

!INCH-POUND!

MIL-L-6086D
30 January 1991
SUPERSEDING
MIL-L-6086C
1 November 1977

MILITARY SPECIFICATION

LUBRICATING OIL, GEAR, PETROLEUM BASE

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

1. SCOPE

1.1 Scope. This specification covers two grades of petroleum base lubricating oil for gears (see 6.1).

1.2 Classification. The oil shall be of the following grades, as specified: (see 6.2)

a. Grade L - Light (identified by military symbol OGL and NATO Code 0-153 (see 6.3))

b. Grade M - Medium (identified by military symbol OGR and NATO Code 0-155 (see 6.3))

2. APPLICABLE DOCUMENTS

2.1 Government documents

2.1.1 Standards. The following standards form a part of this specification to the extent specified herein. Unless otherwise specified the issues of these documents shall be 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: ASD/ENES, Wright-Patterson AFB OH 45433-6503 by using the self-addressed Standardization Document Improvement Proposal

FSC 9150

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

MIL-L-6086D

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities

MILITARY

MIL-STD-290 - Packaging, Packing and Marking of Petroleum Products

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Standardization Document Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified the issues of the documents, which are DOD adapted, are those listed in the issue of the DODISS specified 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 D 91	Precipitation Number of Lubricating Oils (DoD adopted)
ASTM D 92	Flash and Fire Points by Cleveland Open Cup
ASTM D 97	Pour Point
ASTM D 130	Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test
ASTM D 445	Viscosity of Transparent and Opaque Liquids (Kinematic and Dynamic Viscosities) (DoD adopted)
ASTM D 892	Test for Foaming Characteristics of Lubricating Oils
ASTM D 974	Neutralization Number by Color-Indicator Titration
ASTM D 1500	ASTM Color of Petroleum Products (ASTM Color Scale)
ASTM D 2270	Calculating Viscosity Index from Kinematic Viscosity
ASTM D 2783	Measurement of Extreme-Pressure Properties of Lubricating Fluids (Four-Ball Method)
ASTM D 4057	Manual Sampling of Petroleum and Petroleum Products

(Application for copies should be addressed to the ASTM, 1916 Race Street, Philadelphia PA 19103.)

(Non-Government standards and other publications are available from the organizations that prepare or distribute the documents. These documents may be obtained through libraries or other informational services.)

MIL-L-6086D

2.3 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. Gear oils furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.1.1 Requalification. Requalification will be required if there is a change in the base stock source, refining treatment or additives. A minor change in the fluid formulation may be made without requalification, but only after notification to, and approval by, the qualifying activity. 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.

3.2 Materials. The oil shall consist of a well-refined mineral oil previously mixed with a suitable load-carrying additive. The additive shall not be corrosive or cause excessive foaming, and shall be completely compatible with the petroleum-derived base stock. The oil shall be clear and free from visible water, suspended matter, dirt, sediment and other impurities when observed at room temperature $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Refined constituent materials shall not be used.

3.3 Properties. The properties of the finished gear oil shall be as specified in table I and section 4.

TABLE I. Properties of gear oil.

<u>Characteristics</u>	<u>Requirements</u>		<u>Unit</u>
	<u>Grade L</u>	<u>Grade M</u>	
Viscosity	23-34	60-82	centistokes at 37.8°C
Viscosity index	80	80	minimum (min)
Flash point	137.8	154.5	$^{\circ}\text{C}$ maximum (min)
Pour point	-40	-28.9	$^{\circ}\text{C}$ max
Low Wear Index	40	40	min
Precipitation number	0.10	0.10	
Acid or base number	1.0	1.0	max
ASTM color	8	8	max
Foaming tendency			max
Sequence I	5-0	5-0	
Sequence II	20-0	20-0	
Sequence III	5-0	5-0	

MIL-L-6086D

3.4 Performance

3.4.1 Copper corrosion. When tested as specified in section 4 for three hours at 100°C, the corrosion produced shall not exceed No. 2 of the ASTM Corrosion Scale in accordance with ASTM D 130.

3.4.2 Toxicity. The gear oil shall have no adverse effect on the health of personnel when used for its intended purpose. The fluid shall contain no components that produce noxious vapors in such concentrations that irritate personnel during formulation or use under conditions of adequate ventilation while exercising caution to avoid prolonged contact with the skin and while observing Occupational Safety and Health Administration (OSHA) guidelines. Questions pertaining to the toxic effects shall be referred by the procuring activity to the appropriate departmental medical service who will act as an advisor to the procuring activity. Material safety data sheets shall be submitted in accordance with FED-STD-313.

