

METRIC

MIL-DTL-44411C
 29 July 2005
 SUPERSEDING
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DETAIL SPECIFICATION

INSECT REPELLENT, PERMETHRIN

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers permethrin insect/anthropod repellent for dilution in water and application to outer clothing, insect netting, and fabric.

1.2 Classification. The insect repellent covered by this specification should be of the following types, as specified (see 6.2).

Type I - In 151-milliliter (mL) bottles for dilution and hand spray application in the field.

Type II - In drums for industrial application to fabric.

1.3 Part or identifying number (PIN). The PIN to be used for insect repellent acquired to this specification is created as follows:

M 44411 - X

 Type: 1 - type I
 2 - type II

 Specification number

 M prefix

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or e-mailed to STDZNMGT@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at <http://assist.daps.dla.mil>.

AMSC N/A

FSC 6840

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

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks 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 (see 6.2).

FEDERAL STANDARDS

FED-STD-595 - Colors Used in Government Procurement.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-3010 - Test Procedures for Packaging Materials.

(Copies of these documents are available online at <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 (see 6.2).

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 152 - Pesticide Registration and Classification Procedures.
49 CFR - Transportation.

(Copies of these documents are available online at <http://www.access.gpo.gov/> or from Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.)

2.3 Order of precedence. 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.

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3. REQUIREMENTS

3.1 Insect repellent solution. The insect repellent concentrate for the type I and type II application methods shall meet the requirements specified in 3.1.1 through 3.1.3. Required concentration shall be applied in a water emulsion to fabric utilizing an industrial padder or other suitable method in order to obtain a uniform level of emulsion on the fabric.

3.1.1 Composition. The insect repellent concentrate for the type I and type II application methods shall consist of: 40 to 42 percent by weight permethrin, U.S. Patent No. 4,024,163, (3-phenoxyphenyl)-methyl (\pm) cis/trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate; cis/trans isomers mixture: min. 35 percent (\pm) cis and max. 65 percent (\pm) trans, and the balance 58 to 60 percent by weight inert petroleum distillates.

3.1.2 Appearance. The insect repellent concentrate shall be a homogeneous, translucent, yellow to amber colored solution free from insoluble matter when examined as specified in 4.5.2.

3.1.3 Emulsifiability. The insect repellent concentrate shall form a creamy emulsion and shall readily re-emulsify when tested as specified in 4.5.3.

3.2 Marking pen. The marking pen used to mark garments after treatment shall have sufficient ink to mark 12 sets (coats and trousers) of military battle dress uniforms. The marking pen ink shall be resistant to both dry cleaning and laundering.

3.3 Type I plastic bottle, 151 mL. A quantity of 151 mL of insect repellent concentrate shall be supplied in a fluorinated, high density polyethylene (2F HDPE) bottle with ultraviolet (UV) blocker conforming to industrial packaging type 2 set forth in 49 CFR. The color of the bottle shall be olive drab (color number 24097), brown (color number 30051), or amber (color number 32169) in accordance with FED-STD-595.

3.3.1 Bottle screw cap. The screw cap shall be black or match the bottle color and shall be furnished with a resilient leak proof lining and facing that are highly resistant to degradation by the repellent concentrate and shall have a plastic seal to prevent inadvertent opening or loosening. The bottle and cap shall not leak when tested as specified in 4.4.4.

3.4 Application.

3.4.1 Type I. The application procedure for the type I spray method shall be as specified on the label affixed to the bottle.

3.4.2 Type II. The concentrate shall be applied in a water emulsion to fabric utilizing an industrial padder or other suitable industrial method in order to obtain a uniform level of emulsion on the fabric.

