

MILITARY SPECIFICATION

GREASE, MOLYBDENUM DISULFIDE,
FOR LOW AND HIGH TEMPERATURES,
NATO CODE NUMBER G-353

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

1. SCOPE

1.1 Scope. This specification covers the requirements for one grade of low and high temperature molybdenum disulfide grease for use as a lubricant on heavily loaded sliding steel surfaces. This grease is identified by NATO Symbol G-353 Military Symbol GMD.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-M-7866 - Molybdenum Disulfide, Technical, Lubricant Grade.

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data Sheets Preparation and the Submission of.

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Engineering Specifications and Standards Department (Code 93), Naval Air Engineering Center, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-290 - Packaging, Packing and Marking of Petroleum and Related Products.

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D 217 - Cone Penetration of Lubricating Grease.
- ASTM D 942 - Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method.
- 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 2595 - Evaporation Loss of Lubricating Greases Over Wide Temperature Range.
- ASTM D 2596 - Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method), Measurement of.
- ASTM D 3336 - Performance Characteristics of Lubricating Greases in Ball Bearings at Elevated Temperatures.
- ASTM D 4048 - Detection of Copper Corrosion from Lubricating Grease by the Copper Strip Tarnish Test.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Qualification. The molybdenum disulfide grease furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

3.2 First article. When specified (see 6.2.1), a sample shall be subjected to first article inspection (see 4.4 and 6.4).

3.3 Materials. The composition of the grease is not limited, except that it shall contain a diester liquid lubricant with a suitable gelling agent and molybdenum disulfide conforming to MIL-M-7866, (see 4.7.2).

3.4 Physical properties. The finished grease shall conform to the requirements specified in table I when tested in accordance with 4.7.2.

3.5 Chemical properties.

3.5.1 Molybdenum disulfide content. The grease shall contain not less than 4.5 percent and not more than 5.5 percent molybdenum disulfide when tested in accordance with 4.7.2.

3.6 Toxicity. The grease shall have no adverse effect on the health of personnel when used for its intended purpose. The grease shall contain no components which produce noxious vapors in such concentrations as to be an annoyance to 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 contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency (see 4.3.2).

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 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 assure supplies and services conform to prescribed requirements.

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

- a. Qualification inspection (see 4.3).
- b. First article inspection (see 4.4).
- c. Quality conformance inspection (see 4.5).

4.3 Qualification inspection.

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4.3.1 Qualification inspection sample. The qualification inspection sample shall consist of 10 pounds of grease. The sample shall be forwarded to the Aircraft and Crew Systems Technology Directorate, Code 60612, Naval Air Development Center, Warminster, PA 18974. The sample shall be plainly identified by a securely attached durable tag or label marked with the following information:

Sample for qualification inspection.
Grease, Molybdenum Disulfide, for Low and High Temperatures.
Name of manufacturer.
Product code number.
Batch number.
Date of manufacture.
Submitted by (name) (date) for qualification inspection in accordance with MIL-G-21164D under authorization of (reference authorizing letter) (see 6.3).

4.3.2 Test reports. Two copies of the manufacturer's test report, containing complete test data showing that material submitted for qualification conforms to the requirements of this specification, shall be submitted with qualification sample. Location and identity of the plant which produced the sample tested shall also be supplied. Material safety data sheets on toxicity shall be prepared and submitted to the qualifying laboratory (see 4.3.1) in accordance with FED-STD-313 (see 3.6).

4.3.3 Retention of qualification. In order to retain qualification of a product approved for listing on the Qualified Products List (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.

4.3.4 Qualification inspection tests. Qualification inspection tests shall be as specified in 4.7.2.

4.4 First article inspection. The manufacturer shall submit to the qualifying laboratory (see 4.3.1) a 10 pound sample of grease taken from the first production lot of grease processed under the first contract or order. After the product has passed the qualification inspection (see 6.3), the tests shall be limited to the requirements of 3.4 and 3.5 and the methods of 4.7.2. Delivery of the grease shall not be delayed pending completion of testing on the first article sample by the qualifying laboratory.

4.5 Quality conformance inspection. The quality conformance inspection of the grease samples from 4.5.2 shall consist of the examinations and tests specified in table II.

4.5.1 Lot formation. A lot shall consist of all 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 (see 6.5).

4.5.2 Sampling.

4.5.2.1 For examination of filled containers. A random sample of filled containers, fully prepared for delivery, shall be selected from each lot of grease in accordance with MIL-STD-105, inspection level I and an acceptable quality level (AQL) of 2.5 percent defective.

4.5.2.2 For tests. The sample for tests shall consist of two 5 pound samples of grease taken at random from filled containers from each lot of grease. The lot shall be unacceptable if either sample fails to comply with any of the requirements for the tests specified in 4.7.2.

4.6 Test conditions. Test conditions shall be in accordance with 4.7 and the physical values specified in section 3 apply to the average of determinations made on the sample.

4.7 Methods of examinations and tests.

4.7.1 Examinations. Each of the filled containers, selected in accordance with 4.5.2.1, shall be examined for defects of the container and closure, for evidence of leakage and for unsatisfactory markings to determine conformance with 5.1. Each sample container shall also be weighed to determine the amount of contents. If the number of defective containers exceeds the acceptance number of the sampling plan specified in 4.5.2.1, the lot shall be rejected.

4.7.2 Tests. Tests shall be performed in accordance with table III to determine conformance with the requirements specified in 3.4 and 3.5.

