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MILITARY SPECIFICATION

LUBRICANT, COLLOIDAL GRAPHITE IN OIL

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.

1. SCOPE

1.1 Scope.—This specification covers colloidal graphite in oil lubricant for lubrication purposes. (See 6.1.)

1.2 Classification.—The lubricant covered by this specification shall be of the following grades, as specified (see 6.2):

Grade A—Light.
Grade B—Medium.
Grade C—Heavy.

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications and standard, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

FEDERAL

NN-B-621 —Boxes, Wood, Nailed and Lock-Corner.
NN-B-631 —Boxes; Wood, Wirebound, for Domestic Shipment.
VV-L-791 —Lubricants, Liquid Fuels, and Related Products; Methods of Sampling and Testing.
LLL-B-631—Boxes; Fiber, Corrugated (for Domestic Shipment).
LLL-B-636—Boxes; Fiber, Solid (for Domestic Shipment).

MILITARY

JAN-P-106—Packaging and Packing for Overseas Shipment — Boxes, Wood, Nailed.
JAN-B-107—Boxes, Wood, Wirebound (Overseas Type).
JAN-P-124—Packaging and Packing for Overseas Shipment—Containers (Cans, Pails and Drums), Metal (For Other Than Subsistence Items).

NAVY DEPARTMENT

General Specifications for Inspection of Material.

STANDARDS

MILITARY

MIL-STD-129—Marking of Shipments.

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Materials.—The lubricants shall consist of stabilized colloidal electric furnace graphite dispersed in refined mineral lubricating oils. Solids other than stabilized colloidal graphite shall not be used.

3.2 Physical and chemical requirements.—The colloidal graphite in oil lubricants shall conform to the physical and chemical requirements shown in table I.

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TABLE I.—*Physical and chemical requirements.*

	Grade		
	A	B	C
Viscosity (Saybolt universal) seconds at 100°F.	90–110	---	---
Viscosity (Saybolt universal) seconds at 210°F.	---	110–135	275 (min.)
Flash point, °F., (min.)	300	325	325
Pour point, °F., (max.)	–50	15	15
Solids content, weight percent	2.00 ± 0.05	10.00 ± 0.25	10.00 ± 0.25
Ash, weight percent, (max.)	0.25	0.25	0.25
Hiding power of lubricant containing 2 weight percent solids, sq. ft. per gallon, (min.)	1,200	1,200	900

3.3 Stability.

3.3.1 *Grades A and B.*—When grades A and B lubricants are tested as specified in 4.4.6, not less than 95 weight percent of the solids shall be in suspension after centrifuging.

3.3.2 *Grade C.*—When grade C lubricant is tested as specified in 4.4.6, not less than 85 weight percent of the solids shall be in suspension after centrifuging.

3.4 Particle size, grades A and B.—When subjected to microscopic examination as specified in 4.4.8, the largest fraction of the graphite particles shall be smaller than 1 micron (in largest dimension). The remainder shall be smaller than 4 microns.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Inspection procedures.—For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material. For Air Force purchases, inspection in accordance with method 960.1 of Specification VV–L–791 shall be required.

4.2 Sampling.

4.2.1 *Size of lot.*—For purposes of sampling, a lot shall consist of not more than 500 containers of lubricant manufactured as one batch and offered for delivery at one time.

4.2.2 *Sampling procedure.*—Unless otherwise specified by the procuring activity, the Government inspector shall take a representative sample of not less than 1 quart of lubricant from each lot in accordance with method 800.1 of Specification VV–L–791.

4.3 Inspection tests. — Unless otherwise specified by the procuring activity, inspection tests for acceptance of individual lots shall be conducted under supervision of the Government inspector at the place of manufacture to ascertain that the lubricant complies with this specification.

4.4 Tests.

4.4.1 *Viscosity.*—The viscosity shall be determined in accordance with method 30.4 or 30.5 of Specification VV–L–791. The results in all cases shall be reported as Saybolt universal seconds.

4.4.2 *Flash point.*—The flash point shall be determined in accordance with method 110.3 of Specification VV–L–791.

4.4.3 *Pour point.*—The pour point shall be determined in accordance with method 20.1 of Specification VV–L–791.

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4.4.4 *Solids content.* — The solids content shall be determined by flocculating the solids in a weighed sample with ethyl acetate filtering through a tared Gooch crucible, washing and weighing.

4.4.4.1 *Preparation of Gooch crucible.* — Acid washed asbestos is suspended in water by the usual method of vigorous shaking or mechanical stirring. The asbestos pad in the crucible is built up to a thickness of approximately ¼ to ⅜ inch by pouring into the crucible two or three portions of the asbestos water suspension, without tamping or packing the pad. The crucible is dried at 110° C. for 3 hours, cooled in a desiccator for ½ hour, and weighed.