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3.5 Labels and labeling information, type I and type II. The labels shall be legibly and neatly printed, stenciled, lithographed, or silk-screened directly on the container if compatible with the type of material of which the container is made. As an alternate, the label information shall be neatly printed on paper stock in olive drab (color number 24097), brown (color number 30051), or amber (color number 32169) in accordance with FED-STD-595 and shall be sealed to the container with water-resistant adhesive. In all cases the ink shall be black, regardless of how the label information is applied to the container. The label shall not smear or be loosened from the container when tested as specified in 4.4.5.1 and 4.4.5.2. Labeling shall be in compliance with the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act as amended and set forth in 40 CFR 152 (see figure 1). All directions and cautions on the labels shall be in accordance with and approved by the Pesticide Registration Division of the Environmental Protection Agency (EPA). In addition to the EPA approved label, a label containing the following information shall be affixed to each container:

- a. Name, brand, or trademark under which the product is sold.
- b. Name and address of the producer or registrant.
- c. Product lot number.

4. VERIFICATION

4.1 Classification of inspection. The inspection requirements specified herein are classified as a conformance inspection (see 4.3).

4.2 Inspection conditions. For the composition, appearance, and emulsifiability tests, a representative specimen of 100 mL shall be removed from each sample unit and placed in a clean, dry container labeled to identify the lot and container from which it was taken. Unless otherwise specified, all inspections shall be performed on a lot. The lot size shall be expressed in units of filled unit containers.

4.3 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.1 when tested in accordance with 4.4 shall constitute minimum inspections to be performed by the supplier prior to government acceptance or rejection by lot. Unless otherwise specified, sampling shall be conducted in accordance with table I. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract. Failure of any test by any sample shall be cause for rejection of the lot represented.

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TABLE I. Sampling.

Number in a lot	Number of samples
2 to 25	2
26 to 150	3
151 to 1,200	5
1,201 to 7,000	8
7,001 to 20,000	10
20,001 to 35,000	15
over 35,000	20

4.4 Test methods and procedures.

4.4.1 Component and material inspection. In accordance with 4.3, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.1.1 Material certification. A certificate of compliance may be acceptable as evidence that the permethrin meets the requirements of 3.1. When certificates of compliance are submitted, the government reserves the right to inspect such items to determine the validity of the certification.

4.4.2 End item visual examination. The unit packaged end items shall be examined for the defects defined in table II. Sampling shall be conducted in accordance with table I. Failure of any test by any sample shall be cause for rejection of the lot represented.

TABLE II. Visual examinations.

Examination	Defect
Markings (label)	Missing, incomplete, incorrect, illegible, not as specified.
Workmanship	Dirty, not uniform, contains foreign matter; any other defect affecting serviceability.

4.4.3 Net contents examination. The end items shall be examined for net contents. Sampling shall be conducted in accordance with table I. The lot shall be acceptable if the average net content per container for all sample units examined is within ± 2 percent of the amount specified on the label.

4.4.4 Container leakage testing. Sampling shall be conducted in accordance with table I. The leakage test shall be conducted in accordance with the hot water technique of test method 5009 of MIL-STD-3010. A stream of air bubbles shall be considered evidence of leakage.

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4.4.5 Labels.

4.4.5.1 Resistance to water, for type I. The unit container shall be completely immersed in water at a temperature between 20 °C and 27 °C for 1 hour. Remove the unit container and rub fingers over the face of the label to determine if the label either smears or loosens to the point that it can be moved. Any smearing or loosening of the label constitutes a failure.

4.4.5.2 Resistance to insect repellent, for type I. The unit container shall be completely immersed in the type and concentration of repellent contained therein at a temperature between 20 °C and 27 °C for 1 hour. Remove the unit container and rub fingers over the face of the label to determine if the label either smears or loosens to the point that it can be moved. Any smearing or loosening of the label constitutes a failure.

4.5 Methods of inspection.4.5.1 Gas chromatographic method of analysis for determination of permethrin.

4.5.1.1 Scope. This procedure describes a gas chromatographic method for determining permethrin. The active ingredients are determined by injecting a solution of the analytes and acetone into the chromatograph. Separation is obtained and peak areas are compared to an external standard containing a known amount of the analyte.

4.5.1.2 Reagents/gases.

- a. AgrEvo Environmental Health, Permanone® 40 Manufacturer's Concentrate, standard.
- b. Acetone, HPLC pure.
- c. High purity helium.
- d. Compressed air.
- e. Hydrogen.

