

PURCHASE DESCRIPTION

BOOT, COMBAT, TEMPERATE WEATHER, ARMY

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

1. SCOPE

1.1 Scope. This Purchase Description covers the requirements for a Desert Sand-colored, waterproof, temperate weather combat boot for Infantry, Flight and Combat Vehicle Crewman use.

1.2 Classification. The boot will be available in the following sizes and widths as specified (see 6.2).

1.2.1 Schedule of sizes and widths.

Size:	2 through 15 (whole and half sizes), 16 (whole size only)			
Widths:	Narrow	(B)	Wide	(EE)
	Regular	(D)	X-Wide	(EEEE)

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 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, 4, or 5 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.

Comments, suggestions, or questions on this document should be addressed to: Department of the Army, Natick Soldier Research, Development and Engineering Center, Kansas St., Natick MA 01760. ATTN: RDNS-WPW-C.

## COMMERCIAL ITEM DESCRIPTIONS

A-A- 55093 - Laces, Nylon

## DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-41814 - Counter, Footwear

MIL-DTL-32075 - Label: For Clothing, Equipage, and Tentage, (General Use)

MIL-PRF-3122 - Leather, Cattlehide, for Footwear for Uppers and Gussets, Chrome Tanned, Fatliquored

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

2.2.2 Other Government documents. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues shall be those cited in the solicitation or contract.

## DRAWINGS

### DLA TROOP SUPPORT

2-1-1635 - Speed Lace Assembly

(Copies of drawings are available from the DLA Troop Support, 700 Robbins Avenue, Philadelphia, PA 19111-5096, Attn: DSCP-CRFD-TDR.)

(Copies of documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

## ENVIRONMENTAL PROTECTION AGENCY

Regulations for the Enforcement of the Federal Insecticide, Fungicide and Rodenticide Act (40 CFR Part 162)

(Copies are available online at <http://www.epa.gov> pesticides or from the Environmental Protection Agency, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460.)

## FEDERAL TRADE COMMISSION

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies are available online at <http://www.ftc.gov> or from the Federal Trade Commission, 600 Pennsylvania Avenue, N.W., Washington, DC 20580-0001.)

2.3 Non-Government standards and other publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract (see 6.2).

#### AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

- AATCC Test Method - 22 Water Repellency: Spray Test
- AATCC Test Method - 100 Assessment of Antibacterial Finishes on Textile Materials
- AATCC Test Method - 118 Oil Repellency, Hydrocarbon Resistance Test
- AATCC Test Method - 127 Water Resistance: Hydrostatic Pressure Test
- AATCC Evaluation Procedure 9, Visual Assessment of Color Difference of Textiles

(Copies of documents 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

- ANSI/ASQ Z1.4 - Sampling Procedures and Tables for Inspection of Attributes

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

#### AMERICAN TYPE CULTURE COLLECTION (ATCC)

- ATCC – 6538 - Staphylococcus Aureus
- ATCC – 9027 - Pseudomonas Aeruginosa
- ATCC – 373 - Corynebacterium Xerosis

(Information available online at <http://www.atcc.org> or from the American Type Culture Collection (ATCC), P.O.Box 1549, Manassas VA 20108 USA.)

#### ASTM INTERNATIONAL

- ASTM D 297 - Standard Test Methods for Rubber Products-Chemical Analysis
- ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers (Tension Elongation)
- ASTM D 471 - Standard Test Methods for Rubber Property-Effect of Liquids
- ASTM D 624 - Standard Test Methods for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- ASTM D 751 - Standard Test Methods for Coated Fabrics (Hydrostatic Resistance or Breaking Strength)
- ASTM D 1052 - Standard Test Methods for Measuring Rubber Deterioration-Cut Growth Using Ross Flexing Apparatus
- ASTM D 1630 - Standard Test Methods for Rubber Property-Abrasion Resistance (Footwear Abrader)
- ASTM D 1777 - Standard Test Methods for Thickness of Textile Materials

- ASTM D 2208 - Standard Test Methods for Breaking Force and Elongation, Grab Method
- ASTM D 2240 - Standard Test Methods for Rubber Property-Durometer Hardness
- ASTM D 3273 - Standard Test Methods for Resistance to Growth of Mold
- ASTM D 3574 - Standard Test Methods for Flexible Cellular Materials- Slab, Bonded, and Molded Urethane Foams
- ASTM D 3787 - Standard Test Methods for Bursting Strength of Textiles Constant-Rate-of-Traverse (CRT) Ball Burst Test
- ASTM D 3886 - Standard Test Methods for Abrasion Resistance for Textile Fabrics (Inflated Diaphragm Apparatus)
- ASTM D 4786 - Standard Test Methods for Stitch Tear Strength, Single Hole
- ASTM D 4966 - Standard Test Methods for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method)
- ASTM E 18 - Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials
- ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials
- ASTM F 392 - Standard Test Methods for Flex Durability of Flexible Barrier Materials
- ASTM F 1614 - Standard Test Method for Shock Attenuating Properties of Materials Systems for Athletic Footwear

(Copies of documents are available online at <http://www.astm.org> or from the ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA-1971 - Standard on Protective Ensemble for Structural Firefighting (2007 Edition)

(Application for copies should be addressed to National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269-9101)

#### SATRA GLOBAL TEST METHODS

- TM2 - Tensile properties of insole materials
- TM3 - Flexing index
- TM14 - Resistance to scuffing by mild circular abrasion
- TM31 - Abrasion resistance - Martindale method
- TM64 - Compression set - constant stress method
- TM77 - Flexing Machine-Water Penetration Test
- TM80 - Transverse tensile strength of sheet materials
- TM83 - Measurement of the Area Shape Retention and Collapsing Load of Formed Toe Puff and Stiffener Materials
- TM98 - Dimensional stability with changes in atmospheric humidity
- TM101 - Peel Strength of Fiberboards
- TM144 - Friction (slip resistance) of footwear and floorings
- TM184 - Friction of insocks
- TM223 - Floor marking by solings or top pieces

(Application for copies should be addressed to SATRA Technology Center, SATRA House; Rockingham Road, Kettering, Northamptonshire; NN 16 9 JH, England.)

## OTHER PUBLICATIONS

Repeat Insult Patch Test - Modified Draize Procedure - Principles and Methods of Toxicology, (fourth edition) A Wallace Hayes (editor), pp 1057 – 1060, 2001.

(Copies are available online at <http://www.taylorandfrancis.co.uk/> or from Taylor and Francis, 325 Chestnut Street, Philadelphia PA 19106.)

2.4 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 Terms

3.1.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.1.2 Standard sample. The finished leather shall match a swatch of cattlehide leather for shade and sueded flesh appearance and unless otherwise indicated, shall be equal to or better than the sample with respect to all characteristics for which the standard is referenced.

3.1.3 Visual shade matching (All components). The color and appearance of the components shall match the standard for shade and appearance (see 3.1.2) when tested as specified in 4.4.2.

3.2 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 requirements of this document and promotes economically advantageous life cycle costs.

### 3.2.1 Leather.

3.2.1.1 Upper leather. The leather shall be flesh out drum dyed Desert Sand with color penetrating throughout the thickness of the hide so that the chrome tannage is not visible. The leather for the vamps, quarters, backstay/pull-tab shall conform to MIL-PRF-3122, Type I, Treatment A and Treatment B. The leather for the eyelet stays; top band and gusset/tongue shall conform to MIL-PRF-3122, Type II, Treatment A. The following exceptions to MIL-PRF-3122 shall be applicable for the upper leathers:

- a. The flesh surface shall be sueded as to produce a fine uniform nap.
- b. The grain surface shall be lightly buffed to remove the surface of the grain only.

- c. The finish requirements for the leather shall not apply.
- d. The tear strength requirements for the eyelet stays and top band shall not apply. Eighty percent (80%) of the gusset/tongue leather samples must meet a minimum of 23 pounds stitch tear.
- e. The thickness shall be as specified for the cut parts in Table IX.
- f. As an option, the eyelet stays may conform to MIL-PRF-3122, Type I, Treatment A and Treatment B.

3.2.1.2 Leather oil repellency. The leather shall receive a minimum grade of 5.0 when the leather surface is tested as specified in 4.4.2.

3.2.1.3 Leather resistance to wetting. The leather shall receive a minimum grade of 7.0 when the leather surface is tested as specified in 4.4.2.

3.2.2 Insoles The insole shall meet the requirements specified in Table I when tested as specified in 4.4.2.

TABLE I. Insole performance requirements

<b>Characteristics</b>	<b>Physical Requirements</b>
Thickness (all constructions), inches (minimum)	0.090
Fungal resistance	Level 10
Wet Tensile, kgf/cm <sup>2</sup> (minimum)	70
Flexing Index, (5000 cycles) (minimum)	3.7
Abrasion Resistance	
Cellulose board, mm <sup>3</sup> (maximum)	50
Non-Woven board, revs (minimum)	
Dry	25,600
Wet	6400
Transverse Tensile-Dry, kgf/cm <sup>2</sup> (minimum)	8.0
Dimensional Stability, percent (maximum)	0.7
Peel Strength, kgf/cm <sup>2</sup> (minimum)	0.5

### 3.2.3 Fabrics.

3.2.3.1 Bootie lining. The bootie lining shall be constructed from pattern pieces cut from waterproof 3-layer laminate material.

