

TT-L-201A
 January 31, 1978
 SUPERSEDING
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 May 22, 1958

FEDERAL SPECIFICATION
 LINSEED OIL, HEAT POLYMERIZED

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers heat polymerized (bodied, not blown) linseed oil for use in paints, varnishes, and enamels, and as sealers for steam turbine casing joints.

1.2 Classification. The linseed oil shall be of the following types as specified (see 3.2 and 6.2):

Type I - High acid.
 Type II - Low acid.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications:

TT-R-266 - Resin, Alkyd; Solutions.
 TT-T-291 - Thinner-Paint, Volatile Spirits Petroleum Spirits.

Federal Standard:

Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer, and Related Materials;
 Methods of Inspection, Sampling, and Testing.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Philadelphia, Washington, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Houston, Denver, San Francisco, Los Angeles, and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

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Military Standard:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

Code of Federal Regulations:

49 CFR 178 - Department of Transportation (DOT) Shipping Container Specifications.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, DC 20402. Orders should cite the latest edition and supplements thereto.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

- D 13 - Spirits of Turpentine.
- D 79 - Zinc Oxide.
- D 562 - Consistency of Paints Using the Stormer Viscosimeter.
- D 600 - Liquid Paint Driers.
- D 1210 - Fineness of Dispersion of Pigment-Vehicle Systems.
- D 1397 - Unsoaponifiable Matter in Alkyd Resins and Resin Solutions.
- D 1544 - Color of Transparent Liquids (Gardner Color Scale).
- D 1545 - Viscosity of Transparent Liquids by Bubble Time Method.
- D 1639 - Acid Value of Organic Coating Materials.
- D 1950 - Acetone Tolerance of Heat-Bodied Drying Oils.
- D 1951 - Ash in Drying Oils and Fatty Acids.
- D 1959 - Iodine Value of Drying Oils and Fatty Acids.
- D 1960 - Loss on Heating of Drying Oils.
- D 1962 - Saponification Value of Drying Oils, Fatty Acids, and Polymerized Fatty Acids.
- D 1963 - Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C.

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

National Motor Freight Traffic Association, Inc., Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the American Trucking Associations, Inc., Traffic Department, 1616 P Street, N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

3. REQUIREMENTS

3.1 Material. The linseed oil shall be free from other drying oils, water, nondrying oils, volatile oils, metallic driers, and dirt or other impurities.

3.2 Viscosities. The oil shall be furnished in the viscosities shown in table I as specified (see 6.2). The kinematic viscosities in stokes at 25 °C (77 °F) correspond to the following Gardner-Holdt designations:

TABLE I. Viscosities.

Viscosity 1/	Stokes
Q	4.35
R	4.70
S	5.00
T	5.50
U	6.27
V	8.84
W	10.70
X	12.9
Y	17.6
Z	22.7
Z-1	27.0
Z-2	36.2
Z-3	46.3
Z-4	63.4
Z-5	98.5
Z-6	148
Z-7 2/	388
Z-8 2/	590
Z-9 2/	855

1/ A tolerance of plus or minus 1/4 bubble length of the applicable tube on the Gardner-Holdt scale shall be allowed for Q through Y viscosity oils, and plus or minus 1/2 bubble length for Z through Z-9 viscosity oils.

2/ Applicable to type II only.

3.3 Quantitative requirements. When tested as specified in table IV, the oil shall meet the quantitative requirements specified in table II.

3.4 Qualitative requirements.

3.4.1 Appearance. When tested as specified in table IV, the oil shall be clear and free from sediment and suspended matter.

3.4.2 Appearance of dried film. When prepared and tested as specified in 4.4.4, the dried film of oil shall be smooth, uniform in appearance, and shall show no frosting, crowsfooting, alligating, wrinkling, or other defects. This requirement is not applicable to the Z-7, Z-8, and Z-9 viscosity oils.