4.5.1.3 Apparatus.

- a. Gas chromatograph: Hewlett Packard Model 5890 or equivalent for data manipulation, gas chromatograph equipped with flame ionization detector (FID) and autosampler.
- b. Column: A 6-foot by 2-mm inside diameter glass column.
- c. Packing: A 3 percent OV-101 on 100/120 Chromosorb W-HP.
- d. Hewlett Packard Chemstation.

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4.5.1.4 Conditions.

- a. Flow (He): 30 mL/min.
- b. Flow (H₂): 30 mL/min.
- c. Flow (Air): 400 mL/min.
- d. Initial temperature: 230 °C.
- e. Initial time: 0.0 min.
- f. Temperature program rate: 10 degrees/min.
- g. Final temperature: 245 °C.
- h. Final time: 7.0 min.
- i. Run time: 8.5 min.
- j. Injector temperature: 250 °C.
- k. Detector temperature: 275 °C.
- l. Injection volume: 2 µl.

4.5.1.5 External integrator settings.

- a. Attenuation: 7.
- b. Threshold: 5.
- c. Peak width: 0.04.
- d. Chart speed: 0.50 cm/min.

4.5.1.6 Standard preparation. In a 50-mL volumetric flask, weigh 50 mg of AgrEvo Environmental Health, Peremanone® 40 Manufacturing Concentrate to the nearest 0.001 gram and dilute to volume with acetone. Transfer a small portion to a sample vial and label with contents and date. Place the stopper back on the volumetric flask and label it accordingly.

4.5.1.7 Sample preparation. In a 50-mL volumetric flask, weigh 125 mg of insect repellent sample to the nearest 0.001 gram and dilute to volume with acetone. Transfer a small portion to a sample vial and label with contents and date. Place the stopper back on the volumetric flask and label it accordingly.

4.5.1.8 Procedure. After the chromatograph is stable, make three or more injections of the standard and average the area counts. The injections should be repeatable to within 1 percent. Do the same for the sample. Calculate the percent purity by using the following formula:

$$\text{Percent purity} = \frac{\text{average sample area} \times \text{weight of standard} \times 100}{\text{average standard area} \times \text{weight of sample}}$$

4.5.2 Appearance. Examine the insect repellent for color homogeneity and the presence of suspended particles or sediment.

4.5.3 Emulsifiability. Add 5 mL of insect repellent to a 100-mL graduated cylinder containing 85 mL of distilled water. Agitate gently by inverting the cylinder 10 times. A creamy emulsion shall be formed. Let stand for 15 minutes. If any separation has occurred, re-invert the cylinder gently 10 times, let stand for 15 minutes, and examine for homogeneity of the emulsion. The test shall be done at room temperature.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor 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 activities within the military service or defense agency, or within the military service's system 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.

5.1.1 Unit pack. Twelve 151-mL bottles of repellent and twelve marking pens (see 3.2) shall be unit packed.

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 type I insect repellent is intended for use in treating individual outer clothing units, such as the battle dress uniform, as well as insect netting and tents. The type II insect repellent is intended for use in industrial impregnation of fabric used to manufacture the battle dress uniform and is not intended for direct purchase by the government.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type required (see 1.2).
- c. The specific issue of individual documents referenced (see 2.2.1 and 2.2.2).
- d. Packaging requirements (see 5).

6.3 Labels. An example of a label approved by the EPA for type I insect repellent is provided as figure 1.

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INSECT/ARTHROPOD REPELLENT FABRIC TREATMENT
FOR USE BY CERTIFIED OR TRAINED PERSONNEL ONLY
FOR MILITARY USE ONLY
OUTER CLOTHING AND BED NETTING TREATMENT ONLY

EPA Reg. No. 63120-1

EPA Est. No.

