

MIL-W-20553D
17 November 1976
SUPERSEDING
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29 July 1974 AND
MIL-W-20553B
18 March 1962

MILITARY SPECIFICATION

WAX, DESENSITIZING

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

1. SCOPE

1.1 Scope.—This specification covers desensitizing waxes for use in cast and pressed explosive compositions (see 6.1).

2. APPLICABLE DOCUMENTS

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

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-109 - Inspection Terms and Definitions
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-650 - Explosive: Sampling, Inspection and Testing
- MIL-STD-1235- Single and Multilevel Continuous Sampling Procedures and Tables for Inspection by Attributes

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

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Picatinny Arsenal, Dover, New Jersey 07801 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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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 (ASTM)

	D92	-	Test for Flash and Fire Points by Cleveland Open Cup
	D127	-	Test for Drop Melting Point of Petroleum Wax
	D445	-	Test for Kinematic Viscosity of Transparent and Opaque Liquids
	D721	-	Test for Oil Content of Petroleum Waxes
*	D938	-	Congeeing Point of Petroleum Waxes, Including Petrolatum
	D1321	-	Test for Needle Penetration of Petroleum Waxes

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

AMERICAN OIL CHEMISTS SOCIETY (A.O.C.S.)

*	Cc 3 - 25	-	Softening Point
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3. REQUIREMENTS

* 3.1 Qualification (see 4.3 and 6.4).--The desensitizing wax furnished under this specification shall be a product which has passed the applicable qualification tests and has been listed on or approved for listing on the qualified products list (QPL). The desensitizing wax supplied under contract shall conform to the material receiving qualification. In order to retain qualification approval of products, the manufacturer must certify that the product listed on the QPL meets the current specification requirements. Any major change in the fingerprint or formulation shall necessitate requalification (see 4.3.3, 6.4.3, 6.5 and 6.7)

3.2 Material.--The material shall be a wax meeting the following requirements:

3.2.1 Physical and chemical properties.--The desensitizing wax shall conform to the limits specified for the properties listed in Table I, when determined as specified in the applicable subparagraphs of 4.5.

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TABLE I

Property	Requirement	Test Paragraph
Melting Point °F, Min	175 (79.4°C)	4.5.1
Max	200 (93.3°C)	
Viscosity (in Centistokes (cSt) at 210°F) (98°C)	15 ± 6	4.5.2
Penetration (in units of 0.1mm)		
at 77°F Min (25°C Min)	6	4.5.3
* at 110°F Max (43°C Max)	35	
Flash Point °F Min	400 (204°C)	4.5.4
Organic Insoluble Matter		
% Max	0.03	4.5.5
Alkalinity, % Max	None	4.5.6
Acidity, as Acetic Acid, % Max	0.01	4.5.7
Oil Content % Weight, Max	2.5	4.5.8
* Exudation at 160°F (71°C), % Max (see 6.9)	3.0	4.5.9
* Fingerprint (see 3.1)	See 6.4.3	4.5.10

3.3 First article testing.-This specification makes provision for first article testing. Submission of first article quantity by the contractor shall be as specified in the contract.(see 4.2)

3.4 Reactivity at 100°C or 120°C.-The reactivity values shall not exceed 1 milliliter (ml), when determined as specified in 4.5.11. This test is to be performed by a Government laboratory (see 6.6).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.-Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities specified herein, unless disapproved by the Government. In addition, 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 the prescribed requirements. Reference shall be made to MIL-STD-109 to define terms used herein.

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4.1.1 Classification of Inspections.-The inspection requirements specified herein are classified as follows:

- a. First Article Inspection (see 4.2)
- b. Qualification Inspection (see 4.3)
- c. Quality Conformance Inspection (see 4.4)

4.2 First Article Inspection

4.2.1 Submission.-Prior to initiation of regular production the contractor shall submit a first article sample consisting of 200 lbs of wax in accordance with instructions issued by the Contracting Officer for evaluation in accordance with paragraph 4.2.2. All samples submitted shall have been produced by the contractor using the same production process, procedures, and equipment as will be used in fulfilling the contract. The sample shall be accompanied by certificates of analysis. A first article quantity, or portion thereof, as directed by the contracting officer, shall also be submitted whenever there is a lapse in production for a period in excess of 90 days, or whenever a change occurs in manufacturing process, material used, drawing, specification or source of supply as to significantly affect product uniformity as determined by the Government.

