

NOT MEASUREMENT
SENSITIVE

MIL-PRF-10924H
w/Amendment 2
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SUPERSEDING
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w/Amendment 1
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PERFORMANCE SPECIFICATION

GREASE, AUTOMOTIVE AND ARTILLERY

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 a multi-purpose grease for lubrication of ground vehicles and equipment (see 6.1) and is identified by Military Symbol GAA and NATO Code Number G-403.

Comments, suggestions, or questions on this document should be addressed to the Commander, U.S. Army Tank-Automotive and Armaments Command, ATTN: RDTA-EN/STND/TRANS, MS-268, Warren, MI 48397-5000, or emailed to usarmy.detroit.rdecom.mail.tardec-standardization@mail.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

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

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.

U.S. DEPARTMENT OF LABOR (DOL)

OSHA 29 CFR 1910.1200 - Hazard Communication; Interpretation Regarding Lubricating Oils.

(Copies of the Code of Federal Regulations (CFR) are available from the Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402, or at www.dol.gov).

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.

ASTM INTERNATIONAL

- D217 - Standard Test Methods for Cone Penetration of Lubricating Grease.
- D1092 - Standard Test Method for Apparent Viscosity of Lubricating Greases
- D1831 - Standard Test Method for Roll Stability of Lubricating Grease
- D2265 - Standard Test Method for Dropping Point of Lubricating Grease Over Wide Temperature Range.
- D2266 - Standard Test Method for Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method).
- D2596 - Standard Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method).
- D3527 - Standard Test Method for Life Performance of Automotive Wheel Bearing Grease.
- D4048 - Standard Test Method for Detection of Copper Corrosion from Lubricating Grease.
- D4057 - Standard Practice for Manual Sampling of Petroleum and Petroleum Products.
- D4289 - Standard Test Method for Elastomer Compatibility of Lubricating Greases and Fluids.
- D5483 - Standard Test Method for Oxidation Induction Time of Lubricating Greases by Pressure Differential Scanning Calorimetry.
- D5864 - Standard Test Method for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components.
- D5969 - Standard Test Method for Corrosion-Preventive Properties of Lubricating Greases in Presence of Dilute Synthetic Sea Water Environments

MIL-PRF-10924H
w/Amendment 2

- D6184 - Standard Test Method for Oil Separation from Lubricating Grease (Conical Sieve Method).
- D6731 - Standard Test Method for Determining the Aerobic, Aquatic Biodegradability of Lubricants or Lubricant Components in a Closed Respirometer.
- D7373 - Standard Test Method for Predicting Biodegradability of Lubricants using a Bio-kinetic Model.
- D7342 - Standard Test Method for Shear Stability of Lubricating Grease in Presence of Water (Water Stability Test).
- E145 - Standard Specification for Gravity-Convection and Forced-Ventilation Ovens.
- E1131 - Standard Test Method for Compositional Analysis by Thermogravimetry.

(Application for copies may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, or at 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. Greases furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.1.1 and 6.4).

3.2 Materials. Grease should be made with biodegradable material and a lithium complex thickening system capable of meeting the requirements herein. If a candidate grease has a different thickening system, it must be compatible with lithium complex thickened grease.

3.2.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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.

3.3 Operating requirements. The grease shall meet all the operating requirements as specified in 3.3.1.

3.3.1 Finished grease properties. The values, after the application of tolerances (see 4.1.1.1), shall not exceed the maximum (max.) or fall below the minimum (min.) limits as specified in Table I.

MIL-PRF-10924H
w/Amendment 2

TABLE I. Finished grease properties.