3.2.3.1.1 Three-layer laminate. The three-layer laminate lining shall consist of a textile face, a waterproof film, and a tricot knit cloth. The package shall conform to the requirements in 3.2.3.1.1.1 through 3.2.3.1.1.3. The three-layer laminate shall conform to the requirements specified in Table II, when tested as specified in 4.4.2.

3.2.3.1.1.1 Face layer. The face layer shall consist of a textile that meets the Martindale Abrasion, Burst Strength and Bacterial Resistance performance listed in Table II when tested as

specified in 4.4.2.1. Any antimicrobial technology used shall be an EPA-registered antimicrobial and shall be durable for the life of the item. The requirements of this paragraph shall apply to all lining within the boot including the fabric top cover attached to the removable cushioned insert.

3.2.3.1.1.1 Toxicity. The finished lining fabric shall not present a health hazard and shall show compatibility with prolonged, direct skin contact when tested as specified in 4.4.2.1.1 and 4.4.2.1.2. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used.

3.2.3.1.1.2 Waterproof film. The waterproof film shall be polytetrafluorethylene, microporous.

3.2.3.1.1.3 Tricot knit. The tricot knit cloth shall be nylon weighing a minimum of 1.0 ounces per square yard and meet the requirements in Table II when tested as specified in 4.4.2 as part of the three-layer laminate lining specified in 3.2.3.1.1. The color shall be natural unless otherwise specified in the contract or solicitation.

3.2.3.2 Adhesive. The adhesive for laminating the layers together shall be such that the laminate cloth meets the requirements of this specification. The adhesive shall have no adverse health hazard when used as intended.

3.2.3.3 Laminated cloth. The face layer specified in 3.2.3.1.1.1 shall be laminated to one side of the waterproof film specified in 3.2.3.1.1.2 and the tricot knit cloth specified in 3.2.3.1.1.3 shall be laminated to the other side of the waterproof film. The cloth shall conform to the requirements specified in Table II, when tested as specified in 4.4.2.

TABLE II. Laminated cloth performance requirements

<b>Characteristics</b>	<b>Requirements</b>
Martindale Abrasion (Fabric Only) Dry (153,600 revs), cycles (minimum)	9,600
Bursting Strength (lbs.) Fabric Only (minimum)	125
Bacterial Resistance , percent reduction (minimum) Staphylococcus Aureus Pseudomonas Aeruginosa Corynebacterium Xerosis	99 99 90
Hydrostatic Resistance, pounds /square inch (psi) (Liner cloth) Initial (minimum) At seam (minimum) After synthetic perspiration (minimum) After diesel fuel oil (minimum)	50 50 50 50
Water Permeability/ Resistance ( Liner cloth) Initial (minimum) At seam (minimum) After synthetic perspiration (minimum) After diesel fuel oil (minimum)	No leakage No leakage No leakage No leakage
Abrasive Durability (600 cycles) Back / Leather Side (minimum)	No leakage
Moisture Vapor Transmission Rate (MVTR), g/m <sup>2</sup> /24hrs B method (minimum) BW method (minimum)	640 4,000
Flex Durability Gelbo (3,000 cycles) (minimum) Wet, (24 hours to leak) (minimum) Wet, (96 hours to delamination) (minimum)	No leakage No leakage No leakage

3.2.3.4 Color. The color of the face side of the laminated cloth shall be gray based on Government approval unless otherwise specified in the contract or solicitation.

3.2.4 Comfort top band. The comfort top band shall be leather (see 3.2.1.1) and shall have a length equal to the circumference of the boot top, exclusive of the gusset/tongue, and a width of 3/4 ( $\pm$  1/8) inch. As an option, the Top Band may be stitched flesh-side-out both inside and outside the boot.



3.2.5 Two-layer quarter side panels. The fabric for the quarter side panels shall be Desert Sand in color unless otherwise specified, 100 percent nylon 6,6 or equal; 2x2 basket weave, 140 filaments per inch of 1,000 denier in both warp and filling direction; weighing 13.7 (± 1.3) (ounce per square yard). The material shall be fungal resistant, extremely water resistant and backed with a polytetrafluorethylene, microporous membrane. The two-layer material shall conform to the physical requirements listed in Table III when tested as specified in 4.4.2. Construction of the end item shall be such that the seam strength between the 1000-denier nylon and all other components is adequate for the life of the item.

TABLE III. Quarter side panel fabric requirements

Characteristics	Physical requirements
Water Repellency (minimum)	90, 90, 90 <u>1/</u>

1/ These AATCC Test Method 22 Standard Spray Test Ratings are equivalent to an ISO 4 rating (see 6.5).

3.2.6 Leather pull tab. The boot shall contain a one-piece backstay and pull tab which shall be leather (see 3.2.1.1) flesh side out, with a pull tab circumference of 3-1/2 to 3-3/4 inches when completed. Testing shall be as specified in 4.4.2.

3.2.7 Box toe. The box toe material shall be a laminate of 0.020 (± 0.002) inch virgin ionomer resin (surlyn) sandwiched between two layers of non-woven polyester saturated with polystyrene. The total thickness shall be 0.056 (± 0.005) inch. The box toes shall be skived 3/8 (± 1/8) inch wide at the breast. Testing shall be as specified in 4.4.2. A thermoplastic box toe may be used and shall conform to the performance requirements of Table IV.

TABLE IV. Thermoplastic performance requirements

Characteristics	Physical Requirements
Initial Collapsing Load , Newtons (N) (minimum)	130
Resilience, percent (%) (minimum) <u>1/</u>	25 <u>1/</u>
Moisture Resistance, percent (%) (minimum) <u>2/</u>	80 <u>2/</u>
Area Shape Retention, percent (%) (minimum)	
Initial, percent (%) (minimum)	85
10 <sup>th</sup> collapse, percent (%) (minimum)	60

1/ Resilience is percentage retention of initial collapsing load after ten collapses.

2/ Moisture resistance is percentage retention of initial dry collapsing load after 1 hour immersion.

3.2.8 Counters. Counters shall conform to the requirements of MIL-C-41814. The counter shall conform to fit the last used and fill the counter pocket area. The physical requirement for single-hole tear strength of MIL-C-41814 is eliminated. As an alternative, counters manufactured from leather board need not meet the chemical requirements of MIL-C-41814 but must meet the fungicide requirements of MIL-PRF-3122. An extruded thermoplastic film sandwiched between fusion bonded non-woven fabric made from a blend of synthetic fibers and impregnated with a

styrene co-polymer and coated on each side with a thermoplastic adhesive may be used. A Thermoplastic counter may be used and shall conform to the performance requirements of Table IV.

3.2.9 Shanks. The steel or fiberglass shanks shall be bonded to the insole and shall conform to the shape of the last. The fiberglass shank (glass and resin area), when cured, shall be  $5/8$  ( $\pm 1/16$ ) inch in width. The steel shank shall be constructed from 19 gauge, cold rolled carbon steel with a hardness ranging from 47 to 54 Rockwell C scale. The width of the steel shank shall be  $5/8$  ( $\pm 1/32$ ) inch for boot sizes 2 through 6-1/2 (all widths), 7 through 8-1/2 N, and all R widths. For all other sizes and widths, the steel shank width shall be 1 ( $\pm 1/32$  inch). The shank shall be made with two ribs for the  $5/8$  inch width and three ribs for the 1 inch width. Testing shall be as specified in 4.4.2.

3.2.10 Eyelets. There shall be five (5) pair of eyelets below the comfort notch for all sizes. The eyelets shall be brass, with a coated Desert Sand finish, size AA. Testing shall be as specified in 4.4.2.

3.2.11 Speed lace configuration and assembly. The speed loops shall be positioned above the comfort notch. The loops shall be brass with a coated nylon Desert Sand finish. Testing shall be as specified in 4.4.2. The number of speed loops above the comfort notch shall be as follows: Sizes 2-13 (whole and half sizes) shall have four (4) speed loops; Sizes 14-16 (whole and half sizes) shall have five (5) speed loops. Speed lace assembly shall conform to Drawing 2-1-1635.

3.2.12 Quarter foam. There shall be open cell quarter foam,  $3/16$  ( $\pm 1/32$ ) inch thick, located next to the bootie lining. The foam shall cover the counter area and extend upward to within 2 inches from the top of the boot.

3.2.13 Laces. The laces shall conform to Type III, Class 1 of A-A-55093. The color of the laces shall be Desert Sand unless otherwise specified in the contract or solicitation. The length of the laces shall be a minimum of 72 inches for sizes 2 through 6-1/2, 87 inches for sizes 7 through 11, and 97 inches for sizes 11-1/2 through 16.