4.2.2 Inspections to be performed.-The sample will be subjected by the Government to any or all of the examinations or tests specified in 4.4 or 4.5 of this specification and any or all requirements of the applicable drawings and qualification test procedures.

4.2.3 Rejection.-If any sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate its inspections upon any failure of a sample to comply with any of the stated requirements.

4.3 Qualification Inspection

4.3.1 Submission.-The manufacturer shall submit a sample of his product to a Government approved facility as designated by the preparing activity for qualification testing (see 6.3 and 6.4). All samples submitted shall have been produced by the manufacturer using the same procedures, processes and equipment as will be used in regular production. The sample shall be accompanied by a certificate of analysis which shows the location of manufacture.

4.3.2 Qualification Testing.-The testing will include but will not be limited to the following (see 6.4.1 and 6.4.2).

- a. pressibility
- b. incorporability

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- c. sensitivity
- d. compatibility
- e. flow properties of formulated explosives
- f. cast shrinkage

In addition to the qualification tests, each sample of wax shall meet the requirements given in 3.2.

4.3.3 Re-Examination.-Re-examination of a qualified product shall be required by the preparing activity under any of the following conditions:

- (1) The manufacturer has modified the product or changed the material or processing sufficiently so that the validity of previous qualification is questionable.
- (2) The requirements in the specification have been revised sufficiently to affect the character of the product.
- (3) When deemed necessary to determine that the product continues to meet all of the specification requirements.
- (4) A change in the "fingerprint" has occurred (see 6.4.3).

4.4 QUALITY CONFORMANCE INSPECTION

4.4.1 Lot formation.-A lot shall consist of that quantity of desensitizing wax produced by one manufacturer, in accordance with the same specification or same specification revision under one continuous set of operating conditions. The lot size shall not exceed 70,000 lbs of material and each lot shall consist of that quantity of material that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. The product shall be submitted for inspection in accordance with MIL-STD-105.

4.4.2 Examination.-Sampling plans and procedures for the following classifications of defects shall be in accordance with MIL-STD-105. Contractor's sampling plans, if used, shall be approved by the Government and shall provide, as a minimum, the protection afforded the Government by the sampling plans in MIL-STD-105. Continuous sampling plans in accordance with MIL-STD-1235 may be used if approved by the procuring activity.

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Also, at the option of the procuring activity, AQL's and sampling plans may be applied to the individual characteristics listed, using an AQL of 0.40 percent for each Major defect and an AQL of 0.65 percent for each Minor defect.

4.4.2.1 Container sealed

Categories	Defects	Method of Inspection
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Critical: None defined

Major:	AQL 0.40 percent	
101.	Container damaged to the extent that the contents are exposed, or likely to become exposed in subsequent handling.....	Visual

Minor:	AQL 0.65 percent	
201.	Marking misleading or unidentifiable.....	Visual

4.4.3 Sampling for test (see 3.2).—A representative sample of approximately 5 pounds of the wax shall be selected from each lot of desensitizing wax submitted for acceptance. The sample shall be tested for the following properties and the results recorded (see 6.2.2):

<u>Property</u>	<u>Type of Defect</u>	<u>Test Paragraph</u>
Melting Point	Major	4.5.1
Viscosity	Major	4.5.2
Penetration	Major	4.5.3
Flash Point	Major	4.5.4
Organic Insoluble Matter	Major	4.5.5
Alkalinity	Major	4.5.6
Acidity	Major	4.5.7
Oil Content	Major	4.5.8
Exudation	Major	4.5.9
* Fingerprint	See 6.4.3	4.5.10
DSC	See 6.4.3	4.5.10.1
Congealing Point	See 6.4.3	4.5.10.2
Softening Point	See 6.4.3	4.5.10.3

4.5 Test Methods and Procedures (see 6.8).—The tests in 4.5.1 through 4.5.11 shall be performed using prescribed analytical

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procedures for replicate determinations given in standard analytical textbooks.

