INCH-POUND

MIL-F-2312F
24 April 1989
SUPERSEDING
MIL-F-2312E
28 September 1984

MILITARY SPECIFICATION

FELT, HAIR OR WOOL: MILDEW RESISTANT AND MOISTURE RESISTANT TREATMENT FOR

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

1. SCOPE

1.1 Scope. This specification governs the mildew resistant and moisture resistant treatment of hair or wool felt.

1.2 Classification. The finished felt treatment shall be of the following types as specified (see 6.2):

Type I - Mildew resistant
Type II - Moisture resistant
Type III - Mildew resistant and moisture resistant

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 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 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 pertinent data which may be of use in improving this document should be addressed to: U.S Army Natick Research, Development, and Engineering Center Natick, MA 01760-5014 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8305

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STANDARDS

FEDERAL

FED-STD-191 - Textile Test Methods

MILITARY

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

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

Chromatic Transference Scale

(Application for copies should be addressed to the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

(Non-Government standards and other publications are normally available from the organizations that prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

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 Material. The felt to be treated in accordance with this document shall conform to the requirements of the felt specification cited in the applicable acquisition document (see 6.2).

3.1.1 Physical requirements. Tests for physical properties of the finished felt specified herein shall be conducted as specified in 4.2.3

3.1.1.1 Finished weight and thickness. The following plus tolerance in weight and thickness will be allowed for the treated felt, based on the maximum specified for the untreated felt, when tested as specified in 4.2.3.

Type I	-	15 percent maximum
Type II	-	15 percent maximum
Type III	-	20 percent maximum

3.1.2 Color. When undyed felt is specified, the color of the treated felt may deviate from the natural state to that degree imposed by the color of the treating agent used. The color of the dyed felt prior to the application of the finish shall, unless otherwise specified, match the standard sample. When dyed felt is specified. the color of the treated felt shall be that resulting from the combination of the base color and the color imparted by the specified finish.

3.1.3 Soluble matter, nonfibrous material, and ash content. The felt, prior to the treatment, shall conform to the applicable requirements of the untreated felt specification for the amount of soluble matter, nonfibrous materials or ash content (see 4.2.3).

3.2 Treatments.

3.2.1 Type I - mildew resistant. The felt shall be treated with either 2,2' methylene-bis-(4-chlorophenol), salicylanilide or copper-8-quinolinolate which has been solubilized for solvent application. The materials shall be dispersed and so formulated as to effect uniform penetration into the felt when applied.

3.2.1.1 Application. The application of the mildew inhibiting agent shall be such that the felt shall be well penetrated. The process shall provide a uniform deposit in the material and there shall be no noticeable crystallization of the inhibitor on the felt surface.

3.2.1.2 Concentration of inhibitors.

3.2.1.2.1 2,2' methylene-bis - (4-chlorophenol). The finished felt shall contain no less than 1.0 percent and no more than 3.0 percent of 2,2' methylene-bis - (4-cholorophenol) when tested as specified in 4.2.3.

3.2.1.2.2 Salicylanilide. The finished felt shall contain no less than 0.5 percent and no more than 1.5 percent of salicylanilide when tested as specified in 4.2.3.

3.2.1.2.3 Copper-8-quinolinolate. The finished felt shall contain not less than 1.0 percent and not more than 1.5 percent of copper-8-quinolinolate when tested as specified in 4.2.3.

3.2.2 Type II - Moisture resistant. Unless otherwise specified (see 6.2), the felt shall be treated with a wax or metallic-salt-wax compound or emulsion.

3.2.2.1 Application The application of the moisture resistant agents shall be such to provide a uniform deposit in the material and the treated felt shall show no more than 50 percent increase in weight, based on the conditioned weight of the sample, when tested by the immersion test specified in 4.2.3.

3.2.3 Type III - Mildew and moisture resistant. The treatment shall be a combination of type I and type II treatments and shall conform to the requirements specified for type I and type II when tested as specified in 4.2.3.

3.3 Length and put up The length and put up shall be as specified in the applicable felt specification.

3.4 Marking for identification. Each roll or sheet shall be identified in accordance with the applicable felt specification.