3.4.3 Miscibility with mineral spirits and turpentine. When tested as specified in 4.4.5, the oil shall be completely miscible with both mineral spirits and turpentine.

3.4.4 Compatibility with zinc oxide. When mixed and tested as specified in 4.4.6, the thinned paste of oil and zinc oxide shall have a viscosity not greater than 95 Krebs Units and a fineness of grind not less than 6. This requirement is not applicable to the Z-7, Z-8, and Z-9 viscosity oils.

3.4.5 Compatibility with alkyd resin. When tested as specified in 4.4.7, the oil shall show no cloudiness, separation, or other evidence of incompatibility. This requirement is applicable only to type I oil.

3.4.6 Heat test. When tested as specified in 4.4.8, there shall be no violent bubbling or other indication of decomposition or gelation of the oil. This requirement is applicable only to type II, Q through Z-6 viscosity oils.

3.5 Quantities. The linseed oil shall be furnished in 1-pint, 1-quart, 1-gallon, 5-gallon, and 55-gallon quantities.

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TABLE II. Quantitative requirements.

Characteristics	Type I				Type II			
	Q through Y viscosity		Z through Y viscosity		Z through Y viscosity		Z through Y viscosity	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Viscosity	As specified in 3.2 As specified in 3.2 As specified in 3.2 As specified in 3.2							
Acid value	10	11	120	135	110	130	110	130
Iodine value (Wijle)	125	160	135	196	139	196	189	196
Saponification value	189	196	189	196	60	100	0.960	0.975
Soapstone tolerance	95	210	95	210	0.965	0.965	1.4900	1.4940
Acetone solvability	0.950	0.965	0.950	0.965	1.4850	1.4850	1.4870	1.4940
Specific gravity at 15.56°/15.56°C	1.4840	1.4890	1.4890	1.4890	1.4850	1.4900	1.4850	1.4900
Refractive index at 25°C	-	1.5	-	1.5	-	1.5	-	1.5
Unsaturation (percent by weight)	-	0.2	-	0.2	-	0.2	-	0.2
Loss on heating at 105°C (percent by weight)	9.5	22.2	9.5	22.2	3.2	7.9	3.2	7.9
Absorbitor (mm)	-	0.01	-	0.01	-	0.01	-	0.01
Ash (percent by weight)	-	10	-	10	-	6	-	6
Color (Gardner color number)	-	-	-	-	-	11	-	11
Color after heat test (Gardner color number)	-	-	-	-	-	-	-	-
Drying time: Set to touch (hours)	-	2.0	-	2.0	-	2.0	-	2.0
Dry hard (hours)	-	8.0	-	8.0	-	8.0	-	8.0

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 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.

4.2 Inspection of preparation for delivery. An inspection shall be made to determine whether the packaging, packing, and marking comply with the requirements of section 5. The sample unit shall be one shipping container fully prepared for delivery and selected at random. Sampling shall be in accordance with MIL-STD-105. The lot size shall be the number of shipping containers in the end item inspection lot. The packaging and packing shall be examined for the defects listed in table III. The inspection level shall be S-2 with an AQL of 4.0 defects per hundred units.

TABLE III. Classification of preparation for delivery defects

Examine	Defects
Markings	Omitted; incorrect; illegible; improper size, location, sequence, or method of application.
Material	Any component missing or damaged or wrong type.
Workmanship	Inadequate application of components such as incomplete closure of container flaps, loose strapping, inadequate stapling, or distortion of container.

4.3 Testing of the end item. The methods of testing specified in 4.4 shall be followed. Sampling shall be in accordance with MIL-STD-105. The lot shall be expressed in units of gallons. The sample unit for testing shall be one quart. The linseed oil shall be marked and forwarded to the testing laboratory. The inspection level shall be S-2 and the AQL shall be 1.5 defects per hundred units. Unless otherwise specified, all specimens shall be prepared and tested in a room having a temperature of $2 \pm 1^{\circ}\text{C}$ ($7 \pm 2^{\circ}\text{F}$) and a relative humidity of 50 ± 5 percent.