4.4.4.2 *Test procedure.*—Accurately weigh a sample of approximately 0.5 gm. of the lubricant into a 50 ml. beaker. To flocculate the graphite, dilute the sample with 10 ml. of chloroform and stir with a glass rod until uniform, then add approximately 20 ml. of ethyl acetate and again stir. Within 15 minutes, pour the sample through a tared Gooch crucible under slight vacuum, and carefully wash the graphite from the beaker into the crucible with ethyl acetate, using a rubber policeman to facilitate the operation. Wash the crucible with an additional 50 ml. of ethyl acetate. To guard against peptization, place crucible in drying oven at 110° C. for ½ hour. After drying cool the crucible for a few minutes and wash with 100 ml. of technical grade ethyl ether. Again dry crucible at 110° C. for ½ hour and cool. Next, pour approximately 10 ml. of ethyl acetate into crucible, applying little or no vacuum. As the ethyl acetate begins to drop from the bottom of the crucible, gradually add chloroform and continue to wash with this solvent. Care must be taken at this point not to wash graphite through crucible. Continue to wash with chloroform until approximately 50 ml. has been used. Then dry the crucible as before. After cooling, repeat the washing with chloroform, following the above precautions. Again dry for ½ hour, cool for ½ hour in desiccator, and weigh. Repeat the chloroform washing treatment, weighing after each treatment, until the weight of the crucible does not decrease. The weight of solids contained in the original weight of sample is the increase in weight of the crucible. Calculate the percent solids content of the lubricant as follows:

$$\text{Percent solids} = \frac{\text{weight solids}}{\text{weight sample}} \times 100$$

4.4.5 *Ash.*—The ash shall be determined by burning a known amount of the lubricant, igniting the residue and weighing the ash.

4.4.5.1 *Test procedure.* — Weigh 10.00 ± 0.01 gm. of the lubricant into a tared porcelain crucible (size 1A). Support the crucible in a nichrome triangle and warm with a grid type burner. Heat the sides of the crucible above the level of the liquid to prevent creeping of the oil. Then slowly warm the sides of the crucible until the oil ignites and boils gently. Direct the flame across the top and against the side of the crucible, keeping the oil burning gently until the flame dies away. This operation should take at least 10 minutes, and should be carried out in a fume hood. After burning the oil, ignite the crucible with the full heat of the burner until the carbon deposit and the graphite are completely oxidized. Then cool the crucible in a desiccator and weigh. The increase in weight of the crucible is the ash of the lubricant, and this weight, multiplied by the factor 10, gives the percent of ash.

4.4.6 *Stability.*

4.4.6.1 *Grade A.* — The stability test of grade A lubricant shall be determined on a representative sample of the product which has been thoroughly stirred to ensure uniformity. From this sample, remove and analyze two portions in accordance with 4.4.4. From the remainder of the sample, take the portions specified and centrifuge as specified in 4.4.6.3 and 4.4.6.4.

4.4.6.2 *Grades B and C.*—The stability test of grades B and C lubricants shall be con-

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ducted on a blend of one part of the lubricant with 49 parts of the neutral refined mineral oil specified in 4.4.7. Heat a 98-gram portion of the neutral refined mineral oil to 150 ± 10° F. and blend thoroughly with the two grams of the lubricant. Determine the solids content of this blend by the technique specified in 4.4.4. Two samples of the blend weighing approximately 15 gm. each should be analyzed. The result of this analysis gives the initial solids content of the material to be centrifuged. The blended samples shall be centrifuged as specified in 4.4.6.3 and 4.4.6.4.

4.4.6.3 *Centrifuge.*—The centrifuging shall be conducted in a machine which allows the tubes to swing in a horizontal position at a speed of 2,000 ± 50 r.p.m. with a diameter of swing (tip to tip of whirling tubes) of 14 to 17 inches. The centrifuge head shall carry centrifuge tubes of 15 ml. capacity with tapered bottoms. Centrifuging shall be conducted for a period of 11 minutes. If the available centrifuge does not meet the limits specified, the proper speed shall be calculated in accordance with method 300.3 of Specification VV–L–791.

