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METRIC
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DETAIL SPECIFICATION

INSECT REPELLENT, PERMETHRIN

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

1. SCOPE

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

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 documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Standards. The following standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any other data which may be of use in improving this document should be addressed to: Defense Supply Center Richmond (DSCR), ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610 by using Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6840

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STANDARDS

FEDERAL

FED-STD-101 - Test Procedures for Packaging Materials
FED-STD-595 - Colors Used in Government Procurements

(Unless otherwise indicated, copies of the above standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2.2 Other government publications. The following other government publication forms a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR Part 152 - Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act

(Copies are available from the Pesticide Regulations Division, Environmental Protection Agency, 401 M Street, S.W., Washington, DC 20460.)

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.

3. REQUIREMENTS

3.1 Classification. The insect repellent shall be of the following types as specified (see 6.2).

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

Type II - In drums for industrial application to fabric.

3.2 Insect repellent solution. The insect repellent concentrate for the type I and type II application methods shall meet the requirements specified in 3.2.1 through 3.2.3. 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.

3.2.1 Composition. The insect repellent concentrate for the type I and type II application methods shall consist of: 40-42% by weight permethrin, U.S. Patent No. 4,024,163, (3-phenoxyphenyl)-methyl (±)cis/trans-3-(2,2-dichloroethenyl)-2,2-dimethyl-

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cyclopropanecarboxylate; cis/trans isomers ratio: min. 35% (±) cis and max. 65% (±) trans, and the balance 58-60% by weight inert petroleum distillates.

3.2.2 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.

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

3.3 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.

3.4 Type I. The insect repellent solution for type I spray method shall meet the requirements of 3.2 through 3.2.3 and shall be furnished in 151 mL quantities.

3.4.1 Plastic bottle, 151 mL. One hundred and fifty one (151) mL of insect repellent concentrate shall be supplied in a fluorinated, high density polyethylene (2F HDPE) bottle with UV blocker conforming to UNIP.2. The color of the bottle shall approximate Olive Drab (color chip 24097), Brown (color chip 30051) or Amber (color chip 32169) of FED-STD-595, (see 6.4.3).

3.4.2 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, which 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.

3.5 Type II, industrial method. The insect repellent concentrate for the type II industrial method shall meet the requirement specified in 3.2 through 3.2.3.

3.6 Application, types I and II. The application procedure for the type I spray method shall be as specified on the label affixed to the bottle. For the type II industrial method, 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.

3.7 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 approximately Olive Drab (color chip 24097) or Brown (color chip 30051), or Amber (color chip 32169) of 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 40 CFR 152 of the Federal Insecticide, Fungicide, and Rodenticide Act as amended. Labels shall contain, as a minimum: (1) the name, brand, or trademark under which

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the product is sold, (2) the name and address of the producer, registrant, or person, for whom produced, (3) the net contents, (4) the product registration number, (5) the producing establishment, (6) an ingredient statement, (7) warning or precautionary statement, (8) directions for use, and (9) the use(s) classification (see 6.3). 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).

3.8 Workmanship. The end items shall conform to the quality of product established by this specification.

4. VERIFICATION

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

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed on a lot. The lot size shall be expressed in units of filled unit containers. The sample unit shall be one filled container.

4.3 Conformance inspection. Conformance inspection shall be performed in accordance with inspection provisions set forth herein. The characteristics shown in 3.2, 3.4.1, 3.7 and 3.8 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.

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

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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 3.2. 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 that follow. 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.

Examine	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 unacceptable if the average net contents per container, for all sample units examined, is less than or more than that 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 hot water technique of test method 5009 of FED-STD-101. A stream of air bubbles shall be considered evidence of leakage.

4.4.5 Labels.

4.4.5.1 Resistance to water, for type I and type II. The unit container shall be completely immersed in water at 20°C to 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 and type II. The unit container shall be completely immersed in the type and concentration of repellent contained therein at 20°C to 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.

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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 liquid 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.

4.5.1.2.1 AgrEvo Environmental Health, Permanone® 40 Manufacturer's Concentrate, standard.

4.5.1.2.2 Acetone, HPLC pure.

4.5.1.2.3 High purity helium.

4.5.1.2.4 Compressed air.

4.5.1.2.5 Hydrogen.

4.5.1.3 Apparatus.

4.5.1.3.1 Gas chromatograph. Hewlett Packard Model 5890, or equivalent, gas chromatograph equipped with Flame Ionization Detector (FID) and autosampler.

4.5.1.3.2 Column. A 6-foot by 2mm id glass column.

4.5.1.3.3 Packing. A 3% OV-101 on 100/120 Chromosorb W-HP.

4.5.1.3.4 Hewlett Packard Chemstation.

4.5.1.4 Conditions.

4.5.1.4.1 Flow (He). 30 mL/min.

4.5.1.4.2 Flow (H). 30 mL/min.

4.5.1.4.3 Flow (Air). 400 mL/min.

4.5.1.4.4 Initial temperature. 230°C.

4.5.1.4.5 Initial time. 0.0 min.

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4.5.1.4.6 Temperature program rate. 10°/min.