4.4 Test methods. All tests shall be conducted in accordance with the methods specified in table IV to determine compliance with the requirements of section 3.

TABLE IV. Test methods

Test	Methods		
	ASTM Standard	Fed. Test Method Std. No. 141	Reference Paragraph
Viscosity	D 1545	-	-
Acid value	D 1639	-	-
Iodine value	D 1959	-	-
Saponification value	D 1962	-	-
Acetone tolerance	D 1950	-	-
Specific gravity	D 1963	-	4.4.1
Refractive index	-	4371	-
Unsaponifiable matter	D 1397	-	-
Loss on heating	D 1960	-	-
Absorption	-	-	4.4.2
Ash	D 1951	-	-
Color	D 1544	-	-
Drying time	-	4061	4.4.3
Appearance	-	4261	-
Appearance of dried film	-	-	4.4.4
Miscibility	-	-	4.4.5
Compatibility with zinc oxide	D 562, D 1210	-	4.4.6
Compatibility with alkyd resin	-	-	4.4.7
Heat test	-	-	4.4.8

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4.4.1 Specific gravity. The specific gravity of the oil shall be determined at $15.56 \pm 0.05 \text{ } ^\circ\text{C}$ ($60 \pm 0.1 \text{ } ^\circ\text{F}$).

4.4.2 Absorption. A half-pint friction-top can lid (5 to 6 cm in diameter) shall be filled level full with the oil, and a No. 2 Whatman filter paper (12.5 cm in diameter) shall be placed on the surface of the oil with the center of the filter paper approximately over the center of the oil. The paper shall be allowed to remain on the oil for 3 hours at standard conditions (see 4.4). The radial distance on the filter paper from the edge of the area originally wetted by the oil to the farthest extent of the absorption of the oil shall be measured in six directions, 60° apart, and the average shall be calculated to determine compliance with the requirement of table II.

4.4.3 Drying time. To 100 g of the oil shall be added the following materials in the percentages shown by weight: mineral spirits conforming to TT-T-291, type II, grade A, 66 percent; lead drier conforming to ASTM D 600, class B, 0.5 percent as lead metal; and cobalt drier conforming to ASTM D 600, class B, 0.05 percent as cobalt metal. The container shall be closed, and the contents thoroughly mixed. The oil mixture shall be drawn down at a wet film thickness of 50 μm (0.002 in). The film shall be tested for the degree of drying at points not less than 10 mm (0.4 in) from the edges of the film.

4.4.4 Appearance of dried film. The dried film of the oil obtained in 4.4.3 shall be examined visually to determine compliance with the requirement of 3.4.2.

4.4.5 Miscibility with mineral spirits and turpentine. Ten ml of the oil shall be placed in each of two test tubes. Twenty ml of mineral spirits conforming to TT-T-291, type II, grade A, shall be added to one tube, and 20 ml of turpentine conforming to ASTM D 13 to the other tube. The tubes shall be stoppered, shaken to mix the contents thoroughly, and allowed to stand for 48 hours at standard conditions. The oil shall be considered miscible if the mixture shows no precipitation, separation, or cloudiness.

4.4.6 Compatibility with zinc oxide. The oil shall be mixed with zinc oxide conforming to ASTM D 79, American-process type dry pigment, in such proportions as to make a paste suitable for mill grinding. Approximately 67 percent by weight of pigment is required for Q viscosity oil and about 45 percent pigment for I-6 viscosity oil. After thoroughly incorporating all of the dry pigment in the oil by hand mixing, the paste shall be transferred to a three-roll mill and given one pass at a setting of 100 μm (0.004 in) and two passes at a setting of 76 μm (0.003 in). The mill-ground paste shall be allowed to stand overnight to permit complete wetting of the pigment by the oil and then shall be thinned to a consistency of 80 Krebs units as determined in accordance with ASTM D 562 with mineral spirits conforming to TT-T-291, Type II, Grade A. The fineness of grind shall be determined in accordance with ASTM D 1210. After the paste has aged for 5 days at standard conditions in a tightly closed, filled container, the consistency of the paste shall be redetermined in accordance with ASTM D 562 to determine compliance with the requirement of 3.4.4.