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 (examinations and tests) 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 ensure that supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. Qualification inspection (see 4.3)
- b. Quality conformance inspection (see 4.4)

MIL-L-6086D

4.3 Qualification inspection

4.3.1 Qualification samples. The qualification samples shall consist of 1 gallon formulated gear oil and 1 ounce load-carrying additive.

4.3.2 Qualification tests. Qualification sample(s) shall be subjected to all the tests specified under 4.5, method of inspection.

4.3.3 Data to accompany qualification samples. The samples shall be accompanied by a material safety data sheet and the following information: a) a certified test report containing complete information as to the source and type of base stock and additive materials used for the test b) the detailed formulation and composition of the finished product and c) laboratory data showing quantitative results of all tests required by this specification. The samples and reports shall be forwarded to WL/MLSE, Wright-Patterson AFB OH 45433-6533. The samples shall be plainly identified by securely attached durable tags or labels marked with the following information:

- a. Sample for qualification inspection with grade identity
LUBRICATING OIL, GEAR, PETROLEUM BASE
- b. Specification MIL-L-6086D
- c. Name of ingredient (for ingredient material)
- d. Name of manufacturer
- e. Product code number
- f. Date of manufacture

4.3.3.1 Toxicity coordination. At the time of qualification submittal, the contractor shall provide the following certified materials for each ingredient to the Air Force Occupational and Environmental Health Laboratory, AFOEHL/EHT, Brooks AFB, TX 78235:

Chemical Name and Formula (nomenclature of the International Union of Pure and Applied Chemistry)

NIOSH Identification Number (accession or identification number referenced in the Registry of Toxic Effects of Chemical Substances, if assigned)

In addition, the range of percentages of harmful or toxic components in the finished product and any toxicological data useful in evaluating the safety of the formulation shall be furnished. The Government reserves the right to determine whether such data is adequate for the purposes of qualification under the provisions of this specification. The AFOEHL/EHT personnel have 15 working days from the receipt of the contractor materials to report compliance/noncompliance to the qualifying agency.

MIL-L-6086D

4.3.3.2 Formulation sheets example. An example of a satisfactory form for the formulation sheet, indicating the weight percentage and nature of each ingredient, is as follows:

Petroleum oil base stock (composition)	percentage
Load-carrying additive (manufacturer's name and number)	percentage

4.3.4 Retention of qualification. In order to retain qualification of a product approved 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 that the product continues to meet any or all of the specification requirements.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of sampling plans A and B and the tests specified in table II. Samples shall be labeled completely with information identifying the purpose of the sample, name of product, specification number, lot and batch number, date of sampling and contract number.

TABLE II. Test method for gear oil properties.

<u>Characteristic</u>	<u>ASTM</u>
Viscosity	D 445
Flash point	D 92
Acid and base numbers	D 794
Copper corrosion <u>1/</u>	D 130
Color	D 1500
Pour point	D 97
Precipitation number	D 91
Viscosity index	D 2270
Foaming tendency	D 892
Low Wear Index	D 2783

1/ See test paragraph 4.5.2

4.4.1 Inspection lots

4.4.1.1 Bulk lot. A bulk lot (batch) is an indefinite quantity of a homogeneous lubricant mixture of material (see 3.3) 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 the ingredient materials.

MIL-L-6086D

4.4.1.2 Packaged lot. A packaged lot is an indefinite number of one-quart cans or other unit containers of identical size and type offered for acceptance and filled with a homogeneous lubricant mixture of material (see 3.3) from a single, isolated container or filled with a homogeneous lubricant mixture manufactured in a single, plant run (not exceeding 24 hours) through the same processing equipment, with no change in the ingredient materials.

4.4.2 Sampling plan A. A one-gallon bulk lot (4.4.1.1) shall be selected in accordance with ASTM D 4057 and subjected to inspection and tests specified in (4.5.1). If the sample fails any of the quality conformance tests, the inspection lot shall be rejected.

4.4.3 Sampling plan B. A random sample of filled unit containers fully prepared for delivery shall be selected from each package lot (see 4.4.1.2) in accordance with table III. This sample shall be subjected to inspection specified in 4.5.2. If any sample fails, the lot shall be rejected.

TABLE III. Sampling plan

Lot Size	Sample Size
1-4	all
5-50	5
51-90	7
91-150	11
151-280	13
281-500	16
501-12000	19
[acceptance number is zero, (c + 0)]	

4.5 Method of inspection

4.5.1 Inspection. Inspection shall be in accordance with ASTM D 2783 and 4.5.2 of this specification.

4.5.2 Physical and chemical values. Tests shall be performed in accordance with the applicable methods specified in table II. 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 methods.

