**INCH-POUND**

**MC/PS 01-2015 SYSCOM**

**15 March 2015**

SUPERSEDING

MC/PD 05 2011 SYSCOM, dated 21 September 2011

**PERFORMANCE SPECIFICATION**

**UNDERWEAR SET,**

**UNDERSHIRT, FLAME RESISTANT LIGHTWEIGHT COLD WEATHER**

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

**1. SCOPE**

1.1 Scope. This specification prescribes the performance requirements and identifies verification procedures for the U.S. Marine Corps flame resistant lightweight cold weather underwear set undershirt, hereafter referred to as the undershirt.

1.2 Classification. The undershirt will be one type and in the following sizes.

## Schedule of Sizes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| X-Small | Small | Medium | Large | X-Large | XX-Large | XXX-Large |

**2. APPLICABLE DOCUMENTS**

2.1 General. The documents listed in this section are specified in sections 3 or 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 or 4 of this specification, whether or not they are listed.

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center Philadelphia, Clothing and Textiles Directorate, Attn: DLA Troop Support, 700 Robbins Avenue, Bldg. 3D, Philadelphia, PA 19111-5092, or emailed to elizabeth.roland@dla.mil. Since contact information can change, you may want to verify the currency of this address information by using the ASSIST Online database at [www.dodssp.daps.mil](http://www.dodssp.daps.mil).

AMSC N/A. FSC 8415

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*distribution is unlimited.*

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 shall be cited in the solicitation or contract (see 6.1).

COMMERCIAL ITEM DESCRIPTIONS

A-A-55217B Thread, Aramid, Spun Staple

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

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

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issue of documents which are DOD adopted shall be those in the issue of the Acquisition Streamlining and Standardization Information System (ASSIST) database cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the ASSIST are the documents cited in the solicitation.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

AATCC - 8 Colorfastness to Crocking: AATCC Crockmeter Method   
AATCC - 16 Colorfastness to Light

AATCC-20A Fiber Analysis: Quantitative

AATCC - 61 Colorfastness to Laundering, Home and Commercial: Accelerated.   
AATCC - 135 Dimensional Changes of Fabrics after Home Laundering

AATCC Evaluation Procedure - 9 Visual Assessment of Color Difference of Textiles

(Copies of these documents are available online at [http://www.aatcc.org](http://www.aatcc.org/) or AATCC, PO Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN NATIONAL STANDARDS INSTITUTE

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

(For all inquiries please contact the American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036. Website address: <http://www.ansi.org>)

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D737 Standard Test Method for Air Permeability of Textile Fabrics

ASTM D1776 Standard Practice for Conditioning and Testing Textiles

ASTM D2594 Standard Test Method for Stretch Properties of Knitted Fabrics Having Low Power

ASTM D3512 Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble Pilling Tester

ASTM D3776 Standard Test Method for Mass Per Unit Area (Weight) of Fabric

ASTM D3787 Standard Test Method for Bursting Strength of Textiles—Constant-Rate-of-Traverse (CRT) Ball Burst Test

ASTM D6193 Standard Practice for Stitches and Seams

ASTM D6413 Standard Test Method for Flame Resistance of Textiles (Vertical Test)

ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials

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

MISCELLANEOUS

Marzulli, F. and H. Maibach, “Contact Allergy: Predictive Testing in Humans,” Advances in Modern Toxicology, Volume 4, pp 353-372, 1977.

(Copies of this document are available from the U.S. Army Center for Health Promotion and Preventative Medicine, ATTN: MCHB-DC-TTE, Bldg., E-2100, Aberdeen Proving Ground, MD 21010-5422.)

Principle and Methods of Toxicology, A Wallace Hayes (editor), pp 394-396, 1989.

(Applications for copies of referenced documents should be addressed to Raven Press, 1185 Avenue of the Americas, New York, NY 10036)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

**3. REQUIREMENTS**

3.1 First article. When specified (see 6.1), a sample shall be subjected to first article inspection (see 6.2) in accordance with 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 operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Materials and components. The materials and components shall conform to applicable specifications, standards, drawings, and patterns required herein.