4.4.6.4 *Test procedure.* — Two centrifuge tubes shall be filled with the samples prepared as specified in 4.4.6.1 and 4.4.6.2 to a depth of 4 inches and adjusted to 70° F. The tubes are then centrifuged under the conditions specified in 4.4.6.3. After this treatment, decant the supernatant liquid from the tubes into tared beakers, pouring out only that which flows quickly, the whole operation not to require more than 30 seconds. Weigh the decanted material and analyze in accordance with 4.4.4. Calculate the percent solids in suspension after centrifuging as follows:

Grade A:

$$\text{Percent solids in suspension after centrifuging} = \frac{\text{percent solids after centrifuging}}{\text{percent solids before centrifuging}} \times 100$$

Grades B and C:

$$\text{Percent solids in suspension after centrifuging} = \frac{\text{percent solids after centrifuging}}{\text{percent solids in blend before centrifuging}} \times 100$$

4.4.7 *Hiding power.* — The hiding power shall be determined using the Pfund Cryptometer, following the directions of the manufacturer of the instrument. The plate with a wedge constant of 0.0002 shall preferably be used. Since grades B and C are too opaque for examination, they are blended with a neutral refined petroleum oil of the following characteristics:

Gravity, °API, at 60° F.	24-26
Flash point	415° F. (min.)
Fire	475° F. (min.)
Viscosity, S.U.S. at 100° F.	300-310
Viscosity, S.U.S. at 210° F.	50-52

4.4.7.1 *Test procedure.*—A 2.00 ± 0.01 gm. portion of the grade B or C lubricant is diluted to 10.00 ± 0.01 gm. with the oil specified in 4.4.7 and the mixture thoroughly blended at a temperature of approximately 150° F. This blend, containing 2.0 percent solids, shall be examined in the Pfund Cryptometer.

4.4.8 *Particle size.*—The particle size shall be determined on grade A lubricant as received; and on grade B, by blending one part of grade B lubricant with 49 parts of the oil specified in 4.4.7. The samples shall be thoroughly stirred to insure uniformity.

4.4.8.1 *Test procedure.*—A drop of the sample prepared as specified in 4.4.8, is placed on a glass microscopic slide using the utmost care to avoid contamination of the product, slides, or cover glass, with foreign material picked up in normal surroundings. The par-

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ticle size is determined by taking a photomicrograph of the particles followed by measurement on the print, or by direct measurement on the ground glass screen of a metallographic microscope. A magnification of at least 600 diameters shall be used.

5. PREPARATION OF DELIVERY

5.1 Packaging.—Unless otherwise specified by the procuring activity, the colloidal graphite lubricant shall be packaged in 1-quart, 1-gallon, or 5-gallon square cans, or 5-gallon closed-top steel drums, conforming to Specification JAN–P–124 (see 6.2).

5.2 Packing.

5.2.1 *For domestic shipment.* — Twenty-four 1-quart, six 1-gallon, or two 5-gallon cans shall be packed in a nailed wood or wirebound box conforming to Specification NN–B–621 or NN–B–631, respectively; or twenty-four 1-quart or six 1-gallon cans, but not 5-gallon cans, shall be packed in a corrugated or solid fiberboard box conforming to Specification LLL–B–631 or LLL–B–636, respectively. Arrangement within the container shall be in accordance with table IIa, appendix I, of Specification JAN–P–124.

5.2.1.1 *Drums.*—Five-gallon drums will require no further packing.

5.2.2 *For overseas shipment.* — Packing shall be in accordance with table IIa, appendix I, of Specification JAN–P–124, except that only nailed wood or wirebound boxes, conforming to Specification JAN–P–106 or JAN–B–107, respectively, shall be used.

5.2.2.1 *Drums.*—Five-gallon drums will require no further packing.

5.3 Marking.

5.3.1 *Individual containers.* — Each container of colloidal graphite lubricant shall be properly marked with the name of the material, specification number, grade, name of manufacturer, date of manufacture, batch number, and net contents.

5.3.2 *Shipping containers.*—In addition to any special marking required by the contract or order, shipments shall be marked in accordance with Standard MIL–STD–129.

6. NOTES

6.1 Intended use.

6.1.1 *Grade A.*—Grade A lubricant is suitable for the lubrication of machine gun housing guides, windshield wipers, and other lightly loaded sliding members exposed to the weather for both cold and elevated temperatures.

6.1.2 *Grade B.*—Grade B lubricant is suitable for the lubrication of gear trains of hot running torpedoes.

6.1.3 *Grade C.*—Grade C lubricant is suitable for the lubrication of medium or heavy duty gun slides without causing excessive resistance to counterrecoil at ambient temperatures down to –10° F. It should retain sufficient lubricating properties to permit free recoil and counterrecoil when the gun is heated as a result of sustained fire.

6.2 Ordering data. — Requests, requisitions, schedules and contracts or orders should specify the following:

(a) Title, number, and date of this specification.

(b) Grade of lubricant required (see 1.1).

(c) Type and size of container in which the lubricant is to be furnished (see 5.1).

(d) Whether domestic or overseas packing and marking are required (see 5.2 and 5.3).

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