### 3.3 Soling system requirements.

3.3.1 Midsole construction and design. The cushion midsole shall be directly attached to the upper and shall be achieved either through an injection molding or open pouring method. The design shall be as shown in Figures 2a and 2b. The cushion midsole shall be pure polyether polyurethane, Desert Sand color and have an exterior texture pattern that is a good match to the Government standard sample. The dimensions of the cushion midsole shall be sufficient to meet all of the salient characteristics listed within this Purchase Description.

3.3.2 Midsole compound requirements. The requirements for the pure polyether polyurethane cushioned midsole are based on testing done on slabs (according to ASTM procedures) and are not actual soles. The requirements shall be as specified in Table V when tested in accordance with 4.4.2.

TABLE V. Midsole polyether polyurethane requirements

<b>Characteristics</b>	<b>Minimum</b>	<b>Maximum</b>
Density (gm/cc)	0.40	0.60
Hardness (shore A)	50	75
Tensile strength (kgf/cm sq)	25	N/A
Elongation (Percent)	250	N/A
Tear Strength Die T (kg/cm)	3.7	N/A
Volume Swell (Percent) w/ASTM Oil #3 (at 24 hrs)	N/A	10
Compression Set (Percent)	N/A	20
Ross Flex (1 inch X 6 inch) at -5 °C (Percent) 150,000 cycles	N/A	900

3.3.3 Outersole. The outersole design shall be the Quabaug Vibram 360-Degree Lug Model (See Figure 3). The outsole shall be a minimum of 18-iron, 9.5 millimeters (mm) in thickness of solid rubber at each of the lugs. The color of any identification plug shall be Desert Sand in color unless otherwise specified in the contract or solicitation.

3.3.3.1 Rubber outersole compound requirements. The requirements for the rubber outsole are based on testing done on slabs (according to ASTM procedures) and are not actual soles. The requirements shall be as specified in Table VI when tested in accordance with 4.4.2.

TABLE VI. Rubber outsole compound requirements

<b>Characteristics</b>	<b>Physical Requirements</b>
NBS abrasion (minimum)	120
Hardness (shore A)	57-67 A
Stitch Tear, pounds (minimum) Dry Fuel B	300 50
Die C tear strength, pounds (minimum)	250
Ross flex, Oil #3, percent (maximum) 50,000 flexes	250
Volume swell, percent (maximum) Fuel B (46 hrs)	70
Non-marking	Pass
Tensile, pounds (minimum)	2,100
Elongation, percent (minimum)	400

TABLE VI. Rubber outsole compound requirements – Continued

<b>Characteristics</b>	<b>Physical Requirements</b>
Cold Flex (-23 °C), percent after 7,500 flexes (maximum)	500 %
Transitional Hardness, change after 2 hrs at -23°C (maximum)	+10 point shore hardness
Slip Index (cold/ice),(rough ice method) (minimum)	0.20

3.3.4 Shock attenuation and kinematic parameters. Whole boot shock attenuation as measured in accordance with ASTM F 1614 shall be optimized for user comfort and injury reduction, and shall not exceed 18.0 G in the forefoot and shall not exceed 14.0 G in the rearfoot. Shock attenuation shall be achieved through the choice of standard materials and construction techniques used in commercial industry and found in this Purchase Description. Human biomechanical gait parameters while wearing combat boots shall not be compromised to achieve increased shock attenuation. Testing shall be performed on the completed boot with the removable cushion insert.

3.3.5 Bond strength. The bond achieved between the boot upper, cushion midsole, and outsole shall be resistant to any delamination for the life of the item.

3.3.5.1 Entire system to upper. The bond strength shall not be less than 130 pounds. Testing shall be performed on the end item as specified in 4.4.4.

3.3.5.2 Outersole to cushion midsole bond strength. The outersole to cushion midsole strength shall not be less than 100 pounds. Testing shall be performed on the end item as specified in 4.4.4.

**NOTE:** The components of the sole shall be layered in such a manner that the specified bond strengths will be achieved. If test results find values to be less than specified due to material failure, in regards to the bond between the layers, the test shall be classified as a failure.

3.3.6 Removable cushion insert. The removable cushion insert shall be a polyether polyurethane heel cup support made of a polyurethane system and shall meet the requirements of Table VII when tested as specified in 4.4.2, medium black in color, and molded to a cloth, black in color unless either is otherwise specified in the contract or solicitation. The fabric top cover shall meet the performance requirements in 3.2.3.1.1.1. Cushioned inserts shall be mated by size, to the correct size boots and shall be uniform. The total thickness of the insert shall be 0.180 ( $\pm$  0.025) inch forward of the instep, and 0.250 ( $\pm$  0.030) inch elsewhere. Testing shall be as specified in 4.4.2.

3.3.7 Insole board foam top-layer. Microcellular polyurethane foam, 0.125 ( $\pm$  0.01) inch thick, shall be permanently attached to the top of the insole board. The foam shall meet the requirements of Table VII when tested as specified in 4.4.2.

TABLE VII. Insole Board Foam Requirements

<b>Characteristics</b>	<b>Physical Requirements</b>
<b><u>Removable Cushion Insert</u></b>	
Density, lbs/cu.ft.	16-19
Foam Hardness, Shore 00	50-65
Tensile strength, pounds per square inch (psi) (minimum)	82
Compression set @ 25%, percent (maximum)	5
Compression set @ 50%, percent (maximum)	5
<b><u>Insole Board Foam</u></b>	
Density (lb/cu.ft)	19 - 23
Tensile Strength ( Pounds per sq.inch -PSI) (Minimum)	60
Compression set (Percent) ( Maximum) At 50% compression, 23 °C	2
At 50% compression, 70 °C	10
Resilience/Ball Rebound (Minimum)	8

3.4 Design. The boot shall be Desert Sand-colored unless otherwise specified in the contract or solicitation, have a toe up lace closure system with “V” notch; breathable, waterproof and mildew-resistant. The boot shall be flesh-side out Desert Sand leather, with nylon quarters; lined; comfort top band; replaceable rubber outsole; and pure polyether polyurethane cushion midsole. The soling system shall be Direct Attach with a solid rubber outsole. (See Figures 2a and 2b for upper pattern design requirements and Direct Attach soling system design requirements)

3.4.1 Boot height. The height of the finished boot, measured upward on the outside from the bottom of the tread area at the breast of heel area to the top of the boot, shall be 10.0 ( $\pm$  1/4) inches on size 10R and shall graduate up and down between sizes and widths. Testing shall be as specified in 4.4.4.

3.4.2 Boot weight. The weight of a finished boot (size 10R) shall be less than or equal to 2.0 pounds per boot when tested as specified in 4.4.4.

### 3.5 Lasts and molds.

3.5.1 Direct attach soling construction lasts and molds. The boots shall be made on commercial last model “FMT U3813-1 Military” or equal based on Government approval. An electronic table of last dimensions as well as last bottom files for each size and 3-dimensional data file for sizes 10N (B), 10R (D), 10W (EE) and 10XW (EEEE) for the Direct Attach lasts are available from U.S. Army Natick Soldier Research Development and Engineering Center, RDNS-WPW-C, Kansas Street, Natick, MA 01760-5011. The numerical size of the boot shall correspond with the numerical size of the last used to produce the boot (i.e. a size 10R boot shall be produced on a size 10R last). The Direct Attach last has a common last bottom shared by N and R lasts and a common last bottom shared by W and XW lasts for each whole and half size. The Direct Attach (either Injection Molding or Open Pouring) process shall utilize a separate cushion midsole mold to

produce N and R widths for each whole and half size. The Direct Attach process shall use a separate cushion midsole mold to produce W and XW widths for each whole and half size. The total number of molds required to produce the full size tariff shall be fifty eight (58) molds.

### 3.6 Construction.

3.6.1 Cutting uppers. The leather shall conform to the thickness specified in Table VIII. With the exception of the eyelet stays, none of the upper parts shall be split or shaved. Vamps shall be cut from the bend area of the side leather.

TABLE VIII. Required thickness (ounces) of leather uppers

<b>Part</b>	<b>Minimum</b>	<b>Maximum</b>
Vamp	5	6
Foxing	4-1/2	6
Eyelet stay	2-1/2	3-1/2
Gusset/tongue	2-1/2	4
Comfort top band	2-1/2	3-1/2
Backstay/pull-tab	4-1/2	6

3.6.2 Skiving. Skiving of upper leather parts shall be permitted.

3.6.3 Boot finishing. No finish or top coat shall be used.

### 3.7 Leakage and safety requirements.

3.7.1 Leakage. The finished boots shall show no evidence of leakage when tested as specified in 4.4.4.

3.7.2 Whole boot moisture vapor transmission rate (MVTR). The whole boot breathability shall not be less than 5.0 grams per hour. Testing shall be as specified in 4.4.4.

3.7.3 Thermal protection. The boots shall meet the flame, heat and liquid penetration resistance requirements. Testing shall be as specified in 4.4.4.

3.7.3.1 Flame resistance. The boots shall meet the Flame Resistance Test Four requirements of NFPA 1971 when tested as specified in 4.4.4.

3.7.3.2 Upper heat resistance. The boots shall meet the Thermal Conductive Heat Resistance Test One requirements of NFPA 1971 when tested as specified in 4.4.4.