3.3.1 Basic Material. The basic material for the undershirt shall be a flame resistant, circular knit jersey fabric constructed with a modacrylic/FR rayon blend, Longworth style 1922, or equal. The circular knit construction shall provide multi-dimensional moisture management via yarn denier, construction, and permanent rendering of hydrophilic properties. The color of fabric shall be Coyote 498. The fabric shall show no toxicity when used as intended and when tested as specified in 4.4.4. The fabric shall conform to the physical requirements specified in Table I when tested as specified in paragraph 4.4.3.

3.3.2 Cuff Material. The basic material for the undershirt collar and cuffs shall be a flame resistant, circular 1x1 rib knit jersey fabric constructed with a modacrylic/FR rayon blend, Longworth style 2008, or equal. The color of fabric shall be Coyote 498. The fabric shall show no toxicity when used as intended and when tested as specified in 4.4.4. The fabric shall conform to the physical requirements specified in Table I when tested as specified in paragraph 4.4.3.

**TABLE I. Material physical requirements**

| **Material Characteristic** | **Material Requirement** | | **Test Method** |
| --- | --- | --- | --- |
| **Basic Material** | **Cuff Material** |
| Construction | Jersey circular knit | Circular, 1x1Rib knit | Visual |
| Fiber Content | Modacrylic, FR rayon | Modacrylic, FR rayon | AATCC 20A |
| Weight, ounces/ square yard | 4.7 ±0.4 | 4.7 ± 0.4 | ASTM D3776 (Method C) |
| Colorfastness to: (minimum)  Laundering (3 cycles)  Crocking  Wet  Dry  Light, Xenon method | 3.0  4.0  4.0  4.0 | 3.0  4.0  4.0  4.0 | AATCC-61, Option 2a  AATCC- 8  AATCC-16, Option E  (85 kJ) |
| Dimensional Stability (3 cycles) - %  Wales and Courses | 5.0 maximum | 5.0 maximum | AATCC – 135, (1), III, (A), ii |
| Bursting Strength, pounds (minimum) | 65 | N/A | ASTM D3787 |
| Pilling | 3.0 minimum | N/A | ASTM D3512 |
| Air Permeability, cubic feet/square feet/minute | 200 minimum | N/A | ASTM D737 |
| Fabric Stretch (length) %  Fabric Growth (length) % | 30 minimum  5 maximum | 30 minimum  5 maximum | ASTM D2594  (Loose Fit) |
| Water sorption and wicking  Back (water sorption)  Face (wicking) Inches/10 second | < 5 seconds  0.4”/10 seconds minimum | N/A | See 4.4.3.1.3  See 4.4.3.1.2 |
| MVTR, gram/square meter/24 hours | 1400 minimum | N/A | ASTM E96 1/ |
| Moisture Wicking, inches  Wales  Courses | 6” in 35 min.  6” in 35 min. | 6” in 35 min.  6” in 35 min | See 4.4.3.2 |
| Drying time, minutes | 45 maximum | 45 maximum | See 4.4.3.3 |
| Vertical Flame – initial (maximum)  Wales and Courses  After flame, seconds  After glow, seconds  Char length, inches  Melt/Drip | 2.0  5.0  5.0  No Melt/No Drip | 2.0  5.0  5.0  No Melt/No Drip | ASTM D6413 |
| Vertical Flame – after 5 launderings (maximum)  Wales and Courses  After flame, seconds  After glow, seconds  Char length, inches  Melt/Drip | 2.0  2.5  5.0  No Melt/No Drip | 2.0  2.5  5.0  No Melt/No Drip | ASTM D6413  AATCC – 135, 5 Cycles, (1), III, (A), ii |

1/ ASTM E96 shall be performed according to Procedure BW – Inverted Water method.