3.5 Fiber label. Fiber identification label or wool content label shall be in accordance with the applicable felt specification.

3.6 Workmanship. The treated felt shall conform to the quality of product established by this specification and the occurrence of defects shall not exceed the applicable acceptable quality levels.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to the requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material

4.1.2 Certificate of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

4.2 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.2.1 Component and material inspection. In accordance with 4.1, 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

4.2.2 End item visual examination. End item visual examination of the treated felt shall be as specified for the untreated felt in the applicable felt specification (see 6.2) except that:

a. For end item examination for visual or local defects, the following additional defect shall also apply:

Clearly visible crystallization of treatment on surface of felt - Major defect.

b. For end item examination for overall defects, the following additional defect shall also apply:

Non-uniform application of treatment clearly visible.

4.2.3 End item testing. End item testing of the treated felt shall be as specified for the untreated felt in the applicable felt specification (see 6.2) except that:

a. The applicable sample unit shall be increased by 1/2 yard for felt more than 40 inches wide and increased by 1 yard for felt 40 inches and less wide.
b. A certificate of compliance will be acceptable as evidence of conformance to the soluble matter, nonfibrous material, and ash content requirements.
c. The following additional tests shall also apply:

Characteristic	Requirement paragraph	Test method
Weight	3.1.1.1	5041 1/
Mildew inhibitor content, percent:		
2,2' methylene-bis-(4-chlorophenol)	3.2 1.2.1	2011 1/
Salicylanilide	3.2.1.2.2	4.3.2
Copper-8-quinolinolate	3.2.1.2.3	2060 1/
Moisture resistance	3.2 2.1	4.3.1 2/

1/ Applicable to FED-STD-191.

2/ Type II and type III treated felt shall be allowed to reach equilibrium under standard conditions as defined in FED-STD-191 prior to testing.

4.2.4 Packaging examination. Packaging examination of the treated felt shall be as specified for the untreated felt in the applicable felt specification (see 6.1).

4.3 Methods of inspection.

4 3 1 Immersion test. The immersion test shall be conducted in accordance with Method 5502 of FED-STD-191 Three 3 by 3-inch test specimens and an immersion time of 20 minutes shall be utilized in the test. The wringer procedure for the removal of the excess water shall not be used. In lieu thereof the following procedure shall be used:

After immersion for 20 minutes, the specimen shall be withdrawn and placed between two sheets of AATCC standard blotting paper. Without exerting extraneous downward pressure, roll once over and back with a 1-kilogram round steel bar approximately 1-3/4 inches in diameter by 3 inches long or equivalent. Remove the specimen quickly from the blotting paper and weigh and report as specified. The moisture resistance shall be the average of three determinations to nearest 1.0 percent.

4.3.2 Salicylanilide content test. The salicylanilide content test shall be performed as follows using the procedure and calculations in either 4.3.2.7 or 4.3.2.8.

4.3.2.1 Apparatus.

Spectrophotometer
Erlenmeyer flasks
Volumetric flasks
Nessler tubes
Glass funnel
Glass wool
Graduates
Pipettes
Beakers

4.3.2.2 Reagents. All chemicals shall be reagent grade and all water shall be distilled water

Salicylanilide
Methanol
Ammonium hydroxide
Disodium phosphate ($Na_2HPO_4 \cdot 12\ H_2O$)
Monosodium phosphate ($NaH_2PO_4 \cdot H_2O$)
Sodium nitrite
p-nitro-aniline-sulfonic acid (Na salt) or 2-amino-5-nitrobenzene sulfonic acid
HCl (2N)

4.3.2.3 Salicylanilide stock solution (0.1 mg/mL, see 4.3.2.7 and 4.3.2.8). Dissolve 1 g of salicylanilide in 20 mL of methanol. Add 4 mL fresh concentrated ammonium hydroxide. Dilute solution to 100 mL (in a 100 mL volumetric flask) with warm water. Take a 10 mL aliquot out of the above and dilute to 1 L in volumetric flask to obtain a stock solution which has a concentration of 0.1 mg/mL of salicylanilide.