3.7.3.3 Sole heat resistance. The boots shall meet the Thermal Conductive Heat Resistance Test Two requirements of the NFPA 1971 when tested as specified in 4.4.4.

3.7.3.4 Liquid penetration resistance. The boots shall meet the Liquid Penetration Resistance Test requirements of the NFPA 1971 when tested as specified in 4.4.4.

3.8 Marking, permanent identification. With the exception of Product Demonstration Models (PDMs), the Contractor shall permanently mark the correct American and Mondopoint sizes and widths, the contract number (Example: 04-D-1234), and the company or brand name on the inside of the boot in the shaft or gusset area. The marking may be in the form of a label and shall be done in accordance with acceptable commercial practices, and it shall not reduce footwear functionality. The boot shall contain a manufacturing tracking lot number. Embossing of a company or brand name on the exterior of the boot shall not be permitted. Unit packs will include NSN and UPC bar codes as specified in the contract. Each symbol must be Human and scanner readable.

3.8.1 Instruction tag. The instruction label/tag shall be tied to the finished boots, and the print size shall be 1/8 ( $\pm$  1/32) inch. The instruction label/tag shall be printed using the data specified in Figure 1. Each item shall be individually bar-coded with a label/tag conforming to Type VIII, Class 17, of MIL-DTL-32075. The bar-coding element shall be a 13 digit national stock number (NSN). The bar-code type shall be a medium to high code density. It shall be located so that it is completely visible on the item when it is folded and/or packaged as specified in the contract and in a manner that causes no damage to the item. As an option, a hang tag identifying the features of the boot shall be permitted.

3.8.2 Labels. The contractor shall attach an internal label with the words: "This NSN Authorized for US Army Flight and Combat Vehicle Crewman Use". As an option, each boot may contain a sew-in label identifying the waterproof membrane used. Component and boot feature hangtags may be attached to the boots.

3.9 Workmanship. The finished boots shall conform to the quality of product established by this document. The occurrence of defects shall not exceed the contractor's own quality assurance standards and the quality assurance standards defined by the technical data in the bid package.

3.10 Standard sample. The standard sample for color shade and sueded flesh appearance of leather as well as color shade of components shall be a swatch of cattlehide upper leather. The standard sample for texture pattern for the exterior surface of the Direct Attach cushion midsole shall be a finished boot.

#### 4. VERIFICATION

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

- a. First article inspection (see paragraph 4.2).
- b. Conformance inspection (see paragraph 4.3).

4.2 First article inspection. First article inspection when required (see 3.1) shall be examined for the defects specified in 4.4.3 and tested for the characteristics in 4.4.4.

4.3 Conformance inspection. Conformance inspection shall include the examinations of 4.4.1 and 4.4.3 and the testing in 4.4.2 and 4.4.4. Unless otherwise specified sampling for inspection shall be performed in accordance with ANSI/ASQ Z1.4.

4.4 Inspection and component testing.

4.4.1 In-process inspection. Inspection may be made by the Government at any point or during any phase of manufacturing to determine whether the components are as specified or operations and/or assemblies are accomplished as specified. The Government reserves the right to exclude from consideration for acceptance any material or service for which in-process inspection has indicated nonconformance.

4.4.2 Component testing. The components shall be tested for the characteristics listed in Table IX. The methods of testing specified where applicable shall be used. The sampling plan shall be as follows unless otherwise specified in the contract or solicitation.

Lot size (yards or units)	Sample size
Under 800	2
801 – 22,000	5
22,001 and above	8

TABLE IX. Component testing

Component	Characteristic	Requirement Paragraph	Test Method
<b>All Exterior Components</b>	Shade Evaluation	3.1.3	<u>1/</u>
<b>Upper Leather</b>	Range of Characteristics	3.2.1.1	MIL-PRF-3122
	Oil Repellency	3.2.1.2	AATCC 118 <u>2/</u>
	Water Repellency	3.2.1.3	AATCC 118 <u>2/</u>
<b>Insole</b>	Thickness	3.2.2	ASTM D 1777 <u>3/</u>
	Fungal resistance	3.2.2	ASTM D 3273
	Wet Tensile	3.2.2	SATRA TM-2
	Flexing Index	3.2.2	SATRA TM-3
	Abrasion Resistance		
	Cellulose board	3.2.2	SATRA TM-14
	Non-Woven board	3.2.2	SATRA TM-31
	Transverse Tensile-Dry	3.2.2	SATRA TM-80
Dimensional Stability	3.2.2	SATRA TM-98	
Peel Strength	3.2.2	SATRA TM-101	



TABLE IX. Component testing - Continued

<b>Component</b>	<b>Characteristic</b>	<b>Requirement Paragraph</b>	<b>Test Method</b>
<b>Laminated Cloth</b>	Martindale Abrasion Fabric Only, Dry	3.2.3.1.1.1	ASTM D 4966 <u>4/</u>
	Bursting Strength, Fabric only	3.2.3.1.1.1	ASTM D 3787
	Bacterial Resistance		
	Staphylococcus Aureus	3.2.3.1.1.1	AATCC 100 & ATCC- 6538
	Pseudomonas Aeruginosa	3.2.3.1.1.1	AATCC 100 & ATCC-9027
	Corynebacterium Xerosis	3.2.3.1.1.1	AATCC 100 & ATCC-373
<b>Laminated Cloth Continued</b>	Hydrostatic Resistance (psi) (Liner cloth)		
	Initial	3.2.3.1.1.1	ASTM D 751 <u>5/</u>
	At seam	3.2.3.1.1.1	ASTM D 751 <u>6/</u>
	After synthetic perspiration	3.2.3.1.1.1	ASTM D 751 <u>7/ 8/ 9/</u>
	After diesel fuel oil	3.2.3.1.1.1	ASTM D 751 <u>10/ 9/</u>
	Water Permeability/ Resistance (Liner cloth)		
	Initial	3.2.3.1.1.1	AATCC 127 <u>11/</u>
	At seam	3.2.3.1.1.1	AATCC 127 <u>12/ 11/</u>
After synthetic perspiration	3.2.3.1.1.1	AATCC 127 <u>13/ 8/ 9/ 11/</u>	
After diesel fuel oil	3.2.3.1.1.1	AATCC 127 <u>14/ 9/ 11/</u>	
<b>Abrasive Durability</b>	Back / Leather Side	3.2.3.1.1.1	ASTM D 3886 & AATCC 127 <u>15/ 11/</u>
	Moisture Vapor Transmission Rate (MVTR) (g/m <sup>2</sup> /24hrs)		
B method	3.2.3.1.1.1	ASTM E 96 <u>16/</u>	
BW method	3.2.3.1.1.1	ASTM E 96 <u>17/</u>	
<b>Flex Durability</b>	Gelbo (cycles to leak)	3.2.3.1.1.1	ASTM F 392 and AATCC 127 <u>18/ 11/</u>
	Wet ( Hours to leak)	3.2.3.1.1.1	ASTM F 392 and AATCC 127 <u>19/ 11/</u>
	Toxicity	3.2.3.1.1.1.1	4.4.2.1.1
<b>Two-Layer Quarter Side Panels</b>	Fabric Content, Count, Yarn Size	3.2.5	NA
	Water repellency	3.2.5	AATCC-22
<b>Pull Tab</b>		3.2.6	

TABLE IX. Component testing - Continued

Component	Characteristic	Requirement Paragraph	Test Method
<b>Box Toe</b>	Initial Collapsing load (N)	3.2.7	SATRA TM-83
	Resilience(%)	3.2.7	SATRA TM-83 <u>20/</u>
	Moisture Resistance (%)	3.2.7	SATRA TM-83 <u>21/</u>
	Area Shape Retention	3.2.7	SATRA TM-83
<b>Counters</b>	Initial Collapsing load (N)	3.2.8	SATRA TM-83
	Resilience(%)	3.2.8	SATRA TM-83 <u>20/</u>
	Moisture Resistance (%)	3.2.8	SATRA TM-83 <u>21/</u>
	Area Shape Retention	3.2.8	SATRA TM-83
<b>Shank</b>	Hardness	3.2.9	ASTM E-18
<b>Eyelets</b>	Range of Characteristics	3.2.10	NA
<b>Speed Lace</b>	Range of Characteristics	3.2.11	NA
<b>Quarter Foam</b>	Range of Characteristics	3.2.12	NA
<b>Laces</b>	Range of Characteristics	3.2.13	A-A-55093
<b>Cushion Midsole Polyether Polyurethane</b>	Density (gm/cc)	3.3.2	ASTM D 297
	Hardness (shore A)	3.3.2	ASTM D 2240 <u>22/</u>
	Tensile strength (kgf/cm sq)	3.3.2	ASTM D 3574 <u>23/</u>
	Elongation (Percent)	3.3.2	ASTM D 3574 <u>23/</u>
	Tear Strength, Die T (kg/cm)	3.3.2	ASTM D 3574 <u>23/</u>
	Volume Swell (Percent) w/ASTM Oil #3 (at 24 hrs)	3.3.2	ASTM D 471 <u>23/ 24/</u>
	Compression Set (Percent)	3.3.2	SATRA TM-64 <u>25/</u>
	Ross Flex (1 inch X 6 inch) at -5 °C (Percent) 150,000 cycles	3.3.2	ASTM D 1052 <u>26/ 27/ 28/</u>
<b>Rubber Outsole</b>	NBS abrasion (minimum)	3.3.3.1	ASTM D 1630
	Hardness (shore A)	3.3.3.1	ASTM D 2240
	Stitch Tear Dry Fuel B	3.3.3.1	ASTM D 4786 ASTM D 4786 <u>29/</u>
	Die C tear strength, pounds (minimum)	3.3.3.1	ASTM D 624
	Ross flex, Oil #3	3.3.3.1	ASTM D 1052 <u>30/</u>
	Volume swell, Fuel B (46 hrs)	3.3.3.1	ASTM D 471 <u>31/</u>
	Non-marking	3.3.3.1	SATRA TM 223
	Tensile	3.3.3.1	ASTM D 412
	Elongation	3.3.3.1	ASTM D 412
	Cold Flex (-23 °C)		ASTM D 1052 <u>28/</u>
	Transitional Hardness, change after 2 hrs at -23°C	3.3.3.1	ASTM D 2240
	Slip Index (cold/ice)	3.3.3.1	SATRA TM 144