4.5.3 Examination of filled containers. Each sample of filled container and shipping container shall be examined for defects of construction of the container and closure, evidence of leakage and net content in accordance with 4.4.3 for compliance with MIL-STD-290. A container shall be rejected having one or more defects and that is under the required fill. Rejected lots may be resubmitted if the causes for rejection have been corrected by the contractor.

MIL-L-6086D

5. PACKAGING

5.1 Packaging, packing and marking. The packaging, packing and marking of petroleum-base gear lubricating oil shall be in accordance with the requirements of MIL-STD-290. The type and size of the container and the level of packaging and packing shall be as specified by the procuring activity (see 6.2).

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 two grades of petroleum-base gear oil covered by this specification are intended for use in light- to moderate-loaded gear trains or gear boxes that operate in low- to medium-speed ranges down to -40°C .

6.2 Acquisition requirements. 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 document referenced (see 2.1 and 2.2).
- c. Grade and quantity of oil desired.
- d. Size and type of container in which the oil is to be furnished.
- e. Both the level of packaging and level of packing required.

6.2.1 Purchase unit. The oil will be purchased by volume, the unit being a U.S. gallon of 231 cubic inches at 15.6°C .

6.3 Qualification. With respect to products requiring qualification, awards shall be made only for products that are at the time set for opening of bids, qualified for inclusion in the applicable QPL 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 so that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the QPL is WL/MLSE, Wright-Patterson AFB OH 45433-6533. Information pertaining to qualification of products may be obtained from that activity.

6.3.1 Qualification information. It is understood that the material furnished under this specification subsequent to final approval shall be of the same composition and shall be equal to products upon which approval was originally granted. In the event that the gear 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.

MIL-L-6086D

6.4 International agreement. Certain provisions of this specification are the subject of international standardization agreement ASCC Air Standard 15/1 and NATO STANAG No. 1135. When amendment, revision or cancellation of this specification is proposed that will effect or violate the international agreement concerned, the departmental custodians will inform their respective Departmental Standardization Office (DepSo) so appropriate action may be taken respecting the international agreement concerned.

6.5 Disposal actions

6.5.1 Background. Accumulated waste fluid shall be disposed of through a waste coil recovery program unless prohibited by local law. Otherwise, the product shall be disposed of in accordance to local law and regulations promulgated by the U.S. Environmental Protection Agency under Public Law 94-580, Resource Conservation and Recovery Act of 1976.

6.5.2 Handling and safety precautions. Personnel handling the product shall wear appropriate impervious clothing to prevent repeated or prolonged skin contact. Local appraisal is required for exact health and safety complications and to prescribe precise application of protective clothing. If skin or clothing becomes moistened with the product, personnel shall promptly wash with soap or mild detergent and water. Respirators are not required unless there is an inhalation exposure to mists. Personnel shall wear protective clothing when using the product and when cleaning up spills.

6.5.3 Depot-type operations. Additionally, the used product, which has been drained from the hydraulic systems, shall be combined with unused, but contaminated fluid from partially full containers and then recycled.

6.5.4 Container disposal. Tops from one-time use containers shall be discarded with ordinary refuse. Containers shall be made as empty as possible using gravity draining, after which they are to be crushed and buried in a permitted sanitary landfill or incinerated with general refuse. No special decontamination procedures are required for empty containers or their lids.

6.6 Material safety data sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets (MSDS) prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

6.7 Subject term (key word) listing

Copper corrosion
Flash point
Foaming tendency
Viscosity

6.8 Changes from previous issue. Marginal notations are not used in this revisions to identify changes with respect to the previous issue due to the extensiveness of the changes.

MIL-L-6086D

Custodians:

Army - MR
Navy - AS
Air Force - 11

Preparing activity:

Air Force - 11

(Project 9150-1070)

Review activities:

Army - MI, AV
Navy - SA
Air Force - 68

International interest:

(See section 6)

User activities:

Army - AT
Navy - SH

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

RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-L-6086D	2. DOCUMENT DATE (YYMMDD) 910130
3. DOCUMENT TITLE		
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, First, Middle Initial)	b. ORGANIZATION:	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)
8. PREPARING ACTIVITY		
a. NAME ASD/ENES	b. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (513) 255-6295 785-6295	
c. ADDRESS (Include Zip Code) Wright-Patterson AFB OH 45433-6503	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	