4.5.1 Melting Point.--The melting point shall be determined in accordance with ASTM Method D127.

4.5.2 Viscosity.--The viscosity shall be determined in accordance with ASTM Method D445 using the Ubbelohde viscometer.

4.5.3 Penetration.--The penetration shall be determined in accordance with ASTM Method D1321.

4.5.4 Flash Point.--The flash point shall be determined in accordance with ASTM Method D92.

4.5.5 Organic Insoluble Matter.--The solvent for this determination shall consist of either benzene or aliphatic naphtha. Use clean medium porosity glass filtering crucibles which will allow 20 ml of hot solvent 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 solvent through 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 at $100 \pm 5^{\circ}\text{C}$, cool the crucible in a desiccator, weigh the crucible and record weight, return crucible to oven and maintain at $100 \pm 5^{\circ}\text{C}$ 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 solvent to the beaker. Dissolve the wax in the 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 solution. Wash the crucible with hot solvent until the residue and crucible are free from wax, or until approximately 5 ml of the washings, when evaporated to dryness, leaves no residue.

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Retain the filtrate for the determination of alkalinity as specified in 4.5.6. 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 insoluble matter is calculated as follows:

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

Where:

A = increase in weight of filtering crucible, in gm.
W = weight of sample, in gm.

4.5.6 Alkalinity.—The filtrate from the determination of insoluble matter (4.5.5) shall be transferred to a 500 ml separatory funnel, and the flask shall be rinsed with two, 10 ml portions of benzene. Twenty-five ml of distilled water shall be added to the funnel. The funnel shall be shaken, the phases allowed to separate, and the aqueous layer withdrawn. The procedure of adding distilled water, shaking, and separating shall be repeated two more times. The aqueous extracts shall be combined. The extract shall be tested with red litmus paper of such sensitivity that its color is completely changed in one minute by .004 Normal (N) sodium hydroxide solution. The water extract shall be considered to be alkaline if upon application red litmus paper changes color within 30 seconds. The water extract shall be reserved for determination of acidity (see 4.5.7).

4.5.7 Acidity.—Three drops of phenolphthalein indicator shall be added to the water extract, obtained as specified in 4.5.6, and the solution shall be titrated with approximately 0.1N sodium hydroxide solution. A blank determination shall be made on the same quantities of benzene and water as were used in dissolving and extracting the sample. Any acidity shall be calculated to percentage of acetic acid in the sample as follows:

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

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, in gm.

4.5.8 Oil content.—The oil content shall be determined in accordance with ASTM Method D721.

4.5.9 Exudation.—The sample shall be melted at approximately 220°F. When completely molten, the wax shall be cooled with stirring, to about 10°F above its drop melting point and cast into a glass mold, 1 inch inside diameter and 0.5 inch high. The glass mold shall rest on a smooth 0.5 inch thick aluminum plate and at the time of casting, both plate and mold shall be at 70°F + 10°F. Under these conditions the sample will freeze in 3 to 5 minutes. The sample shall be removed from the mold and placed on 20 layers of filter paper, cut in 1 1/2 inch diameter circles. An 80 gm brass weight, 1 inch in diameter, shall be placed on top of the wax casting. This assembled sample shall then be placed on a wire screen and stored in an oven for 24 hours at 160°F + 1/2°F. Before assembly, the brass weight shall be weighed and then reweighed with the wax casting. After hot storage, wax and brass weight shall be removed from the filter paper while still warm, no attempt being made to separate brass weight and wax, and allowed to cool upside down (the wax resting on the brass weight). When cool, the wax and brass weight shall be weighed together. The difference in weights shall be calculated as percent lost during storage. The test shall be run in triplicate and the average of the three values shall be reported as the percent exudation.

$$\text{Percent exudation} = \frac{A-C}{A-B} \times 100$$

Where:

A = weight of wax plus brass weight before exudation test, in gm.

