. MIL-PRF-7870
d. Name of Manufacturer
e. Product Code Number
f. Batch Number
g. Date of Manufacture

6.4 Definitions.

6.4.1 Bulk lot. A bulk lot (batch) is an indefinite quantity of a homogeneous material mixture offered for acceptance in a single, isolated container or manufactured in a single-plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

6.4.2 Packaged lot. A packaged lot is an indefinite number of unit containers of identical size and type offered for acceptance and filled with a homogeneous material mixture from one isolated container; or filled with a material mixture manufactured in a single-plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient material.

6.5 Shelf-life. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government.

These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and (2) the DoD Service and Agency administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: https://www.shelflife.hq.dla.mil/.

6.6 Subject term (key word) listing.

Corrosion-protective
Flash point
Oxidation-resistant
Viscosity

6.7 International Standardization Agreement implementation. This specification implements NATO STANAG 1135, *Interchangeability of Fuels, Lubricants and Associated Products Used by the Armed Forces of the North Atlantic Treaty Nations*, and ASIC AIR STANDARD FG 4024, *Interchangeability Chart of Standardised Aviation Fuels, Lubricants and Associated Products*. 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 https://assist.dla.mil.

6.8 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.

CONCLUDING MATERIAL

Custodians:
Army – AT
Navy – AS
Air Force – 68
DLA – GS

Review activities:
Army – MI, SM, AR
Navy – SA, OS, SH
Air Force – 20
DLA – PS

Preparing activity:
Air Force – 68
(Project 9150-2014-007)

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 using the ASSIST Online database at https://assist.dla.mil.