4.3.2.4 Neutral buffer solution. Dissolve 161.5 g disodium phosphate .$12H_2O$ and 41.5 g of monosodium phosphate .H_2O in water and dilute to 1 L in a volumetric flask. The solution shall yield a PH of 6.5 to 7.5.

4.3.2.5 Color indicator. Dissolve 0.10 g of p-nitro-aniline-sulfonic acid (Na salt) or 2-amino-5-nitrobenzene sulfonic acid in 50 mL water in a 250 mL beaker. Add 2.50 mL 2N HCl and 0.30 mL of 2N sodium nitrite (138 g/L) at room temperature. Allow 5 minutes for color development, then dilute to 100 mL in a volumteric flask.

4.3.2.6 Extraction of salicylanilide. Condition untreated and treated felt at standard conditions. Cut a 1.10g sample of untreated felt for use as a blank. Cut two 1.10g samples from the same general area of the treated felt and identify as "A" and "B". Weigh the three conditioned samples to the nearest 0.01g and record as the conditioned weights. Use sample A to determine the salicylanilide content. Dry sample B to a constant weight at 105 to 110°C, weigh and record as the dry weight of sample B (use this value to calculate the dry weight of sample A, see 4.3.2.7). Since salicylanilide may be decomposed and driven off at high temperature, 110°C should not be exceeded. Separately cut untreated blank and sample A into fine pieces and place in separate 250 mL Erlenmeyer flasks. Add 50 mL methanol and 25 mL neutral buffer solution to each flask. Let stand 15 minutes, shaking frequently. Decant, leaving felt samples in flask, pour through glass wool lined funnel into 500 mL graduates. Repeat three times: the addition of methanol without buffer; the 15 minute standing (shaking frequently); and decanting through glass wool lined funnels into the two respective graduates. Add 50 mL boiling water to each flask, shake, and pour water with felt samples

and precipitates through applicable funnels into the graduates and adjust final volume in each graduate to about 300 mL by rinsing respective funnels with boiling water. Allow solutions to reach room temperature for final volume adjustment to 300 mL with distilled water.

4.3 2.7 Procedure and calculations (visual comparison). Shake filtrate to disperse any precipitate in graduate. Gravity filter through quantitative filter paper, 25 mL of each of sample A solution into each of two separate 100 mL Nessler tubes and 25 mL of blank sample solution into each of five different Nessler tubes. While filtering solutions, prepare the color indicator (see 4.3.2.5). Add 10.5 mL neutral buffer to each of Nessler tubes. Blanks only, pipette 6.5, 7.5, 8.5, 10, 12.5 mL of salicylanilide solution (0.1 mg/mL, see 4.3.2 3) into each of Nessler tubes, respectively. Pipette 5 mL of color indicator into each of the Nessler tubes and dilute to 50 mL with water. Shake well to mix thoroughly. Let stand 5 minutes. Compare samples with blanks containing known amounts of salicylanilide. If samples are lighter in color than any of blanks, pipette water into weakest blank until match is achieved. Take reading of amount of water added, pour off excess until 50 mL remains in tube. If sample is darker than any of the blanks, then add salicylanilide to strongest blank until match is achieved. Record additions. Repeat the above procedure making up two blanks in range determined to be the strength of sample. Then perform the following calculations.

a. Percent salicylanilide in sample equals:

$$\frac{(1200)\ (\text{grams of salicylanilide in blank})\ \left(\frac{50}{\text{final volume of blank in mL after dilution}}\right)}{\text{calculated dry weight (g) of sample A}}$$

NOTE: $\text{Calculated dry weight (g) of Sample A} = \text{Conditioned weight (g) of Sample A} \times \frac{\text{Dry weight (g) of Sample B}}{\text{Conditioned weight (g) of Sample B}}$

b. Examples:

1.) If treated pieces weighing 1.10 grams matches standard tube with 7.5 mL of salicylanilide, the calculation is:

$$\frac{0\ 00075 \times 300 \times 100}{25 \times 1.10} = \%\ \text{salicylanilide in sample}$$