B = weight of brass weight, in gm

C = weight of wax plus brass weight after exudation test, in gm.

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* 4.5.10 Fingerprint.--A Differential Scanning Calorimetry (DSC) curve, congealing point and softening point will be obtained for each qualified wax in accordance with the procedures specified in 4.5.10.1, 4.5.10.2 and 4.5.10.3. The Government (see 4.1) will periodically examine subsequently submitted lots by DSC, congealing point and softening point in accordance with the same procedure specified in 4.5.10.1, 4.5.10.2 and 4.5.10.3 to determine if a major change in the product has occurred (see 6.4.3).

4.5.10.1 Procedure.--Use a Perkin-Elmer, Model DSC-1B, DSC-2, DSC P-3-14 or equivalent instrument with the following conditions:

- a. SAMPLE SIZE - 5-8 mg of compacted or resolidified wax.
- b. HEATING RATE - 5-10°C/Min.
- c. TEMPERATURE RANGE - 25-100°C.
- d. INERT GAS FLOW - 10-20 ml of gas/minute.
- e. CHART SPEED - 20 mm/minute (APPROXIMATE)
- f. SAMPLE CONDITIONING - Heat sample to 5°C above its endotherm and allow it to cool to 25°C without changing its position in the DSC heating chamber. Reprogram sample under conditions a through e.

* 4.5.10.2 A congealing point will be obtained for each qualified wax in accordance with the procedure specified in ASTM D938.

* 4.5.10.3 A softening point will be obtained for each qualified wax in accordance with the procedure specified in A.O.C.S. Method Cc 3-25.

* 4.5.11 Determination of Reactivity.--The reactivity shall be determined in accordance with Method 504.1.1 of MIL-STD-650 with the following exceptions:

The specimens shall consist of 7.50 gm of wax, 5.00 gm of RDX and 5.00 gm of TNT. These specimens are reduced to a practicable and standardized fineness for intimacy of conduct and reproducibility of results, approximately 12 mesh.

Two and one half gm of wax shall be placed in each of three heating tubes. Two and one half gms of RDX shall be placed in one of the tubes containing wax and two and one half grams of TNT shall be placed in another tube

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containing wax. Two and one half gms of RDX and two and one half grams of TNT shall be placed in two additional tubes.

The sum of the volume of gases evolved by the wax and explosive individually subtracted from the volume of gas produced by the wax-explosive mixture shall be the reactivity values to be reported.

5. PREPARATION FOR DELIVERY

5.1 Packaging.—Unless otherwise specified, commercial packaging will be acceptable.

5.2 Packing.—The wax shall be prepared for shipment in such a manner as to permit acceptance by carrier for transportation at the lowest applicable rate and to afford maximum protection from normal hazards of transportation.

5.3 Marking.—Marking of containers shall be in accordance with MIL-STD-129 and such additional code markings, indicating stock number and ultimate destination, as may be specified by the procuring agency.

6. NOTES

6.1 Intended use.—The waxes covered by this specification are intended for use as desensitizers in high explosives. It is likely that a wax may qualify in from one to all explosive compositions. Pressed explosives include Comp A-3 and Comp A-4.

6.2 Ordering data.—Procurement documents shall specify the following:

6.2.1 Procurement requirements

- a. Title, number and date of this specification.
- b. Provisions for submission of first article samples.
- c. Acceptance and description sheets - Acceptance and description sheets shall be prepared for each lot in accordance with MIL-STD-1171.
- d. Special packaging if required.
- e. Reactivity test temperature.

