MIL-W-13945D
14 December 1977
SUPERSEDING
MIL-W-13945C
29 March 1974

MILITARY SPECIFICATION

WAX, HYDROCARBON (FOR ORDNANCE USE)

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

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers five types of hydrocarbon waxes which are either of a natural mineral origin or derived from petroleum (see 6.1).

1.2 Classification. The waxes covered by this specification shall be of the following types as specified (see 6.2):

Type I	-	High melting point, flash point and viscosity
Type II	-	Low melting point
Type III	-	Broad melting point range (low to high)
Type IV	-	High melting point and low needle penetration
Type V	-	Low melting point

2. APPLICABLE DOCUMENTS

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, US Army Natick Research and Development Command, Natick, MA 01760 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 9160

SPECIFICATION

FEDERAL

PPP-B-636 - Boxes, Shipping, Fiberboard

STANDARDS

FEDERAL

FED-STD-595 - Colors

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 - Marking for Shipment and Storage

(Copies of 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.)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS

D 5 Penetration of Bituminous Materials
D 88 Saybolt Viscosity
D 92 Flash and Fire Points by Cleveland Open Cup
D 94 Saponification Number of Petroleum Products
D 127 Drop Melting Point of Petroleum Wax, Including Petrolatum
D 664 Neutralization Number by Potentiometric Titration
D 721 Oil Content of Petroleum Waxes
D 974 Neutralization Number by Color-Indicator Titration
D 1748 Rust Protection by Metal Preservatives in the Humidity Cabinet
D 1959 Iodine Value of Drying Oils and Fatty Acids
D 2266 Wear Preventive Characteristics of Lubricating Grease (Four-Ball Method)

(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 hydrocarbon waxes covered by this specification shall be either natural mineral waxes or waxes manufactured from petroleum.

3.2 Chemical properties. The hydrocarbon waxes shall conform to the chemical requirements specified in table I, when tested as specified in 4.5.

TABLE I. Chemical properties

	Type I	Type II	Type III	Type IV	Type V
Acid number, maximum	0.05	0.05	---	0.10	---
Saponification number, maximum	2.0	1.5	---	---	---
Iodine number, maximum	---	1.5	---	3.0	---
Benzene-insoluble matter, maximum, percent	0.05	0.05	1.00	---	0.05
Mineral acidity or alkalinity	---	---	None	---	None
Organic acidity, maximum, percent	---	---	0.10	---	---
Oil content, maximum, percent	---	---	---	---	0.5

* 3.3 Physical properties. The hydrocarbon waxes shall conform to the physical requirements specified in table II, when tested as specified in 4.5.

TABLE II. Physical properties

	Type I		Type II		Type III		Type IV		Type V	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Melting point, °F (°C)	183 (84)	192 (89)	162 (72)	172 (78)	162 (72)	190 (88)	192 (89)	197 (82)	156 (69)	163 (73)
Viscosity at 210°F, (99°C) S.U.S.	75	100	---	---	---	---	80	95	---	---
Needle penetration at 77°F(25°C)	7	16	6	12	---	30	2	8	---	---
Flash point, Cleveland O.C. °F(°C)	500 (260)	---	---	---	---	---	---	---	---	---
Fire point, Cleveland O.C. °F(°C)	575 (302)	---	---	---	---	---	---	---	---	---

3.4 Color. The color of the hydrocarbon waxes (type I and II) shall be no darker than color No. 30099 of FED-STD-595.

3.5 Corrosion protection (all types). The three test panels shall pass the Corrosive Protection test after exposure of the panels in the humidity cabinet for a minimum of 100 hours, when tested as specified in 4.5.

3.6 Steel on steel wear (all types). The wear scar shall not be more than 1.00 mm in diameter when tested as specified in 4.5.

3.7 Put-up. Unless otherwise specified, the waxes shall be put-up in 11 pound (5 kg) slabs conforming to standard commercial practice.

3.8 Workmanship. The finished product shall be clean, homogeneous in appearance, and free from any foreign matter which may impair its utility.

3.9 Labeling. Waxes shall be labeled as follows: Suspected carcinogen, avoid skin contact.

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, 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 that supplies and services conform to prescribed requirements.

4.2 Quality conformance inspection. Sampling for inspection shall be performed in accordance with MIL-STD-105, except where otherwise indicated hereinafter.

4.2.1 Component and material inspection. In accordance with 4.1 above, components and materials shall be inspected and tested in accordance with all the requirements of referenced specifications, and standards unless otherwise excluded, amended, modified or qualified in this specification or applicable purchase document.