5. PACKAGING

5.1 Packaging, packing and marking. The grease shall be packaged, packed and marked in accordance with MIL-STD-290. The type and size of the containers and the level of packaging and packing shall be as specified by the acquiring activity (see 6.2.1).

6. NOTES

6.1 Intended use. The grease covered by this specification is intended for use as a lubricant for accessory splines, heavily loaded sliding surfaces or for anti-friction bearings carrying high loads and operating through wide temperature ranges where molybdenum disulfide will prevent or delay seizure in the event of inadequate lubrication. This grease should not be used for wheel bearings or for other than steel surfaces without prior performance evaluation.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. Quantity desired.
- c. Whether first article inspection is required (see 3.2 and 4.4).

- d. Size and type of container for grease (see 5.1).
- e. Applicable levels of packaging and packing and other options (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in Qualified Products List (QPL-21164) 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is Commander, Naval Air Systems Command, Attn: AIR-5304, Washington, DC 20361; however, information pertaining to qualification of products and letter of authorization for submittal of sample may be obtained from the Aircraft and Crew Systems Technology Directorate, Code 60612, Naval Air Development Center, Warminster, PA 18974.

6.4 First article. When a first article inspection is required, the item will be tested and should be a sample selected from the first production lot. The first article should consist of a 10 pound sample of grease. The contracting officer should include specific instructions for examinations, tests and approval of the first article.

6.5 Batch. A batch is defined as that 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.

6.6 International standardization agreements. Certain provisions of this specification (see 1.1) are the subject of international standardization agreement, ASCC Air Standard 15/1, NATO STANAG NAT-STD-1135. When amendment, revision, or cancellation of this specification is proposed, which 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. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army - ME
Navy - AS
Air Force - 11

Preparing activity.

Navy - AS

(Project No 9150-0602)

Review activities:

Army - AR, MI
Air Force - 85

International Interests

NATO (see 6.6)

TABLE I. Physical properties.

Characteristics	Requirements
Penetration:	
Unworked, minimum	200
Worked	260 - 310
Dropping point, °C (°F), minimum	165 (329)
Bomb oxidation:	
Pressure drop, KPa (psi), maximum.	
in 100 hours	68.9 (10)
in 500 hours	103.4 (15)
Copper, corrosion:	
ASTM classification, maximum	1b <u>1/</u>
Water resistance, percent grease loss at 40° ± 0.5°C (104° ± 1°F), maximum	20
Evaporation, percent weight loss in 22 hours at 100° ± 1°C (212° ± 2°F), maximum	2.0
Oil separation, percent weight loss in 30 hours, maximum	5
Low temperature torque, at -73°C (-100°F) Nm, maximum:	
Starting	0.98
Running after 1 hour	0.098
Extreme pressure properties load heat index, minimum	50
High temperature performance, hours at 121°C (250°F), minimum	1,000
Penetration after mechanical working 100,000 double strokes	260 - 375
Rust preventative properties	<u>2/</u>
Storage ability after 6 months at 40° ± 2°C (104° ± 4°F):	
Unworked penetration, minimum	200
Worked penetration, change in points from original, maximum	30

TABLE I. Physical properties. - Continued

- 1/ Should the strip appear to have a darker orange color than the ASTM standard strip 1b, consider the observed strip as still in ASTM classification 1b. If any evidence of red color is noticed, the observed strip belongs in ASTM classification 2.
- 2/ No pitting, etching, discoloration or corrosion in excess of three small spots.

TABLE II. Quality conformance tests.

Inspection	Paragraph	
	Requirement	Test method
Penetration	3.4	4.7.2
Dropping point	3.4	4.7.2
Copper corrosion	3.4	4.7.2
Evaporation	3.4	4.7.2
Oil separation	3.4	4.7.2
Low temperature torque	3.4	4.7.2
Extreme pressure properties	3.4	4.7.2
Penetration after mechanical working	3.4	4.7.2
Examination of filled containers	5.1	4.7.1

TABLE III. Methods of tests.

Tests	Method	
	FED-STD-791	ASTM
Dropping point	-	D 2265
Penetration	-	D 217
Bomb oxidation	-	D 942
Copper corrosion	-	D 4048
Water resistance	-	D 1264
Evaporation	-	D 2595
Oil separation	321	-
Low temperature torque <u>1/</u>	-	D 1478
Extreme pressure properties	-	D 2596
High temperature performance	-	D 3336
Penetration after mechanical working	313	-
Rust preventive properties	-	D 1743
Molybdenum disulfide content <u>2/</u>	3720	-
Storage stability <u>3/</u>	3467	-

1/ Test shall be conducted at -73°C (-100°F). Observations for skidding or ball sliding shall be made during test run.

2/ For non-soap greases use method 3722 of FED-STD-791 or instrumental analytical test methods such as X-ray fluorescence techniques.

3/ Temperature of $40^{\circ} \pm 2^{\circ}\text{C}$ ($104^{\circ} \pm 4^{\circ}\text{F}$) to be maintained for 6 months.

INSTRUCTIONS. In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

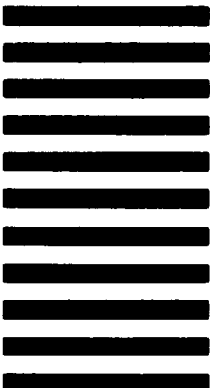
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