3.3.3 Components.

3.3.3.1 Thread. The thread for the undershirt shall be aramid, Tex Size 27 conforming to A-A-55217B Type II. The color of the thread shall match Coyote 498. The thread shall show fastness to laundering equal to or better than the standard sample. When no standard is available, the thread shall show “good” fastness to laundering.

3.3.3.2 Labels.

3.3.3.2.1 Marine Corps Exclusive Label. Each undershirt shall have a heat transfer 33 mm x 27 mm (1.299 inches x 1.063 inches) in size adhered to the inside at the center back neck 3/4 ± 1/4 inches below the collar joining seam. The Marine Corps exclusive label shall be to the left (as worn) of the combination label. The information on the label shall include the following: “Made Expressly for” at the top; followed by a woven USMC emblem in the center; below the emblem, the contractor’s name.

3.3.3.2.2 FROG Label. Each undershirt shall have a heat transfer or a woven FROG label, 63mm x 63mm (2.480 inches x 2.480 inches) in size sewn or adhered to the lower left front (as worn), approximately 1 inch above the hem. If a woven label, it shall be cut single, fused edge, manufactured by ITW Graphics, Bell Label or equal in the following configuration:



3.3.3.2.3 Combination size, identification, and instruction label. The combination size, identification, and instruction label shall be a heat transfer label manufactured by ITW Graphics, Bell Label or equal. The label shall be positioned at the center back neck 3/4 ± 1/4 inches below the collar joining seam. The heat transfer label shall contain the following information and configuration:

**Size and Identification Information:**

UNDERSHIRT, FR LIGHTWEIGHT

CONTRACT NO.:

NSN:

FIBER CONTENT:

CONTRACTOR’S NAME:

SIZE:

**Instruction Information:**

Machine Wash in Luke Warm water (105oF)

Tumble dry low or Line Dry  
Do Not Use Fabric Softeners

DO NOT BLEACH, DRY CLEAN

OR IRON

3.3.3.2.4 Bar-code label/tag. Each undershirt shall be individually bar-coded with a label/tag conforming to Type VI, Class 17 of MIL-DTL-32075. The label/tag shall be located so that it is completely visible on the item when folded and/or packaged as specified and shall cause no damage to the item.

3.4 Design and construction.

3.4.1 Design. The undershirt shall have a rib knit mock turtleneck and cuffs, offset shoulder seams and long sleeves with an underarm gusset. All joining seams shall be a flat locked construction to reduce chaffing and provide comfort in movement.

3.4.2 Construction. The following specifics will provide garments with uniform appearance, comfort and durability for use during field duties, combat and operations other than war. End item construction and appearance shall conform to the figures provided and the finished dimensions cited (see 3.7) to maintain end item configuration.

3.4.2.1 Patterns. Standard patterns, providing a seam allowance of 3/8-inch for all seams - except where otherwise specified, will be furnished by the Government. The list of pattern parts and computer nomenclature in Table II is provided to insure that the pattern set provided is complete. The Government patterns shall not be altered in any way, and are to be used only as a guide for cutting the contractor’s working patterns. The working patterns will be identical to the Government patterns, except that additional notching, if needed, to facilitate manufacture is possible. Minor modifications are permitted where necessary to accommodate the manufacturer’s processes and the use of automated equipment. These modifications shall not alter the serviceability or appearance requirements of these garments.

3.4.2.1.1 Pattern parts. The component parts shall be cut from the basic material or cuff material in accordance with the pattern parts listed in Table II.

**TABLE II. List of Pattern Parts**

|  |  |  |
| --- | --- | --- |
| **Fabric** | **Piece Name** | **Cut Parts** |
| Basic material | BACK | 1 |
| FRONT | 1 |
| SHOULDER | 2 |
| UNDERARM GUSSET | 2 |
| SLEEVE | 2 |
| Cuff material | COLLAR | 1 |
| CUFF | 2 |

3.4.2.2 Seaming. The seams and seaming used shall be consistent, exhibit a uniform appearance, and conform to the ASTM D-6193, Stitch and Seam Types listed in Table III. All material edges shall not ravel. A seam allowance of 3/8 inch gage is provided for all seaming. The stitches per inch shall be 10-14 for all seams except stitch type 607 which shall be 12-14 stitches per inch.