TABLE IX. Component testing - Continued

Component	Characteristic	Requirement Paragraph	Test Method
<b>Removable Cushion Insert</b>	Density	3.3.6	ASTM D 3574
	Foam Hardness	3.3.6	ASTM D 2240
	Tensile strength	3.3.6	ASTM D 3574
	Compression set @ 25%, percent	3.3.6	ASTM D 3574 <u>32/</u>
	Compression set @ 50%, percent	3.3.6	ASTM D 3574 <u>32/</u>
<b>Insole Foam</b>	Density	3.3.7	ASTM D3574
	Tensile Strength	3.3.7	ASTM D3574
	Compression set At 50%, 23°C At 50%, 70°C	3.3.7	ASTM D3574 D ASTM D3574 D
	Resilience/Ball Rebound	3.3.7	ASTM D3574 H

1/ The color of the components shall be Desert Sand, matching that of the standard sample (see 3.3) when tested in accordance with AATCC Evaluation Procedure 9 option A with sources simulating artificial daylight D75 illuminant with a color temperature of 7500 ( $\pm 200$ )°K, illumination of 100 ( $\pm 20$ ) foot candles and shall be a good match to the standard sample under incandescent lamplight at 2856 ( $\pm 200$ )°K as specified in Section 3.1.3 of this Purchase Description.

2/ AATCC TM 118, Table 1- Standard Test Liquids (Hydrocarbons) shall be replaced with a Water/Isopropyl Alcohol mixture as shown in Table X.

TABLE X. Replacement Table – AATCC 118

Grade	Test Liquid Ratio	
	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

3/ A thickness gauge of the dead-weight type equipped with a dial graduated to read directly to 0.001 inches shall be used. The presser foot shall be circular, with a diameter of 1.129 ( $\pm 0.001$ ) inches and with moving parts weighted to apply a total load of 0.60 ( $\pm 0.03$ ) pounds per square inch (psi) to the specimen. The anvil shall be not less than 1.129 inches in diameter. The presser foot and anvil surface shall be planed to within 0.001 inches and shall be parallel to each other to within 0.001 inches.

- 4/ Martindale Tester; Pressure applied: 12 kPa; visually examine specimens after each 3200 cycles; abrader changed after each 3200 cycles. Use Option 1 for evaluation; no hole appears.
- 5/ Test five (5) samples in accordance with ASTM D 751 Procedure A1 with the face (foot side) of the liner cloth in contact with the water.
- 6/ Test five (5) samples containing sealed seams in accordance with ASTM D751 Procedure A1 with the face (foot side) of the liner cloth in contact with the water and the seam centrally located in the circular orifice.
- 7/ Test five (5) samples, four inch by four inch (4" x 4"), cut from the laminate material and exposed to contamination; synthetic perspiration (Footnote 8). Contaminate prior to leak testing by dispensing 2 milliliters (ml) of perspiration solution on both sides of the sample (see Footnote 9 for contamination procedure.) Determine hydrostatic resistance in accordance with ASTM D751 Procedure A1 with the face (foot side) of the liner cloth in contact with the water.
- 8/ Synthetic perspiration shall be prepared in a 500-milliliter (ml) glass beaker by combining 3.0 grams sodium chloride, 1.0 gram trypticase soy broth powder, 1.0 gram normal propyl propionate, and 0.5 grams of liquid lecithin. Add 500 milliliters (mls) of distilled water, add a magnetic stirring bar and cover beaker. Place the beaker on a combination hot plate/ magnetic stirring apparatus. While stirring, heat the solution to 50 degrees C until all ingredients are dissolved. Then, while stirring, cool solution to 35 degrees C.
- 9/ Dispense contaminate on to the center of a glass plate (8 inches by 8 inches by 0.25 inch thick.). Sample shall be placed face down on the plate and an additional contaminate dispensed on the backside. Place a second glass plate on the sample. Next, position a 4-pound weight on the center of the second glass plate. After 16 hours, remove the sample (do not rinse) and test immediately.
- 10/ Test five (5) samples, four inches by four inches (4" x 4"), cut from the laminate material and exposed to diesel fuel as follows: Contaminate prior to leak testing by dispensing 3 drops of diesel fuel onto both sides of the sample (see Footnote 6 for contamination procedure.) Determine hydrostatic resistance in accordance with ASTM D751 Procedure A1 with the face (foot side) of the liner cloth in contact with the water.
- 11/ Test five (5) samples in accordance with AATCC 127 with face/ foot side towards water. Suter test conditions shall be 0.7 psi (50 cm), for 5 minutes. Any observed water droplets in test area constitutes a failure.
- 12/ Test five (5) samples containing sealed seams in accordance with AATCC 127 with the face (foot side) of the liner cloth in contact with the water and the seam centrally located in the circular orifice. Follow Suter test conditions and inspection as specified in Footnote 11.
- 13/ Test five (5) samples, eight inches by eight inches (8" x 8"), cut from the laminate material and exposed to synthetic perspiration (Footnote 8.) Contaminate prior to leak testing by dispensing 2 milliliters (mls) of perspiration solution on both sides of the sample (see Footnote 9 for contamination procedure.) Determine water resistance in accordance with AATCC 127 with the face (foot side) of the liner cloth in contact with the water. Follow Suter test conditions and inspection specified in Footnote 11.
- 14/ Oil Test five (5) samples, eight inches by eight inches (8" x 8"), cut from the laminate material and exposed to diesel fuel as follows: Contaminate prior to leak testing by dispensing 3 drops of diesel fuel onto both sides of the sample (see Footnote 9 for contamination procedure.) Determine water resistance in accordance with AATCC 127 with the face (foot side) of the liner cloth in contact with the water. Follow Suter test conditions and inspection as specified in Footnote 11.

- 15/ Test back side of five (5) laminate samples in accordance with ASTM D3886. Non-contact pin diaphragm approved for use to decrease variability. The test is to be run for the specified number of cycles prior to testing for leakage. Leakage shall be determined in accordance with AATCC 127. Follow Suter test conditions and inspection as specified in Footnote 11.
- 16/ Determine MVTR in accordance with ASTM E96 method B with the back side of the test cloth shall face the water. The free stream air velocity shall be 550 ( $\pm$  50) feet per minute (fpm) as measured 2 inches above the specimen. The airflow shall be measured at least 2 inches from any other surface. The test shall be run for 24 hours and weight measurements shall be taken at only the start and completion of the test. At the start of the 24-hour test period, the air gap between the water surface and the specimen shall be 0.75 ( $\pm$  0.06) inches.
- 17/ Determine MVTR in accordance with ASTM E 96 method BW with the backside of the test cloth facing the water. The free stream air velocity shall be 550 ( $\pm$  50) feet per minute (fpm) as measured 2 inches above the specimen. The airflow shall be measured at least 2 inches from any other surface. The specimen shall be sealed to the cup in any manner that prevents wicking or leaking of water out of the cup. The test shall be run for 2 hours and weight measurements shall be taken at only, the start and completion of the test.
- 18/ Test one (1) sample, 8 inch by 12 inch, shall be conditioned and flexed in accordance with ASTM F392 except specimen shall not be aged, the short edges shall not be heat sealed or otherwise joined and the specimen shall be flexed for the specified number of cycles. Two (2) 6 inch by 8 inch specimens, shall be cut from the flexed sample and tested for leakage in accordance with AATCC 127. Follow Suter test conditions and inspection as specified in Footnote 11.
- 19/ One (1) sample, 14 inches by full width, shall be selected from a sample unit and tested for leakage after the required number of hours of continuous agitation. The specimen shall be agitated using the “normal,” cycle in an automatic home laundering machine except that the washing machine shall be capable of continuous agitation. The water level shall be maintained at 16 ( $\pm$  0.5) gallons, and the water temperature shall be 32 ( $\pm$  9 degrees C). Additional fabric shall be added to the specimen to create a load weight of 2 ( $\pm$  0.2) pounds. Upon completion of the continuous agitation the specimen is to be air dried and then tested for leakage in accordance with AATCC 127. Follow Suter test conditions and inspection as specified in Footnote 11.
- 20/ Resilience is percentage retention of initial collapsing load after ten collapses.
- 21/ Moisture resistance is percentage retention of initial dry collapsing load after 1 hour immersion.
- 22/ Thickness of test sample used shall equal 12.7 millimeters (mm) (0.5 inch) from test slabs.
- 23/ Thickness of test sample used shall equal 12.7 millimeters (mm) (0.5 inch) from test slabs or 6.0 millimeters (mm) from actual cushioned midsoles. Actual cushioned midsoles shall be used for verification testing only. However, all test reports used for conformance purposes and submitted to the Government shall use test slabs.
- 24/ Test conducted after 24 hours at Room Temperature with ASTM test slabs.
- 25/ Thickness of test sample used shall equal 12.7 millimeters (mm) (0.5 inch) from test slabs or 19.0 millimeters (mm) from actual cushioned midsoles. Actual cushioned midsoles shall be used for verification testing only. However, all test reports used for conformance purposes and submitted to the Government shall use test slabs.
- 26/ Test method modified to include 2 millimeter (mm) insole board glued onto the specimen and conducted at - 5 degrees C. Samples shall be pre-conditioned for 2 hrs at -5 degrees C
- 27/ Thickness of test sample used shall equal 6.4 millimeters (mm) (0.25 inch) from test slabs or