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6.2.2 Contract data requirements.-For Army procurement, the data specified in paragraph 4.4.3 shall consist of the physical and chemical properties of the wax. A copy of all test results should be forwarded to Commander, Picatinny Arsenal, ATTN: SARPA-QA-A-P, Dover, New Jersey 07801 (Data Item DI-R-1724 or equivalent).

6.3 Qualification test samples

6.3.1 Qualification samples shall be identified by tags marked with the following information:

- a. Wax, Desensitizing, Specification MIL-W-20553
- b. Sample for Qualification Tests
- c. Manufacturers Formula Number or Brand Name
- d. Date of shipment
- e. Name and address of manufacturer

6.3.2 Sample for Navy Qualification Testing.-The test sample shall consist of approximately 350 pounds of wax unless otherwise specified and shall be sent to the following location: Commanding Officer, Naval Weapons Station, ATTN: NEDED, Yorktown, Virginia, 23691.

6.3.3 Sample for Army Qualification Testing.-The sample shall consist of approximately 20 pounds of wax unless otherwise specified and shall be sent to the following location: Commander, Picatinny Arsenal, ATTN: SARPA-QA-A-P, Dover, New Jersey 07801.

6.4 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 the applicable Qualified Products List 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 orders for the products covered by this specification. The activity responsible for the Qualified Products List is Picatinny Arsenal, Dover, New Jersey 07801 and information pertaining to qualification of products may be obtained from that activity.

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6.4.1 Qualification Test Procedures.--Information pertaining to U.S. Army Qualification Testing can be obtained from Commander, Picatinny Arsenal, ATTN: SARPA-QA-A-P, Dover, New Jersey 07801.

* 6.4.2 Qualification Test Procedures.--The test procedure used by the U.S. Navy for qualification of waxes is contained in Naval Weapons Station Technical Report TR 74-1.

For Comp B	- TR 74-1
For H-6 and D-2	- TR 74-2
For Comp A-3	- WS 13574, OD 45295
	WS 13564, OD 45001

Information pertaining to U.S. Navy qualification testing can be obtained from Commanding Officer, Naval Weapons Station, ATTN: NEDED, Yorktown, Virginia, 23691.

* 6.4.3 Definition of major changes.--A major change in the product requires requalification (see 4.3.3). The determination of a major change in a manufacturer's product will be based upon the evaluation of the DSC curve for the following:

Changes in characteristics from the original curve and subsequent curves for the same product in regard to shifts of the melting point or changes in the composition of wax (SINGLE CUT vs a blend) or melting point characteristics as demonstrated by the appearance of new peaks or disappearance of peaks in the DSC curve.

The determination of a major change in a manufacturer's product for congealing and softening points will be based on a shift of greater than 2.5°C (5.0°F) from original values.

* 6.5 A qualified wax applies only to the wax produced in the plant specified (location) on the QPL. Waxes produced in a location other than that specified even though the same blend stocks are used will not be considered qualified.

6.6 Reactivity.--This test is applicable to the first article testing unless otherwise specified by the procuring activity. The temperature at which the test is to be run should also be specified by the procuring activity.

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6.7 Picatinny Arsenal is the preparing activity for this specification and is responsible for the coordination of specification testing and preparation of the Qualified Products List.

6.8 Prior approval of the Contracting Officer is required for use of equivalent test methods. A description of the proposed method should be submitted thru the Contracting Officer to: Commander, ATTN: SARPA-QA-A-P, Picatinny Arsenal, Dover, New Jersey 07801. This description should include but not be limited to the procedures used, the accuracy and precision of the method, test data to demonstrate the accuracy and precision and drawings of any special equipment required.

* 6.9 The requirement for exudation is mandatory for Navy procurement only. The Navy has found it necessary to control this parameter for its items.

6.10 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.

Custodian:
Army-PA
Navy-OS

Preparing Activity:
Army-PA

Review Activities:
Army-PA
Navy-OS

User Activity:
Navy-AS

Project Number: 9160-0059