4.3 Inspection of the end item.

4.3.1 Examination of the end item. The end item shall be examined for the defects set forth in the applicable subparagraphs at the inspection levels and acceptable quality levels (AQLs) set forth in 4.4. Random samples shall be drawn from each lot for examination of visual defects, weight and preparation for delivery defects. The lot size for purposes of determining the sample size shall be expressed in units of five wax slabs of the same type for the examinations in 4.3.1.1 and 4.3.1.2 and in units of shipping containers for examination under 4.3.1.3.

4.3.1.1 Examination of the end item for visual defects. The sample unit for this examination shall be one wax slab, as applicable.

Examine	Defect
Color (types I and II only)	Darker than color chip No. 30099.
Construction	Not put-up in slabs as applicable.
Workmanship	Not clean. Not homogeneous in appearance.

4.3.1.2 Examination for net weight. The sample unit for this examination shall be one wax slab. The lot shall be unacceptable if the average sample net weight is less than specified.

* 4.3.1.3 Packaging inspection. An examination shall be made to determine that the packing and marking comply with the section 5 requirements. Defects shall be scored in accordance with the list below. The sample unit shall be one shipping container fully prepared for delivery except that it need not be closed. Examination for closure defects shall be made on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot.

Examine	Defect
Marking (exterior)	Omitted, incorrect, illegible, of improper size, location, sequence or method of application.
Materials	Any component missing, damaged or not as specified.
Workmanship	Inadequate application of components, such as: Incomplete closure of container flaps, loose strapping, improper taping or inadequate stapling. Bulged or distorted containers.
Content	Number of slabs of wax per shipping container is more or less than required. 1/

1/ For this defect, one shipping container in the sample shall be examined.

4.4 Inspection levels and acceptable quality levels (AQLs) for examination. The inspection levels for determining the sample size and the acceptable quality levels (AQLs) expressed in defects per 100 units shall be as follows:

Examination paragraph	Inspection level	AQL
4.3.1.1	S-3	2.5
4.3.1.2	S-2	N.A.
4.3.1.3	S-2	2.5

4.5 Testing of the end item. A composite sample of the end item shall be tested for the characteristics listed in table III for each lot. For purposes of sampling, a lot shall consist of the finished hydrocarbon wax of one type made in a single batch. The sample unit for testing shall be a 2-pound (0.91 kg) composite. The sample size shall be as indicated below. The portions selected for the composite sample shall be melted together, mixed thoroughly and cast in a mold prior to testing. The composite sample shall be stored in a clean, dry, sealed container for testing. Care shall be exercised to prevent contamination or alteration of the composite during the sampling, compositing, storage and testing. All test reports shall contain the individual values utilized in expressing the final result. The lot shall be unacceptable if the composite sample fails to meet any specified requirement.

Lot size (pounds)	Sample size
800 or less	2
801 up to and including 22,000	3
22,001 or more	5

INSTRUCTIONS FOR TESTING END ITEM — TABLE III

CHARACTERISTIC	Specification Reference		Requirements Applicable To		Number Determinations Per Unit	Results Reported As		Inspect Level	AQL
	Requirement	Test Method	Individ Unit	Lot Aver		Pass or Fail	Numerically to Nearest		
Acid number (types I, II and IV)	Table I	4.6.1			Average of 2		0.01		
Saponification number (types I and II)	Table I	4.6.2		X	Average of 2		0.01		
Iodine number (types II and IV)	Table I	4.6.3		X	Average of 2		0.01		
Benzene insoluble matter (types I, II, III and V)	Table I	4.6.4		X	Average of 2		0.01 percent		
Mineral acidity or alkalinity (types III & V)	Table I	4.6.5		X	1	X			
Organic acidity (type III)	Table I	4.6.6		X	Average of 2		0.01		
Melting point (all types)	Table II	4.6.7		X	Average of 2		1.0°F(0.6°C)		
Viscosity at 98.9°C (types I and IV)	Table II	4.6.8		X	Average of 2		second		
Needle penetration at 25.0°C (types I, II, III and IV)	Table II	4.6.9		X	Average of 2		1		
Flash point (type I)	Table II	4.6.10		X	Average of 2		5°F(3°C)		
Fire point (type I)	Table II	4.6.11		X	Average of 2		5°F(3°C)		
Oil content (type V)	Table I	4.6.12		X	Average of 2		0.1 percent		
Corrosion protection	3.5	4.6.13		X	Average of 3	X			
Steel on steel wear	3.6	4.6.14		X	Average of 3		0.01 mm		

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4.6 Test procedures.

* 4.6.1 Determination of acid number (types I, II and IV only). The acid number shall be determined in accordance with ASTM Method D 974 except that the weighed sample shall be dissolved in 50 milliliters (ml) of hot xylene before starting the test. If difficulty is encountered in observing the end point of titrations, ASTM Method D 664 shall be used with the above modification.