2.) If treated sample is lighter than standard and 10 mL of water is added to tube containing 6.5 mL salicylanilide, the calculation is:

$$\frac{0.00065 \times 50/60 \times 300 \times 100}{25 \times 1.10} = \%\ \text{salicylanilide in sample}$$

3.) If treated sample is darker than standard and 3 mL of salicylanilide is added to tube containing 8.5 mL salicylanilide, the calculation is:

$$\frac{(0.00085 + 0.0003) \times 50/53 \times 300 \times 100}{25 \times 1.10} = \% \text{ salicylanilide in sample}$$

6.5	mL	=	0.71% based on 1.1 g dry sample weight
7.5	mL	=	0.82% based on 1.1 g dry sample weight
8.5	mL	=	0.93% based on 1.1 g dry sample weight
10.0	mL	=	1.09% based on 1.1 g dry sample weight
12.5	mL	=	1.36% based on 1 1 g dry sample weight

4.3.2.8 Procedure and calculations (spectrophotometer). Shake filtrate to disperse any precipitate remaining in graduate. Gravity filter all sample extracts through quantitative filter paper. Pipet 25 mL of treated sample extract into 50 mL volumetrtic flask. Pipet 25 mL of the untreated sample extract into each of seven separate 50 mL volumetric flasks. Pipet 1, 2, 3, 4, and 5 mL of stock solution of salicylanilide (0.1 mg/mL, see 4.3.2.3) separately into each of the respective volumetrics. Add 10.5 mL neutral buffer and 5 mL color indicator (see 4.3.2.5) to all volumetrics; standards and sample, and bring up to volume with a solution of methanol and water (50: 50, volume: volume). Mix well, wait 5 minutes for color development, and read absorbance at 457 nm on a spectrophotometer. Then perform the following calculations:

a. Plot standard curve of absorbance at 457 nm vs. mg of salicylanilide, 0.1, 0.2, 0.3, 0.4, and 0.5. Determine mg of salicylanilide in treated sample extract from graph, or alternatively calculated linear regression for standard curve and determine mg of salicylanilide in treated sample extract from equation.

b. Calculate the percent salicylanilide in treated felt as follows:

$$\text{Percent salicylanilide in treated felt} = \frac{(1.2)\ \text{salicylanilide in extract (mg)}}{\text{calculated dry weight of felt (g)}}$$

NOTE: $\text{Calculated dry weight (g) of Sample A} = \text{Condition weight (g) of Sample A} \times \frac{\text{Dry weight (g) of Sample B}}{\text{Conditioned weight (g) of Sample B}}$

If aliquot other than 25 mL is drawn for sample extracts, calculation must be modified as appropriate; e.g. 10 mL aliquot would boost factor from 1.2 to 3.

c. Examples:

Mg of salicylanilide in extract	Dry weight of felt (g)	Percent salicylanilide in felt
0.5	1.0	0.60
1.0	1.0	1.20
0.5	1.1	0.55
1.0	1.1	1.09

5. PACKAGING

5.1 Packaging The treated felt shall be preserved, packed and marked in accordance with the specification for the basic felt material

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 treatments are intended to be applied to felt covered by C-F-202, Felt Sheet (Hair) and Felt Roll (Hair), or C-F-206, Felt Sheet: Cloth, Felt, Wool, Pressed as applicable The treatments specified herein do not not apply to felt purchased for orthopedic or other medical uses.

6.2 Acquisition requirements Acquisition documents must 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 2.1.1 and 2.2)
d. When other than a wax or metallic-salt-wax compound or emulsion is required (see 3.2.2).

6.3 Subject term (key word) listing.

Felt, hair or wool
Mildew resistant treatment
Moisture resistant treatment

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

Custodians:
Army - GL
Navy - NU
Air Force - 99

Review activities:
Army - MD
Air Force - 82
DLA - CT

User activities:
Navy - AS, SH

Preparing activity:
Army - GL

(Project 8305-0269)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-F-2312F	Felt, Hair or Wool: Mildew Resistant & Moisture Resistant Treatment For

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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