MEASUREMENT
NOT SENSITIVE
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PERFORMANCE SPECIFICATION

LEATHER, CATTLEHIDE, FOR FOOTWEAR UPPERS AND GUSSET, CHROME TANNED, FATLIQUORED

This document is approved for use by all Departments and Agencies of the Department of Defense (DoD).

1. SCOPE.

1.1 Scope. This specification covers the performance requirements for leather from chrome tanned, fatliquored US cattlehide with full grain, corrected grain (fully finished or nubuck), or fleshout surface.

1.2 Classification. This specification covers the following types, classes, and treatments for leather.

1.2.1 Types.

Type I - Leather for vamp, quarters, foxing, backstay, pull tab
Type II - Leather for gusset, tongue, comfort top band, eyelet stays

1.2.2 Classes.

Class 1 - Full grain: Original grain surface of the skin intact.
Class 2 - Corrected grain, fully finished: The grain surface has been lightly buffed to lessen defects and a smooth pigmented finish applied.
Class 3 - Corrected grain, sueded nubuck: The grain surface has been lightly buffed or snuffed to produce a fine nap.
Class 4 - Fleshout: Leather is used flesh (rough) side out. The flesh surface is buffed to produce a uniform nap. The grain surface, closest to the foot, is lightly buffed.

Comments, suggestions, or questions on this document should be addressed to: DLA Troop Support Standardization Team, 700 Robbins Avenue, Philadelphia, PA 19111-5096.
Since contact information can change, you may want to verify the currency of the address information using Acquisition Streamlining and Standardization Information System (ASSIST) online database https://assist.dla.mil.

AMSC N/A FSC 8330

1.2.3 Treatments.
Treatment A - Treated for resistance to water absorption
Treatment B - Treated for resistance to water penetration
Treatment AB - Treated for resistance to water absorption and penetration
Treatment C - Not treated for resistance to water
Treatment D - Treated for resistance to staining
Treatment ABD - Treated for resistance to water absorption, water penetration, staining

NOTE: As an option, comfort top band and eyelet stays may conform to Type I, Treatment AB.

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

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those specified in the solicitation or contract.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC Test Method 118 - Oil Repellency: Hydrocarbon Resistance Test
AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale
AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles

(Copies are available on line at http://www.aatcc.org/ or from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR QUALITY (ASQ)

ANSI/ASQ Z1.4 – Sampling Procedures and Tables for Inspection by Attributes

(Copies are available online at http://www.asq.orq or from the American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM D1610 - Standard Practice for Conditioning Leather and Leather Products for Testing
ASTM D2098 - Standard Test Method for Dynamic Water Resistance of Shoe Upper Leather by the Dow Corning Leather Tester

ASTM D2099 - Standard Test Method for Dynamic Water Resistance of Shoe Upper Leather by the Maeser Water Penetration Tester
ASTM D2212 - Standard Test Method for Slit Tear Resistance of Leather
ASTM D2617 - Standard Test Method for Total Ash in Leather
ASTM D2807 - Standard Test Method for Chromic Oxide in Leather (Perchloric Acid Oxidation)
ASTM D2810 - Standard Test Method for pH of Leather
ASTM D2813 - Standard Practice for Sampling Leather for Physical and Chemical Tests
ASTM D2868 - Standard Test Method for Nitrogen Content (Kjeldahl) and Hide Substance Content of Leather, Wet Blue and Wet White
ASTM D3495 - Standard Test Method for Hexane Extraction of Leather
ASTM D3790 - Standard Test Method for Volatile Matter (Moisture) of Leather by Oven Drying
ASTM D4705 - Standard Test Method for Stitch Tear Strength of Leather, Double Hole
ASTM D6012 - Standard Test Method for Determination of Resistance of Leather to (Bleeding) Color Stain Transfer
ASTM D6015 - Standard Test Method for Static Water Absorption of Leather

(Copies are available online at http://www.astm.org or from the ASTM INTERNATIONAL, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19426-2959.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, 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 Inspections.

3.1.1 Conformance inspection. When specified (see 6.2), a sample shall be subjected to conformance inspection in accordance with 4.3.

3.2 Standard sample. The finished leather shall match the standard sample for shade and surface appearance, and unless otherwise indicated, shall be equal to or better than the standard sample with respect to all characteristics for which the sample is referenced (see 6.3).

3.3 Recycled, recovered or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Material. The leather shall be full grain, corrected grain (fully finished or nubuck), or fleshout from US chrome tanned cattlehide sides suitable for footwear uppers and gussets.