* 4.6.2 Determination of saponification number (types I and II only). The saponification number shall be determined in accordance with ASTM Method D 94, except that an accurately weighed sample of approximately 10 grams (g) shall be taken and dissolved in 50 ml of hot xylene before beginning the test.

* 4.6.3 Determination of iodine number (types II and IV only). The iodine number shall be determined in accordance with ASTM Method D 1959.

4.6.4 Determination of benzene-insoluble matter (types I, II, III and V).

4.6.4.1 Types I, II and III. An accurately weighed portion of approximately 5 grams of the sample shall be dissolved in about 200 ml of benzene on a steam bath. The solution shall be filtered through a tared Gooch crucible which has previously been heated and washed with hot benzene. The wax which adheres to the beaker shall be dissolved in hot benzene. The washings shall be transferred to the crucible and the crucible washed with hot benzene until the residue and crucible are wax-free. The filtrate of type III wax shall be saved for further use as specified in 4.6.5 and 4.6.6. The crucible and contents shall be dried for 1 hour at 100° to 105°C, cooled in a desiccator, and weighed. The gain in weight of the crucible shall be calculated to percentage of benzene insoluble material.

4.6.4.2 Type V only. Use clean medium porosity glass filtering crucibles which will allow 20 ml of hot benzene to flow through them, under suction, within 15 seconds or less. Condition the crucibles prior to use as follows: wash three (3) 20 ml portions of hot benzene thru the crucible with the aid of suction, wash one (1) 20 ml portion of acetone through the crucible, back wash the crucible with one (1) 20 ml portion of acetone, dry the crucible in an oven, cool the crucible in a desiccator, weigh the crucible and record weight, return crucible to oven and maintain at 100 ± 5°C until used.

Weigh approximately 5 grams of the sample to the nearest 0.1 milligram and transfer to a 400 ml beaker. Add approximately 250 ml of benzene to the beaker. Dissolve the wax in the benzene solvent by placing the beaker and

contents on a steam bath and heat at a temperature of 65°C minimum. Continue heating until the wax dissolves (stirring may be used). Filter the hot solution through the previously conditioned and tared hot crucible with the aid of suction. Maintain the crucible and contents at above 60°C to prevent the wax from coming out of the solution. Use a heat gun or other commercially available equipment to maintain the temperature of the benzene solution. Wash the wax which adheres to the beaker with hot benzene and transfer the washings to the crucible. Wash the crucible with hot benzene until the residue and crucible are free from wax, or until approximately 5 ml of the washings, when evaporated to dryness, leaves no residue.

Retain the filtrate for the determination of acidity or alkalinity as specified in 4.6.5. During filtration air must not be sucked through the crucible. This is to prevent the air from cooling the filtering surface which could cause the wax to come out of solution and clog the crucible. Dry crucible and contents in an oven for 30 minutes at 100°C to 105°C, cool in a desiccator, and weigh. The percentage of benzene insoluble matter is calculated as follows:

$$\text{Percent insoluble matter} = \frac{100A}{B}$$

Where: A = increase in weight of filtering crucible, in g
B = weight of sample, in g

4.6.5 Determination of mineral acidity or alkalinity (types III and V). The filtrate from the determination of benzene-insoluble matter (see 4.6.4) shall be transferred to 500 ml separatory funnel, and the flask rinsed with two 10 ml portions of benzene. Twenty-five milliliters of distilled water shall be added to the funnel, the mixture shaken, the phases allowed to separate, and the aqueous layer withdrawn. The procedure of adding water, shaking, and separating shall be repeated two or more times. The aqueous extracts shall then be combined, and tested with blue and red litmus papers of such sensitivity that their colors are completely changed in one minute by N/250 sulfuric acid or sodium hydroxide solutions, respectively. If inorganic acidity or alkalinity is present, it shall be determined by noting if the water extract changes the color of either paper within 30 seconds.

4.6.6 Determination of organic acidity (type III only). Three drops of phenolphthalein indicator shall be added to the water extract obtained as directed in 4.6.5 and the solution titrated with an accurately standardized sodium hydroxide solution, approximately N/10. A blank determination shall be made of the same quantities of benzene and water as were used in dissolving and extracting the sample. Any organic acidity shall be calculated to percentage of acetic acid in the sample as follows:

$$\text{Percentage of acetic acid} = \frac{6.0\ (A - B)\ N}{W}$$

Where:

A = ml of sodium hydroxide solution used in determination.
B = ml of sodium hydroxide solution used in blank.
N = normality of sodium hydroxide solution.
W = weight of sample.

* 4.6.7 Determination of melting point (all types). The melting point shall be determined in accordance with ASTM Method D 127.