**TABLE III. Stitching**

| **Location** | **Stitch Type** | **Seam Type** |
| --- | --- | --- |
| Join shoulders to front and back. | 607 | FSa-1 |
| Fold cuff in half and join to sleeve. | 607 | FSa-1 |
| Set sleeves flat. | 607 | FSa-1 |
| Join gusset to back and sleeve. | 607 | FSa-1 |
| Close sleeves and cuffs. | 607 | FSa-1 |
| Join collar edges. | 504 | SSa-1 |
| Set collar with seam at center back. | 504 | SSa-1 |
| Turn collar down and cover stitch, catching seam. | 406 | SSh-2 |
| Turn under undershirt hem 3/4” + 1/8” and cover stitch. | 406 | EFa-2 |
| Turn under seam tails at cuff ends and secure with 5/8” bartack. | Bartack | N/A |
| Secure hem ending with a 5/8” bartack. | Bartack | N/A |
| Place combination instruction/ID label at center back 3/4” + 1/4” below the collar opening and apply with heat transfer machine or stitch to back around all four sides . | N/A | N/A |
| Place FROG label on lower left front as worn approximately 1 inch above hem and apply with heat transfer machine. | N/A | N/A |

3.4.2.2.1 Bartacks. Bartacks for reinforcement shall be placed in the locations listed in Table IV:

**Table IV. Bartack locations**

|  |  |  |
| --- | --- | --- |
| **Bartacks Locations** | **Length, inches** | **Quantity per Garment** |
| Bottom of cuff @ underarm seam | 5/8 | 2 |
| Undershirt hem @ side seam | 5/8 | 1 |

3.4.2.3 Tacking and backstitching. Ends of seams and rows of stitching, when not caught in other seams or stitching, shall be securely backstitched not less than 1/4 inch. Thread breaks (all stitch types) shall be secured by stitching back of the break not less than 1/2 inch.

3.5 Toxicity. The undershirt shall not present a health hazard and shall show compatibility with prolonged direct skin contact when tested as specified in 3.5.1. Chemicals recognized by the Environmental Protection Agency (EPA) as human carcinogens shall not be used. The contractor must furnish information, which certifies that the finished product is composed of materials, which have been safely used commercially or provided sufficient toxicity data to show compatibility with prolonged, direct skin contact.

3.5.1 Toxicity Test. An acute dermal irritation study and a skin sensitization study shall be conducted on laboratory animals. When the results of the studies indicate the undershirt is not a sensitizer or irritant, a Repeat Insult Patch Test shall be performed in accordance with the Modified Draize Procedure. If the toxicity requirement (see 3.5) can be demonstrated with historical data, then toxicity testing may not be required. All finishes/chemicals used to process the garment 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 human carcinogens is prohibited.

3.6 Color.

3.6.1 Visual matching. The color and appearance of the material 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 + 200K.

3.6.2 Colorfastness. The basic material and components shall conform to the colorfastness requirements listed in Table I.

3.7 Finished measurements. The finished undershirt shall conform to the measurements listed in Table V. All measurements shall be taken with the garment laid flat. Sleeve lengths should not be uneven by more than 1/2 inch.