Characteristics	Limits
Dropping point, °C, minimum <u>1/</u>	220
Worked penetration (1/10 mm)	265-295
Oxidation stability (PDSC) at 210 °C, minimum, min	15
Corrosiveness (copper strip), maximum <u>2/</u>	1 b
Water stability, after 10 0000 Double strokes, +10.0% water, Penetration (1/10 mm)	-25 to +60
Life performance (four test runs) at 160°C, hours, minimum	100
Evaporation loss (TGA) at 180°C, 1 hr - Percent, maximum	10.0
Oil separation @ 100 °C, %, max	8.0
Wear preventive characteristics - Avg. scar dia. mm, maximum	0.60
Load carrying capacity – Load wear index, kgf, minimum Welding point, kg, min	35.0 250
Low temperature torque, N·m, maximum at -54°C Breakaway Running (at 5 min)	7.00 5.00
Worked stability, after 10 0000 Double strokes, penetration (1/10 mm)	-25 to +60
Elastomer compatibility CR: Volume change, % Hardness change, Durometer-A points NBR-L: Volume change, % Hardness change, Durometer-A points	0 to +40 0 to -15 -5 to +30 +2 to -15
Salt water corrosion resistance	Pass
Roll stability, penetration (1/10 mm)	-25 to +60
Biodegradability, minimum, %	60

1/ °C = degrees Celsius

2/ The grease shall show no green color in that portion contacting the copper strip. The copper strip shall not tarnish more than a classification of 1 b when compared with the ASTM copper strip corrosion standards (ASTM D4048).

3.4 Support and ownership requirements. The grease shall meet all support and ownership requirements as specified in 3.4.1 through 3.4.5.

3.4.1 Hazardous materials. The grease shall not contain carcinogenic or potentially

carcinogenic constituents as defined under the Hazard Communication Standard 29 CFR 1910.1200.

3.4.2 Storage stability. The grease shall be capable of prolonged storage without degradation in performance and any sign of biodegradation.

3.4.3 Color. The grease color shall be the discretion of the manufacturer as long as the grease contains no dye which could cause discoloration to adjacent surfaces, personnel or clothing.

3.4.4 Compatibility. The grease shall be compatible with all qualified greases when tested in accordance with 4.3.8.

3.4.5 Odor. The grease shall have no odor, which by its rancid, alcohol, or perfume nature, will impede its application or use by personnel.

3.4.6 Homogeneity. The grease shall be homogeneous, smooth in texture, and free of entrapped air which could cause variation in its performance.

4. VERIFICATION

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

- a. Qualification inspection (see 4.1.1).
- b. Conformance inspection (see 4.1.2).

4.1.1 Qualification inspection. Qualification inspection shall consist of all the verifications listed in Table II and shall be in accordance with acceptable tolerances (see 4.1.1.1).

4.1.1.1 Tolerances. Acceptable tolerances for values or limits in 3.3.1 shall be as specified by the qualifying activity (see 6.2).

TABLE II. Verification methods

Title	Requirements	Verification
Operating requirements	3.3	4.3.3
Finished grease properties	3.3.1	4.3.3.1
Compatibility	3.4.4	4.3.8
Support and ownership	3.4	4.3.9
Hazardous materials	3.4.1	4.3.9.1
Storage stability	3.4.2	4.3.9.2
Color	3.4.3	4.3.9.3
Odor	3.4.5	4.3.9.4
Homogeneity	3.4.6	4.3.9.5

4.1.2 Conformance inspection. Unless otherwise specified (see 6.2 and 6.4), the results obtained shall fall within the tolerances/specific values determined at the time of qualification (see 4.1.1.1). The grease shall be tested for all the requirements specified in Table II, except for elastomer compatibility, life performance, low temperature torque, roll stability from Table I and storage stability.

4.2 Sampling for tests. The sample for tests shall consist of two 2.27 kilogram (kg) samples of grease taken at random from filled containers from each lot of grease (see 6.3). For users who obtain grease in large containers, two 2.27 kg samples shall be taken in accordance with ASTM D4057. The lot shall be unacceptable if either sample fails to comply with any of the tests specified.

4.3 Verification methods. The types of verification methods included in this section are visual inspection, measurement, sample tests, full-scale demonstration tests, simulation, modeling, engineering evaluation, component properties analysis, and similarity to previously approved or previous qualified designs.

4.3.1 Verification alternatives. The manufacturer may propose alternative test methods, techniques, or equipment, including the application of statistical process control, tool control, or cost effective sampling procedures, to verify performance. See the contract for alternatives that replace verification required by this specification.

4.3.2 Inspection conditions. Unless otherwise specified herein, tests shall be conducted on unworked grease, in any sequence.

4.3.3 Operating requirements verification. Complete each test under 4.3.3.

4.3.3.1 Finished grease property verifications. Use the test methods as specified in Table III to determine that finished grease properties are as specified within tolerances (see 4.1.1.1).