* 4.6.8 Determination of viscosity at 98.9°C (types I and IV only). The viscosity shall be determined in accordance with ASTM Method D 88 using the Saybolt Universal Viscosimeter modified as follows: A portion of approximately 150 grams of the sample shall be transferred to a 400 ml beaker and melted, the application of heat being so controlled that the temperature of the molten material does not exceed 100°C. The molten wax shall be filtered through a 100-mesh strainer into the oil tube of a Saybolt Universal Viscosimeter until it overflows into the gallery. The receiving flask shall be surrounded with transparent oil bath maintained at a temperature of 99 ± 2°C. At least two determinations shall be made of the viscosity, and the average of the results shall be reported to the nearest second.

4.6.9 Determination of penetration at 25°C (types I through IV only). The penetration shall be determined in accordance with ASTM Method D 5 using a total weight of 100 grams for types I, II and IV wax, and a total of 200 grams for type III wax.

* 4.6.10 Determination of flash point (type I only). The flash point shall be determined in accordance with ASTM Method D 92.

4.6.11 Determination of fire point (type I only). The fire point shall be determined in accordance with ASTM Method D 92.

4.6.12 Determination of oil content (type V only). The oil content of the wax shall be determined in accordance with ASTM Method D 721.

4.6.13 Determination of corrosion protection (Humidity Cabinet). The corrosion protective properties shall be determined in accordance with ASTM Method D 1748 with the following changes:

(a) Coating Test Panels: Three test panels shall be immersed in the molten compound, maintained at the recommended temperature for application, until the temperature of the panels reach that of the compound. The panels shall then be withdrawn mechanically at the rate of four inches per minute so that a film of compound 1.5 + 0.2 mils in thickness shall adhere to the panels.

(b) Film Thickness: The thickness of the applied film may be determined by using similar panels dipped in the same manner and using the specific gravity-weight surface area method or any other suitable method.

(c) The panels should be allowed to hang for approximately 16 hours before being placed in the humidity cabinet.

(d) On completion of the test, the compound shall be removed by a suitable solvent and the panels evaluated as specified.

4.6.14 Steel on steel wear. This test shall be determined in accordance with ASTM Method D 2266.

5. PACKAGING

5.1 Packing. Packing shall be level A, B, or C, as specified (see 6.2).

* 5.1.1 Level A. Five slabs of wax of one type only, put up as specified (see 3.7), shall be packed in a snug-fitting fiberboard shipping container conforming to style CSSC, grade V2s of PPP-B-636. Each slab of wax shall be completely separated with a sheet of polyethylene film or other material in such a manner as to effectively prevent adjacent slabs of wax from sticking together. Each shipping container shall be closed in accordance with method III, waterproofed in accordance with method V, and reinforced as specified in the appendix of PPP-B-636, except that the inspection shall be in accordance with 4.3.1.3.

* 5.1.2 Level B. Five slabs of wax of one type only, put up as specified (see 3.7), shall be packed in a snug-fitting fiberboard shipping container conforming to style CSSC, type CF, (variety SW) or SF, class domestic, grade 275 of PPP-B-636. Each slab of wax shall be completely separated with a sheet of polyethylene film or other material in such a manner as to effectively prevent adjacent slabs of wax from sticking together. Each shipping container shall be closed in accordance with method II as specified in the appendix of PPP-B-636, except that the inspection shall be in accordance with 4.3.1.3.

* 5.1.2.1 Weather-resistant fiberboard container. When specified (see 6.2), the fiberboard shipping container shall be grade V3c, V3s, or V4s fiberboard box fabricated in accordance with PPP-B-636 and closed in accordance with method III as specified in the appendix of PPP-B-636, except that the inspection shall be in accordance with 4.3.1.3.

5.1.3 Level C (Commercial Packing). Wax shall be packed in a manner to insure carrier acceptance and safe delivery at destination at the lowest transportation rate for such supplies. The quantity per shipping container shall be the same as that normally used by the contractor for retail distribution. Containers shall comply with Uniform Freight Classification or National Motor Freight Classification, as applicable.

5.2 Marking. In addition to any special marking required by the contract, shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The hydrocarbon waxes covered under this specification are intended for use as follows:

Type I - for use with polychloronaphthalene as an inert filler.
Type II - for use as a protective lubricant for 20-mm ammunition.
Type III - for use as a component material of inert sealing compound.
Type IV - for use as a component material of inert sealing compound.
Type V - for use as a component material in a liner.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type required (see 1.2).
(c) Selection of the applicable level of packing (see 5.1).
(d) When weather-resistant grade fiberboard shipping containers are required for level B packing (see 5.1.2.1).

* 6.3 Changes from previous issue. The margins of this specification are marked with an asterisk (*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. 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 and relationship to the last previous issue.

* 6.4 Metric equivalents. Metric equivalents, indicated in parentheses throughout this document, are based on practices, conversion factors, and symbols specified in ASTM E 380 Standard for Metric Practice, and are for information only. In each instance, the value stated in US customary units shall be controlling.

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