**TABLE V. Finished measurements (Inches)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **X-Small** | **Small** | **Medium** | **Large** | **X-Large** | **XX-Large** | **XXX-Large** | **TOL** |
| 1/2 Chest 1/ | 20-1/2 | 22 | 23-1/2 | 25 | 26-1/2 | 28 | 29-1/2 | ± 1 |
| Back Length 2/ | 29 | 29-1/2 | 30 | 30-1/2 | 31 | 31-1/2 | 32 | ± 1/2 |
| Sleeve Outseam 3/ | 24-1/8 | 24-3/8 | 24-5/8 | 24-7/8 | 25-1/8 | 25-3/8 | 25-5/8 | + 1/2  - 1/4 |
| 1/2 Cuff Opening 4/ | 3 | 3-1/4 | 3-1/2 | 3-3/4 | 4 | 4-1/4 | 4-1/2 | ± 1/4 |
| 1/2 Neck | 8 | 8-1/8 | 8-1/4 | 8-1/2 | 8-3/4 | 9 | 9-1/2 | ± 1/4 |

1/ **1/2 Chest** Lay undershirt on a flat surface with sleeves laid straight up above shirt, i.e. gusset lays flat, measure from folded edge to folded edge at base of sleeve setting seam.

2/ **Back Length** Measure from center of back at neck seam to bottom of shirt hem

3/ **Sleeve Outseam** Measure in a straight line from shoulder seam at outer folded edge to base of cuff.

4/ **1/2 Cuff Opening** Measure from folded edge to folded edge at base of finished cuff.

5/ **1/2 Neck Opening** Lay undershirt on a flat surface, align top edges of collar and measure from folded edge to folded edge along collar joining seam.

3.8 Workmanship. The finished undershirt shall be free from loose thread, foreign matter, and irregular defects that can adversely affect usage or durability. The finished undershirts shall be uniform in quality, free from defects that adversely affect form, fit or function and those defects specified in Table VI.

**4. VERIFICATION**

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

1. First article inspection (see 4.2).

2. Conformance inspection (see 4.3).

4.2 First article inspection. The first article inspection when required (see 3.1) shall consist of the end item examinations and tests specified in Table I. The presence of excessive defects, as defined by contract, (see 4.1) or failure to pass any test shall be cause for rejection of the first article.

4.2.1 First article samples. Unless otherwise specified in the procurement document, first article samples shall be provided. The sample size will be specified in the procurement document. The sample unit shall be one undershirt and the lot size shall be expressed in units of undershirts.

4.2.1.1 Materials and components inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced specifications, drawings, and standards unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document. In addition to testing provisions specified in referenced documents, components shall be tested for the characteristics specified in this specification. Tests shall be conducted with both the specimen and test apparatus under standard conditions as defined in the various ASTM and AATCC test methods. All requirements are applicable to the sample unit. All test reports shall contain the individual values utilized in expressing final results. The lot shall be unacceptable if one or more sample units fail to meet any test requirement specified. Unless otherwise specified in subsidiary specifications, sampling shall be as follows:

Lot Size (yards) Sample size

800 or less 2

801 up to and including 22,000 3

22,001 and over 5

4.3 Conformance inspection. In accordance with 4.1, conformance inspection shall include the examination specified in 4.3.1. Sampling for inspection shall be performed in accordance with ASQC Z1.4, as defined by contract, except where otherwise indicated.

4.3.1 Conformance inspection samples. Sampling for conformance inspection shall be performed in accordance with ASQC Z1.4. The sample unit shall be one undershirt and the lot shall be expressed in units of undershirts.

4.4 Examinations and tests.

4.4.1 Visual examination. The end item shall be visually examined for compliance to 3.4. The undershirt shall be examined for defects in shade, design, material, construction, and workmanship, with defects classified in accordance with Table VI.