6.0 millimeters (mm) from actual cushioned midsoles. Actual cushioned midsoles shall be used for verification testing only. However, all test reports used for conformance purposes and submitted to the Government shall use test slabs.

- 28/ Test conducted after 2 hours conditioning
- 29/ Test conducted after 46 hours in Fuel B at Room Temperature
- 30/ One (1) drop of oil per 6,000 flexes.
- 31/ Test conducted after 46 hours at Room Temperature with ASTM test slabs
- 32/ Parts measured at 77 degrees F.

4.4.2.1 Bacterial resistance (lining fabric). Testing shall be conducted on a single ply of fabric. The following specificity will be followed within the AATCC 100 test method for interlaboratory correlation. An untreated control fabric will be run for each determination that closely approximates the characteristics of the treated fabric without anti-microbial technology.

- a. Grow test organisms in 1x nutrient broth (NB) overnight.
- b. Determine Optical Density at 600 nanometers (OD600). Dilute with 1x NB to OD600 = 1, yielding a cell concentration of approximately 108 CFU/ml.
- c. Wash 1 milliliter (ml) cells twice with 1 milliliter (ml) 0.125x (diluted 1:8) NB medium with 0.15 % (w/v) Triton X-100. Recheck OD600.
- d. Dilute cells 1:10 with 0.125x NB/ 0.15 % (w/v) Triton X-100 to target concentration of 1-2x10<sup>7</sup> CFU/ml. Serially dilute inoculum 10-fold for plating to determine concentration.
- e. For a single determination for each organism, two incubation times, 0, and 24 hr, shall be examined. Cut each specimen into 48 millimeter (mm) circles in triplicate for each time point. Do not sterilize; plating will be done on medium selective for the test organisms (see step k).
- f. Inoculate each single swatch specimen in a petri dish with 0.2 milliliter (ml) (or the amount that a single swatch specimen can absorb within 10 - 20 minutes) to avoid puddling of inoculum not in contact with the sample.
- g. Place the rolled swatch into a sterile 100 Milliliter (ml) bottle and cap. Swatch rolled with tweezers when inserting into the bottle will minimize contaminating the neck with the organisms on the swatch (purpose is to reduce or prevent inoculum not in contact with the swatch).
- h. Process 0 hour contact time immediately. Incubate 24 hour inoculated swatch at 37 (+2)°C.
- i. For swatch inoculation volume of 0.2 milliliter (ml), neutralize with 20 milliliter (ml) Dey-Engley (D-E) broth (dilution is 10-2). Shake 1 minute. Add D-E to each of the replicate before doing 10-fold dilutions. For other inoculation volumes, adjust D-E volume appropriately for a 10-2 dilution. Shake bottles 1 minute.
- j. Dilute D-E solution 10-fold in PBS buffer (final dilutions 10-3, 10-4, 10-5).
- k. Spread plate 0.1 milliliter (ml) 10-3, 10-4, 10-5 dilutions in duplicate on selective media. These dilutions are usually suitable to obtain valid counts.
  - i. *S. aureus* – BBL Mannitol salts agar (cat # 211407, BD Diagnostic Systems)
  - ii. *P. aeruginosa* – Centrimide agar (cat # 7222, Neogen Corp)
- l. Incubate plates overnight at 37 (+2)°C.
- m. Report the microbial concentrations (CFU/ml) for each swatch at both contact times. Use average triplicate concentration for 0 and 24 hour contact times to calculate percent reduction for the treated swatches and untreated control. Also report starting inoculum concentration;

minimum valid concentration is  $5 \times 10^6$  CFU/ml. If the treated swatches show 90% reduction, the test should be rerun to verify. Untreated control would not be expected to exhibit reduction.

4.4.2.1.1 Toxicity test. When required (see 6.2), an acute dermal irritation study and a skin sensitization study shall be conducted on laboratory animals. When the results of these studies indicate the finished lining fabric is not a sensitizer or irritant, a Repeat Insult Patch Test shall be performed in accordance with the Modified Draize Procedure. (See 2.3). If the toxicity requirement (see 3.2.3.1.1.1.1) can be demonstrated with historical use data, toxicity testing may not be required (see 6.2).

4.4.2.1.2 All antimicrobial treatments used to process the lining fabric shall be identified and accompanied by the appropriate Material Safety Data Sheet (MSDS) information. The use of chemicals recognized by the Environmental Protection Agency (EPA) as known human carcinogens is prohibited.

4.4.3 End item visual examination. The end item shall be examined for the defects listed in Table XI. The lot size shall be expressed in units of boots. The boots shall be examined with cushion insert inserted. For the pairing examination, and when determining possible differences in outsole thickness, the pair shall be examined together. During the inspection for the defects listed in Table XI, the departures from specification requirements listed in the table shall be observed and recorded. Presence of these departures shall not result in the rejection of the lot; however, the plant quality assurance and Government personnel reserve the right to establish and impose lot rejection criteria when either the severity or the presence of these departures warrants such a measure. These additional rejection criteria may be invoked at any time during the life of the contract when the Government judges this action to be in its best interest. Defects of pairing shall be classified as a single defect. Sampling for end item inspection shall be in accordance with American National Standard ANSI/ASQ Z1.4. Defects in Table XI denoted by an asterisk (“\*”) shall be deemed either Major or Minor by the Government depending on the respective defect’s affect on the form, fit and function of the item.

TABLE XI End item visual defects.

Examine	Defect	Classification	
		Major	Minor
Pairing	Not properly mated; i.e., not right and left of same size	101	
	Variation in color, luster, or appearance	*	*
	Variation of more than 1/4 inch in height of pair	102	
	Box toe malformed	*	*
	Difference in outsole thickness between left and right boots: -more than 3/32 inch	103	
	- more than 1/16 inch but not more than 3/32 inch		201
Cleanliness	Any non-removable spot, stain, or foreign matter affecting appearance		202
Color and finish	Color not as specified	*	*
	Finish streaky, chipped, flaky or shaggy/nappy on upper		203
	Any raw edges not stained to match upper leather		204
Design	Not as specified	104	
Construction & Workmanship (general)	Any cut, tear, hole, repair or damage	*	*
	Any component or assembly omitted or misplaced, operation omitted, not properly performed	*	*
Seams & Stitching(upper)	Open seam not repaired	105	
	Repair of open seam not as specified		205
	NOTE: A seam shall be classified as open when one or more stitches joining a seam are broken, or when two or more consecutive skipped or runoff stitches occur. On multiple stitched seams, a seam is considered open when one or both sides of the seam are open. When the above conditions occur on the inside of the boot, it shall be scored as a * defect.		
	Tight tension resulting in puckering or cutting of the leather	*	*
	Loose tension resulting in a loosely secured seam	*	*
	Stitching omitted where required	*	*
	Gage of stitching irregular	*	*
	Thread ends not trimmed throughout the boot		206
	Needle holes or needle chew	*	*
	Back seam malformed		207
Vamp stitching at outsole junction	One or more rows of defective stitching not repaired	106	
	Stitching repaired, but first stitch more than 1/4 inch from outsole junction	107	
	Repaired with one stitch in lieu of two or more stitches		208
Outersole	Thickness not as specified	108	
	Edge is irregular, affecting appearance		209
	Any malformation	*	*