ACTIVE INGREDIENT:

Permethrin*	40.00%
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INERT INGREDIENTS	60.00%
TOTAL	100.00%

Contains petroleum distillates

*(3-phenoxyphenyl) methyl (\pm) cis-trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-
 cyclopropanecarboxylate; cis/trans isomers ratio: min 35% (\pm) *cis* and max 65% (\pm) *trans*

NET CONTENTS: 5.1 fluid oz (151 ml)

DANGER
KEEP OUT OF REACH OF CHILDREN

SEE BACK PANEL FOR ADDITIONAL PRECAUTIONS

Produced and Packaged for:
 DEPARTMENT OF DEFENSE
 DEFENSE GENERAL SUPPLY CENTER
 RICHMOND, VIRGINIA 23297-5000

FIGURE 1. Example of approved EPA label.

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PRECAUTIONARY STATEMENTS HAZARD TO HUMANS AND DOMESTIC ANIMALS

DANGER

Corrosive. Causes irreversible eye damage. Do not get in eyes or on clothing. Wear protective eyewear (goggles, face shield, or safety glasses). Harmful if swallowed. Wash thoroughly with soap and water after handling fluid, container, or wet treated clothing and before eating and smoking. Remove contaminated clothing and wash clothing before use.

FIRST AID

IF IN EYES:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice.
IF SWALLOWED:	Immediately call a poison control center or doctor for treatment advice. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give any liquid to the person. Do not give anything by mouth to an unconscious person.
IF INHALED:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for treatment advice.
IF ON SKIN:	Rinse skin immediately with plenty of water for 15-20 minutes. Call poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also call the National Pesticide Telecommunications Network at 1-800-858-7378 for emergency medical treatment advice.

NOTE TO PHYSICIAN

This product contains a pyrethroid and a petroleum solvent. The possibility of aspiration pneumonia must be considered. The product can cause severe eye damage; ophthalmology consultation is recommended. Mucosal damage may contraindicate the use of gastric lavage.

ENVIRONMENTAL HAZARD

This pesticide is extremely toxic to fish and other aquatic organisms. Do not apply directly to any body of water. Do not contaminate water by cleaning of equipment or disposal of equipment washwaters.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame.

FIGURE 1. Example of approved EPA label - Continued.

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DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Treated uniform, netting and tentage provides protection to covered areas of body from bites of mosquitoes, ticks, chiggers, and human body lice.

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DO NOT APPLY TO SKIN. Keep away from food, eating utensils, and water supplies. Thoroughly wash any items contaminated with this product. Wear protective gloves when mixing and loading.

Application Procedure: TO AVOID INHALATION, APPLICATOR MUST WEAR RESPIRATOR. Thoroughly clean 2-gallon field sprayer by triple rinsing with clean water. Place entire contents of permethrin container into two gallons of clean water in a 2-gallon field sprayer. Agitate and bring to a pressure of 55 psi. For clothing: Place each article of Battle Dress Uniform (jacket and trousers) on the ground and spray each side for 50 seconds at 55 psi. Hang the uniform for 3 hours or until dry. When dry, garment is ready to wear. Mark uniform with date of treatment. DO NOT RETREAT UNIFORM; one treatment is effective for life of the uniform. DO NOT TREAT UNDERWEAR OR CAP. For bednet: Spread netting on the ground and spray at a distance of 12-18 inches using a fan nozzle at 55 psi. Spray with a slow sweeping motion to completely cover the netting fabric without runoff.

STORAGE: Do not store at temperatures below 40 °F (4.5 °C). Store product in original container in a locked storage area. Store and transport in upright position.

DISPOSAL: *If empty* - Do not reuse this container. Do not rinse unless required for recycling. Place in trash. *If partially filled* - Call your local solid waste agency or 1-800-CLEANUP for disposal instructions. Unless otherwise instructed, place in the trash. Never pour unused product down the drain or on the ground.

FIGURE 1. Example of approved EPA label - Continued.

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6.4 Subject term (key word) listing.

arthropod
battle dress uniform
clothing
emulsion
netting

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:

Army - GL1
Air Force - 68

Preparing Activity:

DLA - GS3

(Project 6840-1417)

Review Activities:

Army - MD1
AFPMB - PM

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST database at <http://assist.daps.dla.mil>.