TABLE III. Finished grease property test methods.

Test	ASTM or FED-STD-791 Method
Dropping point	D2265
Oxidation stability (PDSC) at 210°C	D5483
Worked penetration	D217
Corrosiveness (copper strip)	D4048
Water stability	D7342 Procedure A
Life performance	D3527
Evaporation (TGA)	E1131
Wear preventative characteristic	D2266
Load carrying capacity	D2596
Oil separation	D6184
Low temperature torque	FED-STD-791 1/
Worked stability	D217 2/
Salt water corrosion resistance	D5969 3/

TABLE III. Finished grease property test methods – Continued.

Test	ASTM or FED-STD-791 Method
Elastomer compatibility	D4289
Roll stability	D1831
Biodegradation	D5864, D 6731 or D7373 4/

- 1/ Low temperature torque shall be performed in accordance with 4.3.4
- 2/ Worked stability shall be performed in accordance with 4.3.5.
- 3/ Salt water corrosion resistance test shall be performed in accordance with 4.3.6.
- 4/ Biodegradation test shall be performed in accordance with 4.3.7.

4.3.4 Low temperature torque. The test shall be conducted at $-54 \pm 0.5^\circ\text{C}$ according to the FED-STD-791. The breakaway (maximum) torque shall be determined at the beginning of the operation and the running torque shall be determined after five minutes of operation. Both determinations should be calculated by the averaging of four test runs. If the test apparatus is not available, the ASTM D1092 test method shall be used to determine the breakaway torque at -54°C as follows: The apparent viscosity shall be determined at shear rate, 25 reciprocal seconds. This value is then converted to the breakaway torque Newton-meters (N·m) using the following correlation equation (1). If this alternate method is used, only breakaway torque values can be reported. However, in case of referee disputes, only the results from the low temperature torque test method shall be accepted. Failure of the grease to meet the requirements of Table I shall constitute failure of this test.

$$\text{Breakaway torque (N·m)} = 2.36 \times (\text{apparent viscosity at } 25 \text{ sec}^{-1} \times 10^{-4}) + 1.48 \quad (1)$$

[Standard error: 0.373]

4.3.5 Worked stability test. The test shall be performed using the standard procedure of ASTM D217 with the following modifications. A change in worked penetration of the grease of more than 60 units higher or 25 units lower than the original worked penetration shall constitute failure of this test.

- a. Work a sample of the test grease on a motorized grease worker for 100,000 double strokes (approximately 28 hours) in accordance with the procedure described in ASTM D217 for prolonged worked penetration.
- b. Immediately after the grease has been subjected to 100,000 double strokes, bring the grease worker and the sample to $25 \pm 0.5^\circ\text{C}$ in accordance with the procedure described in ASTM D217 for prolonged worked penetration.
- c. Immediately after the test grease sample reaches $25 \pm 0.5^\circ\text{C}$, determine the prolonged worked penetration of the grease.

4.3.6 Salt water corrosion test. This test shall be performed using the standard procedure of ASTM D5969 with NaCl solution (1 percent NaCl by weight in distilled water). Failure of the grease to meet the requirements as defined in ASTM D5969 under rating shall constitute failure of this test.

4.3.7 Biodegradability. Determine the percent of theoretical CO₂ evolved (P) of the grease IAW ASTM D 5864 or O₂ consumption (D) according to ASTM D 6731 or the percentage of biodegradability can be determined according to ASTM D7373. A value of biodegradability less than 60 % in 28 days shall constitute failure of this test.

4.3.8 Compatibility. Two grease samples shall be mixed using an electric mixer in 10 %, 50 %, and 90 % ratios. These mixture samples must be stored at room temperature for seven days. Then, the mixture samples shall be tested according to Table III except for biodegradation test. Failure of each mixture sample to meet the requirements of Table I shall constitute failure of this test.

4.3.9 Support and ownership requirements. Complete each test under 4.3.9.

4.3.9.1 Hazardous materials and compatibility tests. Use one or more of the methods outlined in 3.4.1 through 3.4.5 to verify the absence of hazardous materials or hazards to personnel.