TABLE XI End item visual defects. - Continued

Examine	Defect	Classification	
		Major	Minor
Eyelets/ speed laces	Number of eyelets/speed laces not as specified	109	
	Not the same number of eyelets/speed laces in each row	110	
	Eyelets/speed laces not properly spaced within the row or misalignment between the rows to an extent interfering with proper lacing	*	*
	Any eyelet/speed lace not securely clinched		210
Marking & instruction tag	Missing, incomplete, incorrect, not applied in the specified manner, misplaced, illegible, or not of specified size		211
Lining	Torn, loose or wrinkled	*	*
	Not properly mated with upper		212
Bar code label/tag	Bar-code omitted or not readable by scanner; human-readable interpretation (HRI) omitted or illegible; bar-code type not as specified or code density not as specified		213
Removable Cushion Insert	Missing, wrong size, or wrong side up	111	
Cushion Midsole	Scuffing, scratches, air holes or gaps in midsole material and/or sidewalls	*	*
Upper leather	Not flesh side out	112	
	Leather deeply snuffed; i.e., fiber structure damaged	*	*
	Grub or tick damage, scratches, brands, or bony leather	*	*
	Fat wrinkles or veins	113	
	Stretchy vamp	*	*
	Thickness exceeds the maximum or less than the minimum specified	114	
	Rough fiber on flesh side	*	*
	Off-stretch cut or Slaughter cut	*	*
Excessive roughing or scouring	*	*	
Gusset tongue and collar leather	Leather embossed	115	
	Flanky Loose flesh, boney, or boardy	*	*

4.4.4 End item testing. The finished boot shall be tested for the characteristics listed in Table XII. The sample size for all tests except SATRA whole boot flex leakage, thermal resistance, MVTR and liquid penetration resistance shall be five (5) boots per lot. For these tests, the sample size shall be three (3) boots for each test per lot. The lot size shall be no less than 800 pair.

TABLE XII. End item tests

<b>Characteristic</b>	<b>Requirement Paragraph</b>	<b>Test Method</b>
Bond strength	3.3.5	-
Entire sole to upper	3.3.5.1	4.5.2
Outersole to cushion midsole	3.3.5.2	4.5.1
Height	3.4.1	-
Weight	3.4.2	-
Boot Leakage	3.7.1	4.5.8
Whole Boot MVTR	3.7.2	4.5.3
Thermal protection:	3.7.3	-
Flame resistance	3.7.3.1	4.5.4
Upper heat resistance	3.7.3.2	4.5.5
Sole heat resistance	3.7.3.3	4.5.6
Liquid penetration resistance	3.7.3.4	4.5.7

1/ Test results for each characteristic shall be reported as Pass/Fail.

#### 4.5 Methods of inspection.

##### 4.5.1 Bond strength test of outersole to cushion midsole.

4.5.1.1 Specimen. The specimen shall be a completed boot which has aged at least 2 days. The outersole shall be separated from the cushion-midsole, for a distance of approximately 2-1/2 inches each from the toe end of the specimen.

4.5.1.2 Apparatus. A power-driven adhesion machine, or an approved testing device of equal performance, shall be used. The rate of travel of the power-actuated grip shall be 2 inches per minute. The machine shall be operated with a device for maintaining maximum load indication.

4.5.1.3 Procedure. The separate toe ends of the specimen shall be clamped in the jaws of the machine. The specimen shall extend outward at right angles to the direction of the application load. The machine shall be started, and the surface being tested shall be pulled apart to a distance of not more than 4.5 inches from the toe. Upon attaining that degree of separation, the load indicated on the machine shall be read and recorded. If the required load is achieved (at any time during the pull test) the test is deemed as passing.

##### 4.5.2 Bond strength test of entire soling system to boot upper.

4.5.2.1 Specimen. The test specimen shall be legibly marked on each side at two points (2 inches and 4 inches from the tip of the toe). The entire soling system shall then be separated from the upper to the 2 inch mark. The separation may be aided by any suitable device or machine capable of withstanding the amount of force necessary to accomplish separation. After separation to the two inch mark is achieved, the toe cap of the boot shall be crushed to facilitate mounting of the specimen in the tester. In event that the point of separation at the 2 inch mark is not between the upper and the soling system, that portion of the soling system remaining adhered to the upper shall

be separated manually (with the aid of a knife or other instrument), so as to show separation between leather and soling system. Care should be taken in order to be sure that the leather is not cut.

4.5.2.2 Apparatus and procedure. The apparatus for measuring soling system/upper separation shall be as described in test method ASTM D 2208. The separated and crushed toe portion of the boot shall be gripped by one clamp in a manner such that the minimum effective jaw surface area applied shall be 1 inch by 1 inch. The jaw surface shall be centered approximately 1/2 inch to 1 inch from the tip of the toe. The other jaw surface shall hold the overlay portion of the separated upper, and it shall not be less than 1 inch by 2 inches, with the long dimensions perpendicular to the pull of the machine. The machine shall be set in operation and the separation continued at a speed of 10 inches per minute until the outsole is separated from the upper to a point past the mark 4 inches from the tip. The maximum value attained during separation shall be taken as the bond strength.

4.5.3 Whole boot breathability. The boot breathability test shall be designed to indicate the Moisture Vapor Transmission Rate (MVTR) through the boot by means of a difference in concentration of moisture vapor between the interior and the exterior environment.

4.5.3.1 Apparatus.

- a. The external test environment control system shall be capable of maintaining 23° (± 1)° C and 50% (± 2) percent relative humidity throughout the test duration.
- b. The weight scale shall be capable of determining weight of boots filled with water to an accuracy of (± 0.01) gram.
- c. The water holding bag shall be flexible so that it can be inserted into the boot and conform to the interior contours; it must be thin enough so that folds do not create airgaps; it must have much higher MVTR than the footwear product to be tested; and it must be waterproof so that only moisture vapor contacts the interior of the footwear product rather than liquid water.
- d. The internal heater for the boot shall be capable of controlling the temperature of the liquid water uniformly in the boot to 35° (± 1°) C.
- e. The boot plug shall be impervious to both liquid water and water vapor.

4.5.3.2 Procedure.

- a. Place boot in test environment.
- b. Insert holding bag into boot opening and fill with water to a height of 12.5 centimeters (cm) (5 inch) measured from inside sole.
- c. Insert water heater and seal opening with boot plug.
- d. Heat water in boot to 35° C.
- e. Weigh boot sample and record as  $W_i$ .
- f. Hold temperature in boot after weighing for a minimum of 6 hours.
- g. After 6 hours, reweigh boot sample. Record weight as  $W_f$  and test duration as  $T_d$ .
- h. Compute whole boot MVTR in grams/hour from the equation below:

$$MVTR = \frac{W_i - W_f}{T_d}$$

4.5.3.3 Method of inspection. Each boot shall be tested in accordance with the method described in paragraph 4.5.4.2. The average whole boot MVTR from the five (5) boots tested shall be greater than 5 grams/hour to satisfy the breathability standard.

4.5.4 Flame resistance. The boots shall meet the Flame Resistance Test Four requirements of NFPA 1971, Standard on Protective Ensemble for Structural Firefighting, 2007 Edition. The areas of the boot to be tested are in accordance with Figure 8.5.5.2 of NFPA 1971; in addition, a sixth area, the nylon quarter side panels, shall also be tested. The requirement that the boot shall not melt or drip does not apply, although the boot shall not exhibit any burn-through (Reference: Sections 7.10.2 and 8.5). The boot will be considered to have failed the burn-through test when burn-through is observed through all layers of the quarter panel and lining components.

4.5.5 Upper heat resistance. The boots shall meet the Thermal Conductive Heat Resistance Test One requirements of NFPA 1971, Standard on Protective Ensemble for Structural Firefighting, 2007 Edition. (Reference: Sections 7.11.3 and 8.5).

4.5.6 Sole heat resistance. The boots shall meet the Thermal Conductive Heat Resistance Test Two requirements of the NFPA 1971, Standard on Protective Ensemble for Structural Firefighting, 2007 Edition. (NFPA 1971, section 8.8).

4.5.7 Liquid penetration resistance. The boots shall meet the Liquid Penetration Resistance Test requirements of the NFPA 1971, Standard on Protective Ensemble for Structural Firefighting, 2007 Edition. (Reference: Sections 7.10.4 and 8.28), specific testing to section 8.28.4.2 #4, surrogate gasoline fuel C, as defined in ASTM D 471, standard test method for rubber properties, effect of liquids, using a 50 percent by volume of the toluene and iso-octane.).

4.5.8 Boot leakage test. The boot leakage test shall be designed to indicate leakage by using water as a liquid medium through the boot by means of a whole shoe flex test in accordance with SATRA TM77 (modified as indicated below) while the boot is submerged. The minimum standard for passing this test is 100,000 flexes. Each boot shall be preconditioned by flexing in accordance with SATRA TM77 DRY with a foot form of steel shot for 100,000 flexes.

4.5.8.1 Apparatus. SATRA TM184 whole shoe flexing apparatus or equal will be modified to allow the end item to be submerged to a depth of the mid-point between the third and fourth eyelet. The mechanism for flexing on any other apparatus must be exactly the same as the SATRA TM184. The sides of the apparatus must be raised to alleviate splashing on the mechanism for flexing.