3.5 Color. The color shall be as specified in the contract/end item document (see 4.5.1).

3.5.1 Color transfer. Except as noted below, the side of leather closest to the foot shall be tested for color transfer (bleeding) in accordance with paragraph 4.4. The stain on the test pad shall be evaluated using AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale and shall have a grade not less than 3.
NOTE: Leather which has a natural colored (i.e. Desert Sand, Olive, Coyote) flesh side that has been subject to small amounts of dye added to the drum in order to level the shade of the natural color need not be tested for staining.

3.6 Surface appearance. Class 2, Class 3 and Class 4 shall be buffed or snuffed only to the extent that is necessary to remove superficial blemishes. The grain side of Class 1 and Class 2 leather may have a light application of finish containing only sufficient pigment to assist in making the color uniform.

NOTE: A fine hair cell embossed pattern for Class 1 and Class 2 may be applied to the grain surface of the side. If embossed, the leather shall match the standard sample for fine hair cell pattern. Heavily printed (embossed) leather shall not be permitted, unless otherwise stated in the footwear specification. Leather previously dyed or finished in a color not specified and then redyed or refinished a specified color shall not be acceptable.

3.7 Fungicide. One of the following leather fungicides is required.

3.7.1 2-(Thiocyanomethylthio) benzothiazole (TCMTB). The leather shall contain no less than 100 parts per million (ppm) and no more than 400 ppm of active ingredient 2-TCMTB (see 4.5.2.1).

3.7.2 Diiodomethyl paratolylsulfone (DMTS). The leather shall contain no less than 300 ppm and no more than 2000 ppm (see 4.5.2.2).

3.8 Water and/or stain resistant treatment. When treatment A, B, AB, D, or ABD is specified, the leather shall meet the following requirements as applicable.

3.8.1 Treatment A (water absorption). When treatment A is specified, 100 percent of the specimens of leather shall gain no more than 30 percent of their weight by water absorption when tested as specified in paragraph 4.4.

3.8.2 Treatment B (water penetration resistance). When treatment B is specified, at least 80 percent of the specimens tested shall withstand no less than 15,000 cycles by ASTM D2099 or no less than 4,000 cycles by ASTM D2098 without water penetration, when tested as specified in paragraph 4.4.

3.8.3 Treatment AB (water absorption/penetration resistance). When treatment AB is specified, paragraphs 3.8.1 and 3.8.2 shall apply.

3.8.4 Treatment D (stain resistance). When treatment D is specified, the leather shall meet the following requirements as applicable.

3.8.4.1 Leather oil repellency. The leather shall receive a minimum grade of 5.0 when the top leather surface is tested as specified in 4.4.

3.8.4.2 Leather resistance to wetting. The leather shall receive a minimum grade of 7.0 when the top leather surface is tested as specified in 4.4.

3.8.5 Treatment ABD (water absorption/penetration/stain resistance). When treatment ABD is specified, paragraphs 3.8.1, 3.8.2, and 3.8.4 shall apply.

3.9 Tearing strength (slit tear) Type I. At least 80 percent of the specimen tested shall have tearing strength values of not less than 28-pounds and none below 20-pounds when tested as specified in paragraph 4.4.

3.10 Stitch tear strength Type II. At least 80 percent of the specimen tested shall have stitch tearing strength values of not less than 30-pounds when tested as specified in paragraph 4.4. Tear strength for eyelet stay and top band shall not apply.

3.11 Chemical requirements. The leather shall conform to the chemical requirements in Table I when tested as specified in paragraph 4.4.

TABLE I. Chemical requirements

CHARACTERISTICS	MINIMUM	MAXIMUM
Hexane Soluble material, percent 1/	4.0	16.0
Chromic oxide shall be calculated on a hide substance basis, percent 1/, 2/	4.0	7.5
Non-determined material, percent (Type I) 1/	-	20.0
pH value	3.0	4.0
Total ash, percent (Type I) 1/	-	10.0

1/ Calculated on a moisture-free basis according to ASTM D3790.
2/ Calculated on a hide substance basis according to ASTM D2868.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Conformance inspection (see 4.4)

4.2 Conformance inspection. Conformance inspection (see 3.1.1) shall include the tests of 4.4 through 4.5.3 as applicable. A sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4 and with quality acceptance limits as specified in the contract and/unless otherwise specified, sampling for inspection shall be performed in accordance with ASTM D2813the referenced documents (see 6.2).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with all the requirements of referenced documents, unless otherwise excluded, amended, modified or qualified in this specifications or applicable procurement documents (see 6.2)