4.3.9.2 Storage stability test. The test shall be performed on a 6.8 kg unopened can of grease that has been dated and labeled "Storage Stability Test. The undisturbed can or pail of the test grease shall be placed in a thermostatically controlled, dark, convection oven, meeting the requirements of ASTM E145, located in an area essentially free from vibration, at $38 \pm 3^{\circ}\text{C}$ for 180 ± 5 days. The can shall be positioned in center of the oven and raised at least 75 mm from the bottom, to ensure temperature uniformity. At the end of the storage interval, the can of test grease shall be subjected to the tests of Table III except for biodegradation, life performance, water stability, and low temperature torque. Failure of the grease to meet the requirements of Table I, within tolerances, shall constitute failure of this test (see 4.1.1.1).

4.3.9.3 Color tests. Use one or more of the methods outlined in 3.4.1 through 3.4.5 to verify the absence of any dye which could cause discoloration to adjacent surfaces, personnel or clothing.

4.3.9.4 Odor tests. Use one or more of the methods outlined in 3.4.1 through 3.4.5 to verify the absence of rancid, alcohol, or perfume odor, which could impede application or use of the grease.

4.3.9.5 Homogeneity tests. Use one or more of the methods outlined in 3.4.1 through 3.4.5 to verify the absence of entrapped air and the homogeneous and smooth texture of the grease.

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 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 services 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 grease covered by this specification is intended for the lubrication and surface corrosion protection of all ground vehicles and equipment operated over the temperature range from -54 to +180°C. This grease may also be used in other applications within this temperature range where a National Lubricating Grease Institute (NLGI) No. 2 consistency grease with oxidation resistant and corrosion prevention properties is desirable. This grease is not intended for use on machinery which comes in contact with food. This specification requires a grease that is capable of lubrication and corrosion protection over an extremely wide range of temperatures; there is no currently available non-government standard which fulfills the requirements of this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this specification.
- b. The specific issue of individual documents referenced (see 2.3).
- c. Quantity of grease requested, in kilograms.
- d. Size and type of container for grease.
- e. Tolerances for finished oil requirements (see Table I and 4.1.1.1).
- f. If conformance testing is other than as specified (see 4.1.2).
- g. Packaging requirements, quantity and PIN (see 5.1 and 1.2).

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 No. 10924 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. Information pertaining to qualification of products may be obtained from US Army Tank-automotive and Armaments Command, Warren, Michigan 48397-5000.

6.4 Conformance testing. Affordable conformance inspection with confidence varies depending upon a number of procurement risk factors. Some of these factors include: Contractor past performance, government schedules and budget, product material and design maturity, manufacturing capital equipment and processes applied, the controlled uniformity of those processes, labor skill and training, and the uniformity of measuring processes and techniques. During the solicitation, contracting documents should indicate those tests desired from Table II and their designated frequency based on a risk assessment for the procurement.

6.5 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313; and 29 CFR 1910.1200 requires that the Material Safety Data Sheet for each hazardous chemical used in an operation must be readily available to personnel using the material. Contracting officers will identify the activities requiring copies of the Material Safety Data Sheet.

6.6 National stock numbers. The following National Stock numbers have been assigned to the grease covered by this specification:

<u>Grease</u>	<u>National Stock No.</u>
Tube, 2-1/4 oz. (64 g)	9150-01-197-7688
Cartridge, 14 oz. (400 g)	9150-01-197-7693
Can, 1.75 lb (800 g)	9150-01-197-7690
Can, 6.50 lb (3 kg)	9150-01-197-7689
Pail, 35 lb (16 kg)	9150-01-197-7692
Drum, 120 lb (54 kg)	9150-01-197-7691

6.7 Subject term (key word) listing.

Corrosion, surface protection
Lubricating grease, ground vehicles
(NLGI), No. 2 consistency
Biodegradability

6.8 International Standardization Agreement. This specification implements STANAGs 1135 and 2845. 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>.

6.9 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

MIL-PRF-10924H
w/Amendment 2

Custodians:

Army - AT
Navy - YD
Air Force – 68

Preparing Activity:
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Review Activities:

Army - AR, EA, MI, SM
Navy - AS, SA
DLA - GS, PS

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