4.5.1.4.7 Final temperature. 245°C.

4.5.1.4.8 Final time. 7.0 min.

4.5.1.4.9 Runtime. 8.5 min.

4.5.1.4.10 Injector temperature. 250°C.

4.5.1.4.11 Detector temperature. 275°C.

4.5.1.4.12 Injection volume. 2 µl.

4.5.1.5 External integrator settings.

4.5.1.5.1 Attenuation. 7.

4.5.1.5.2 Threshold. 5.

4.5.1.5.3 Peak width. 0.04.

4.5.1.5.4 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, Permanone® 40 Manufacturing Concentrate to the nearest 0.001 g 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 g 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%.) Do the same for the sample. Calculate the percent purity by using the following formula.

$$\% \text{ Purity} = \frac{\text{Average sample area x Weight of standard x 100}}{\text{Average standard area x Weight of sample}}$$

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

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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.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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 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 of individual outer clothing units, such as the Battle Dress Uniform, insect netting and tentage. The type II 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. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.2.2).
d. Packaging requirements (see 5.1)

6.3 Labels. An example of a label approved by the EPA for type I insect repellent follows:

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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.
ACTIVE INGREDIENT:	
Permethrin*	40.00%
INERT INGREDIENTS	60.00%
TOTAL	100.00%

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

NET CONTENTS: 5.1 fluid oz (151 mL)

WARNING
KEEP OUT OF REACH OF CHILDREN

SEE BACK PANEL FOR ADDITIONAL PRECAUTIONS

Produced and Packaged For:

DEPARTMENT OF DEFENSE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA 23297-5000

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

WARNING

HARMFUL IF SWALLOWED OR INHALED
CAUSES EYE IRRITATION

DO NOT APPLY TO SKIN. Keep away from food, mess gear and water supplies. Thoroughly wash mess gear if contaminated with this product. Avoid breathing vapors or contact with face, eye, or skin. Wash thoroughly after handling fluid, container, or wet treated uniform and before eating and smoking. Wear protective gloves when mixing and applying.

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STATEMENT OF PRACTICAL TREATMENT FOR EXPOSURE TO PERMETHRIN FLUID IN SMALL BOTTLES

If on skin: Wash affected areas with soap and water.
If in eyes: Flush eyes with plenty of water. Contact physician if irritation persists.
If swallowed: Contact a physician or Poison Control Center immediately. Do not induce vomiting unless directed by a physician. Vomiting may cause aspiration pneumonia.
If inhaled: Remove person to a well ventilated area. Apply artificial respiration if indicated.

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 equipment or disposal of equipment wash water.

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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Application procedure: TO AVOID INHALATION, APPLICATOR MUST WEAR RESPIRATOR. Thoroughly clean 2-gallon field sprayer by triple rinsing with clean water. Add entire contents of permethrin container to 2-gallons of clean water in a 2-gallon field sprayer. Agitate and bring to a pressure of 55 psi. For clothing: Place 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 RE-TREAT UNIFORMS; 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 without runoff.

STORAGE AND DISPOSAL: Do not store below 32°F. Do not contaminate water, food, or mess gear by storage or disposal. Recap empty permethrin container, place in plastic bag and put in trash.

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6.4 Sources.

6.4.1 Permethrin. Permethrin can be purchased from AgrEvo Environmental Health, 95 Chestnut Ridge Road, Montvale NJ 07645 as Permanone® 4O Manufacturing Concentrate.

6.4.2 Marking pen. Marking pen can be purchased from Mark-Tex Corporation, 161 Coolidge Avenue, Englewood, NJ 07631.

6.4.3 Permethrin bottles. Bottles can be purchased from Lawson, Mardon and Wheaton, Wheaton Avenue, Millville, NJ 00332.

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6.5 Subject term (key word) listings.

Arthropod
Arthropod repellent
Battle dress uniform
Bites protection
Clothing
Clothing application
Permanone
Pyrethroid
Uniform treatment

Custodians:
Army - GL1
Air Force - 68

Reviewers:
Army - MD1, EA
AFPMB - PM

Preparing Activity:
DLA - GS
(Project 6840-1049)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-DTL-44411B	2. DOCUMENT DATE (YYMMDD) 980121

INSECT REPELLENT, PERMETHRIN

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON *(if applicable)*	**7. DATE SUBMITTED** (YYMMDD)

8. PREPARING ACTIVITY

a. NAME	b. TELEPHONE *Include Area Code)*
Defense Supply Center Richmond	(1) Commercial (804) 279-5019 (2) AUTOVON 695-5019
(DSCR) ATTN: DSCR-VBD 8000 Jefferson Davis Highway Richmond, VA 23297-5610	