4.4 Material testing. The leather shall be tested for the characteristics listed in Table II. The methods of testing as specified wherever applicable and as listed in Table II shall be followed. All test reports shall contain the individual values utilized in expressing the final results. All specimens shall be conditioned according to ASTM D1610 prior to testing. Sampling shall be in accordance with ASTM D2813. Samples should be marked to indicate the location of the backbone and root of the tail. The lot shall be rejected if any one of the following conditions exists:

a) More than 20 percent of the specimens fail to meet the water penetration, slit or stitch tearing strength.
b) Any specimen fails requirements for water absorption, color transfer or stain resistance.
c) Any slit tear specimen falls below 20 pounds.
d) Any composite test result fails to meet the specified requirements.

The sample size shall be in accordance with the following:

Lot size (square feet)	Sample size (sides)
Up to 15,000	10
15,000 to 25,000	15

TABLE II. Material tests.

CHARACTERISTICS	REQUIREMENT PARAGRAPH	TEST METHOD	SAMPLE UNIT	COMPOSITION
Material	3.4	Visual	-	-
Tannage	3.4	Visual	-	-
Color transfer	3.5.1	ASTM D6012 1/	X	-
Surface appearance	3.6	Visual	-	-
Fungicide	3.7	4.5.2	-	X
Water absorption (Treatment A)	3.8.1	ASTM D6015	X	-
Water penetration (Treatment B)	3.8.2	ASTM D2098 or ASTM D2099 2/	X	-
Stain resistance (Treatment D)				
Oil repellency	3.8.4.1	AATCC 118	X	-
Water repellency	3.8.4.2	AATCC 118 3/	X	-
Tearing strength -Slit (Type I)	3.9	ASTM D2212	X	-
Stitch tearing strength (Type II)	3.10	ASTM D4705	X	-

TABLE II. Material tests – Continued

CHARACTERISTICS	REQUIREMENT PARAGRAPH	TEST METHOD	SAMPLE UNIT	COMPOSITION
Chemical treatments:				
Hexane –Soluble Material	3.11, Table I	ASTM D3495	-	X
Chromic oxide	3.11, Table I	ASTM D2807	-	X
Non- determined material (Type I)	3.11, Table I	4.5.3	-	X
pH value	3.11, Table I	ASTM D2810	-	X
Total ash (Type I)	3.11, Table I	ASTM D2617	-	X

1/ Use AATCC Evaluation Procedure 8, AATCC 9-Step Chromatic Transference Scale
2/ Test method used shall be referenced in the test report.
3/ AATCC 118, except that a water/isopropyl alcohol mixture as shown in Table III shall be used in place of AATCC Table 1- Standard Test Liquids (Hydrocarbons).

TABLE III. Water and isopropyl alcohol mixture

	Test Liquid Ratio	
Grade	Water	Isopropyl
0	100	0
1	90	10
2	80	20
3	70	30
4	60	40
5	50	50
6	40	60
7	30	70
8	20	80
9	10	90
10	0	100

4.5 Methods of testing and evaluation

4.5.1 Visual shade matching. The color and appearance of the leather (when applicable) shall match the standard sample when viewed using the AATCC Evaluation Procedure 9, Option A, with sources simulating artificial daylight D75 illuminant with a color temperature of 7500 (± 200) K illumination of 100 (±20) foot candles, and shall be a good match to the standard sample under incandescent lamplight at 2856 (± 200) K.

4.5.2 Fungicide.

4.5.2.1 2-(Thiocyanomethylthio) benzothiazole (TCMTB). Testing to determine the concentration of Busan 30 L in the leather shall be conducted by using Buckman Laboratories standard test method for 2-(Thiocyanomethylthio) Benzothiazole Analysis of Leather by High Pressure Liquid Chromatography (HPLC). This method may be obtained by contacting Buckman Laboratories (see 6.5).

4.5.2.2 Diiodomethyl-*para*-tolylsulfone (DMTS). The chemical concentration in the leather shall be conducted using the HPLC test method as follows:

4.5.2.2.1 Grinding. Grind the leather according to ASTM D2813.

4.5.2.2.2 Stock standard preparation. Weigh accurately approximately 100 milligrams (mg) of Diiodomethyl-*para*-tolylsulfone Internal Reference Standard (IRS), into a 100 milliliter (ml) volumetric flask. Add approximately 50 ml of acetonitrile, stopper and sonicate to aid dissolution (about 1 minute). Dilute to volume with acetonitrile.