4.4.7 Compatibility with alkyd resin. Fifty g of the oil, 50 g of alkyd resin solution conforming to TT-R-266, type I, class A, and 55 g of mineral spirits conforming to TT-T-291, type II, grade A, shall be thoroughly mixed in a suitable stoppered glass container. The mixture shall be examined immediately after mixing and after standing for 30 minutes to determine compliance with the requirement of 3.4.5.

4.4.8 Heat test. One hundred ml of the oil in a 250-ml low-form glass beaker shall be heated from room temperature to $315 \pm 10 \text{ } ^\circ\text{C}$ in approximately 15 minutes and shall be held at that temperature for one hour. The oil shall be observed during the heating period to determine compliance with the requirement of 3.4.6. The oil shall be allowed to cool to standard temperature, and then the color of the oil shall be determined in accordance with ASTM D 1544 to determine compliance with the requirement of table II.

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or Commercial, as specified (see 6.2).

5.1.1 Level A. The linseed oil shall be furnished in 1-pint metal cans, 1-quart metal cans, 1-gallon metal cans, 5-gallon metal pails, or 55-gallon steel drums, as specified (see 6.2). The metal cans, pails, and drums shall meet or exceed the requirements of DOT specifications under 49 CFR 178.

5.1.2 Commercial. The linseed oil shall be packaged in cans, pails, or drums, as applicable, in accordance with normal commercial practice. The complete package shall be designed to protect the item against damage during shipment, handling and storage.

5.2 Packing. Packing shall be level A or Commercial, as specified (see 6.2).

5.2.1 Level A. Forty-eight 1-pint cans or twelve 1-quart cans or six 1-gallon cans of linseed oil, packaged as specified in 5.1, shall be packed in fiberboard boxes made from weather-resistant fiberboard with a bursting test strength of not less than 275 lbs. per square inch. The box flaps shall be secured with water-resistant adhesive applied to not less than 75 percent of the surface area of contact between the flaps, or with 3 inch wide waterproof tape applied to the full length of the seams and extending over the ends not less than 3 inches. Alternatively, wirebound, cleated plywood, or nailed wood boxes shall be acceptable shipping containers when lined with a waterproof barrier material. The barrier material shall be sealed at the edges with waterproof tape or adhesive. Five gallon metal pails or 55-gallon steel drums need no further packing.

5.2.2 Commercial. The one pint, one quart, and one gallon linseed oil packaged as specified in 5.1, shall be packed in fiberboard boxes to insure safe delivery at destination, to provide for safe redistribution by the initial receiving activity, and shall be acceptable by common carrier under the National Motor Freight Classification or Uniform Freight Classification.

5.3 Unitization. When shipments to Government depots are full car or truckload, the shipping containers shall be unitized for shipment and handling in accordance with normal commercial practice. The unitized load shall not exceed 2,500 pounds in weight, 63 inches in height, 56 inches in length, and 45 inches in width.

5.4 Marking. Marking shall be as specified in the contract or order (see 6.2).

6. NOTES

6.1 Intended use. The linseed oil covered by this specification is intended for use in paints, varnishes, enamels, and other similar types of coating materials. Oils of 2-7 through 2-9 viscosity are intended for use as sealers for steam turbine casing joints.

6.2 Ordering data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents:

- (a) Title, number, and date of this specification.
- (b) Type required (see 1.2).
- (c) Viscosity required (see 3.2).
- (d) Quantity required and size of container (see 5.1).
- (e) Level of packaging and packing required (see 5.1 and 5.2).

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Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See Section 2 of this specification to obtain extra copies and other documents referenced herein.