4.5.8.2 Procedure. Testing will be in accordance with SATRA TM77 at 140 ( $\pm 10$ ) flexes/minute and 35 degrees for each flex cycle. A modified SATRA TM184 whole boot flex apparatus or equal must be used so that the water depth required can be achieved. The top of each item must be sealed appropriately so that the water splashing from the test does not enter through the top of the boot. Absorbent blotting paper will be "balled up" and placed within the boot upper so that any water ingress through the top or upper can be determined. A change in the color between the top and the bottom sections of the absorbent blotting paper will indicate water ingress. The steel shot foot-form shall be removed for testing in water. The end item shall be checked at

100,000 cycles for leakage, as indicated by a color change in the absorbent blotting paper within the boot.

4.5.8.3 Method of inspection. End items will be evaluated in accordance with SATRA TM77, by checking for a change in color of the absorbent blotting paper that is “balled up” and placed within the boot upper. If water enters the top of the boot during the test, new absorbent blotting paper shall be inserted for the remainder of the test, unless the water has leaked to below the fourth eyelet. If water has definitely leaked through the top of the boot by splashing and reached to below the fourth eyelet, then the whole boot must be dried and the absorbent blotting paper replaced before the test is resumed. Water ingress into the boot by way of wicking up the boot upper (outside) and down into the boot lining (inside) will not be considered an item failure. If it cannot be determined if the water has entered through the top or upper of the boot, a new boot shall be requested and subjected to the test.

## 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

6.1 Intended use. The boots are intended for wear by military personnel of the Department of Defense.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number and date of this Purchase Description.
- b. Sizes and widths required (see 1.2).
- c. When first article is required, (see 3.1 and 4.2).
- d. Toxicity requirements (see 3.2.3.1.1.1.1)
- e. Packaging (see 5.1)
- f. Inclusion of specific instructions regarding arrangement for examinations, quantity, testing and approval.

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of Federal Acquisition Regulation (FAR) 52.209-4. The first article should be a pre-production sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article (see 3.1 and 4.2).

6.4 Subject term (key word) listing.

Footwear  
Leather  
Liner  
Waterproof

6.5 International standardization agreements. Certain provisions of this document are the subject of international standardization agreement as cited in NATO STANAG 2333. When an amendment, revision, or cancellation of this document is proposed that will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliatory action through international standardization channels, including departmental standardization office, if required.

6.6 Equal item. Prior to use of an "or equal" item, the contractor shall submit the item with supporting data to the contracting officer for subsequent approval or disapproval by the responsible military agency. If deemed necessary, the government reserves the right to test the infantry combat boot in the field with the "or equal" component or end item at the contractor's expense prior to approval.

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

Use and Care Instructions  
Army Combat Boot (Temperate Weather)

1. Wear with: 1 pair of cushioned sole socks depending on safety/uniform requirements; 1 pair of insole inserts if desired.
2. Sizes. These boots are supplied in whole and half sizes 2 through 15 and 16 whole size, widths N (B), R (D), W (EE), and XW (EEEE). In some instances, it may be necessary to select a slightly larger size than normally worn in order to allow for normal swelling of the feet and the use of inserts or cushioned socks.
3. Pull on boot, using pull-tab, seating heel firmly into place, then lace. Boots should fit snugly but not tightly. There should be at least a 3/4-inch minimum additional length at toe.
4. Trousers should be bloused over the outside and below the comfort collar of the boot.
5. Break-in: DO NOT soak boots in water or bake in an oven to break-in. Boots should be worn-in gradually at first with ever-increasing walking or marching distances while remaining comfortable. If blistering occurs, check to make sure that boots are fitted properly and that you are wearing recommended socks
6. Your Combat Boots are waterproof. However boots may become damp or wet due to excessive perspiration or water coming over the top of the boot. If boots become wet, empty excess water, change socks, and continue to wear while changing socks regularly. Boots will dry much faster when worn than if left to stand and dry. DO NOT expose boots to excessive heat to dry, including hair dryers, heating vents, stoves etc.
7. Your Combat Boots are designed for maximum performance in a field environment. Do not apply polish to your Combat Boots.
8. Your Combat Boots are designed to be easy to care for. The nylon quarter side panels of your boots are as strong as leather and will last if cared for properly. To clean your Combat Boots, brush with stiff nylon bristle brush to clean and then use warm water. Do not use soap to clean your boots. If additional, more stringent cleaning is necessary, only water-soluble cleaning products should be used as oil- or alcohol-based cleaning products may damage your boots.
9. Your Combat Boots come with a replaceable rubber outsole. Do not wear sole past rubber outsole into the softer midsole material or permanent damage to your boots will occur. The midsole is the soft cushioned material between the rubber lug outsole and the boot upper.
11. Your ACB(TW) provides limited flame resistance, conductive heat resistance and liquid fuel penetration protection and is authorized by the US Army for flight and Combat Vehicle Crewman Use.
10. (Must include information on how/where the boots can get resoled or who to contact to receive information on resoling.)

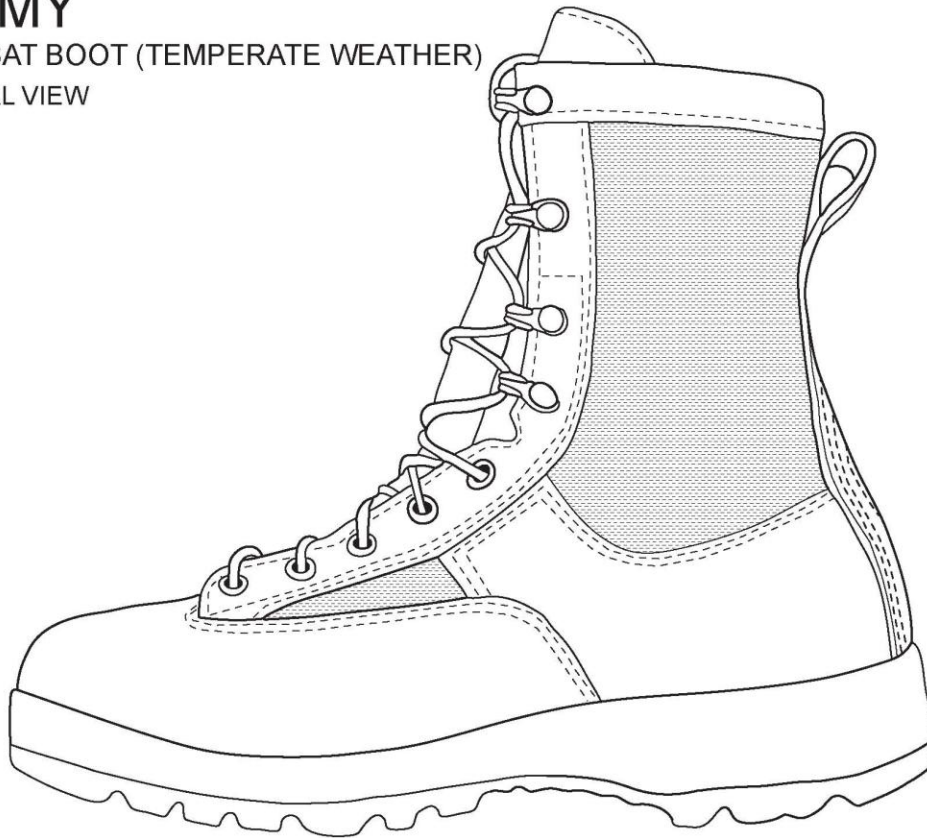
**FIGURE 1. Care and Use Instruction Tag**



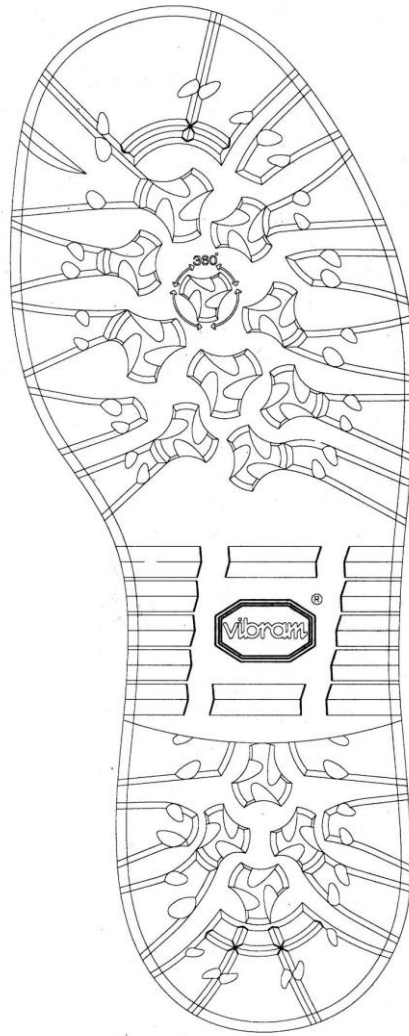
**FIGURE 2a. Army Combat Boot (Temperate Weather)  
[lateral view]**



**ARMY**  
COMBAT BOOT (TEMPERATE WEATHER)  
MEDIAL VIEW



**FIGURE 2b. Army Combat Boot (Temperate Weather)  
[medial view]**



**FIGURE 3. Outsole Design**

Custodians:  
Army – GL

Preparing Activity  
GL-Army