4.5.2.2.3 Working Standards Preparation. Transfer 3ml aliquots of the Stock Standard Preparation in to 25, 50, 100, and 250ml volumetric flasks. Dilute to volume with acetonitrile. These standards contain approximately 120, 60, 30 and 12 ppm of Diiodomethyl-*para*-tolylsulfone.

NOTE:
(1) A lower standard may be required for samples containing very low levels of Diiodomethyl-*para*-tolylsulfone.
(2) Solutions must be stored in darkness to prevent degradation. Minimize exposure to light during preparation and use. The Standard Preparations may be retained one month.

4.5.2.2.4 Sample preparation. Accurately weigh 3 to 5-grams of sample into a 150ml beaker. Add 75-100ml of acetonitrile. Cover samples with parafilm; mix 16 to 24 hours on magnetic stir plate. The following day, allow samples to settle; remove necessary amount of acetonitrile and inject.

NOTE: Samples may have to be diluted further to fall within standard curve.

4.5.2.2.5 Testing equipment:

a) HPLC System with variable ultraviolet (UV) detector and integrating computer. Suitable syringe and glassware.
b) A micro-Bondapak C18 column (Waters Associates PIN 2734) or equivalent.
c) 0.45-micron polycarbonate filters (Nuclepore Corporation, Catalog No. 111107) or equivalent.
d) Calculator capable of doing linear regression.
e) Reagents: Acetonitrile (Chromatographic grade).

4.5.2.2.5.1 Typical mobile phase. Mix 550ml of distilled water and 450ml of acetonitrile. Filter and degas the solution. The concentration may be varied to meet system suitability requirements within range 50 percent to 40 percent acetonitrile.

4.5.2.2.5.2 Typical chromatographic conditions:

Injection Volume	20 Microliters
Flow	2.5 ml/minute
Detector	235 nm

4.5.2.2.6 System suitability. Inject the highest working standard until 2 percent agreement is reached between two (2) successive injections. Chromatograph for approximately 15 minutes. Confirm separation of the for monoiodomethyl-*para*-tolylsulfone peak from the Diiodomethyl-*para*-tolylsulfone peak. Elution for Monoiodomethyl-para-tolylsulfone is about 6 minutes and for Diiodomethyl-paratolylsulfone is about 8.5 minutes.

4.5.2.2.7 Procedure. Inject each standard and sample preparation in duplicate allowing each injection to run for at least 15 minutes. Measure the peak response for the Diiodomethyl-*para*-tolylsulfone.

NOTE: The run time may have to be increased for samples with late eluting peaks. Perform a linear regression of peak response (area) versus concentration for each of the components.

For each component:

$$\text{Concentration (ppm) in leather} = \text{Concentration (ppm) from linear regression.} \times \frac{\text{volume of acetonitrile (ml)}}{\text{Sample wt(g)}}$$

4.5.3 Non-determined material (Type I). The percent non-determined material shall be calculated as follows:

Non-determined material, percent = 100-(A+B+C)

Where A = Percent Hexane extractable material determined as specified in Table II.
B = Percent ash determined as specified in Table II.
C = Percent Hide Substance determined as specified in ASTM D2868

NOTE: Non- determined material is reported on a moisture-free basis, and therefore the values A, B, and C used in the calculation are also on a moisture free basis.

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 or in-house contractor 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 activities within the Military department 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.

6 NOTES:

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory or contractually binding.)

6.1 Intended use. The cattlehide leather will be used in the upper and gusset leather parts of general purpose footwear.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification
b. Type, Class, and Treatment required (see 1.2)
c. Conformance inspection acceptance (see 3.1.1 and 4.2)
d. Color as specified in end item footwear document (see 3.4)
e. When fungicides are not required (see 3.6)
f. Packaging (see 5.1)

6.3 Standard sample. For access to samples address the contracting activity issuing the invitation for bids or request for proposal.

6.4 Subject term (key word) listing
Boots
Corrected Grain, Fully Finished
Corrected Grain, Sueded Nubuck
Fleshout
Full Grain
Shoes

6.5 Buckham Laboratories:
1256 North McLean Blvd.,
Memphis, TN 38108-1241,
telephone: (901) 278-0330
email: knetix@buckman.com

6.6 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 – 11

Preparing activity:
DLA-CT

Project Number: 8330-2016-001

Review activities:
Army - MD

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 ASSIST Online database at https://assist.dla.mil.