**TABLE VI. Visual Examination**

|  |  | **Classification** | |
| --- | --- | --- | --- |
| **EXAMINATION** | **DEFECT** | **Major** | **Minor** |
| Workmanship | Component part omitted, distorted, full, tight, or twisted; any part of undershirt caught in any unrelated stitching, the edge of any component part required to be forced out having folds of more than 1/8 inch. | 101 |  |
| Material | Hole, cut, tear, smash, burn, drill hole, run, needle chew, visible mend, thin place, misweave affecting appearance or serviceability. | 102 |  |
| Shade | Shade variation within a part or between parts. Thread color not as specified. | 103 |  |
| Dye streak, color not as specified | 104 |  |
| Seam and Stitching | Seam: puckered, distorted, pleated, wavy, twisted; edge or raised stitching sewn too close to edge, resulting in damage to cloth,. |  | 201 |
| irregular or open seam, raw edge affecting appearance or serviceability | 105 |  |
| seam allowance not as specified, |  | 202 |
| loose or tight stitch tension; broken or missing thread or stitch; |  | 203 |
| Bartacks | Bartacks missing, insecure, misplaced, not specified size, stitches loose or broken. |  | 204 |
| Cleanness | Spot, stain, excessive thread ends not trimmed or removed, odor. |  | 205 |
| Labels | Label omitted, incorrect, illegible, not attached as specified; | 106 |  |
| Bar codes omitted, not readable by scanner; human-readable interpretation (HRI) omitted or illegible; |  | 206 |
| Bar code not visible on folded, packaged item; |  | 207 |
| Bar code attachment causes damage to the item | 107 |  |
| Packaging | Any undershirt not packaged in accordance with the contract or purchase order. |  | 208 |

4.4.2 Dimensional examination. The undershirt shall be examined for conformance to the dimensions specified in Table V.

4.4.3 Material and garment testing. The cloth and/or garment shall be tested for the characteristics listed in Table VII. The testing shall be performed using the test methods as specified in Table VII. All test reports shall contain the individual values utilized in expressing the final results. For material testing, the sample unit shall be 5 continuous yards full width of the finished cloth, for all physical and chemical tests. For garment testing, the sample unit shall be one undershirt per lot. The lot shall be considered unacceptable if one or more sample units fail to meet any requirements specified.

**TABLE VII. Material and Garment Testing Requirements**

| **Characteristic** | **Requirement Paragraph** | | **Test Method** |
| --- | --- | --- | --- |
| **Basic Material** | **Cuff Material** |
| Construction | 3.3.1 | 3.3.2 | Visual 1/ |
| Fiber Content | 3.3.1 | 3.3.2 | AATCC-20A 1/ |
| Weight | 3.3.1, Table I | 3.3.2, Table I | ASTM D3776 (Method C) |
| Colorfastness  Laundering (3 cycles)  Crocking  Light, Xenon method | 3.3.1, Table I, 3.6.2 | 3.3.2, Table I, 3.6.2 | AATCC-61, Option 2a  AATCC-8  AATCC-16, Option E (85 kJ) |
| Dimensional Stability | 3.3.1,Table I | 3.3.2, Table I | AATCC-135, (1), III, (A) , ii |
| Bursting Strength | 3.3.1, Table I | N/A | ASTM D3787 |
| Pilling | 3.3.1, Table I | N/A | ASTM D3512 |
| Air Permeability | 3.3.1, Table I | N/A | ASTM D737 |
| Fabric Stretch and Growth | 3.3.1, Table I | 3.3.2, Table I | ASTM D2594 (Loose Fit) |
| Water sorption and wicking  Back (water sorption)  Face (wicking) | 3.3.1, Table I  3.3.1, Table I | N/A  N/A | 4.4.3.1.3  4.4.3.1.2 |
| MVTR | 3.3.1, Table I | N/A | ASTM E96 |
| Moisture Wicking | 3.3.1, Table I | 3.3.2, Table I | 4.4.3.2 |
| Drying time | 3.3.1, Table I | 3.3.2, Table I | 4.4.3.3 |
| Vertical Flame | 3.3.1, Table I | 3.3.2, Table I | ASTM D6413 |
| Toxicity | 3.5, 3.5.1 | 3.5, 3.5.1 | 4.4.4, 4.4.4.1 1/ |
| Visual color matching | 3.6.1 | 3.6.1 | AATCC Evaluation Procedure 9, Option A |

1/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.

4.4.3.1 Water sorption and wicking. Water sorption and wicking shall be determined using the following procedure:

4.4.3.1.1 Water sorption and wicking test specimens. Fabric specimens shall be conditioned in accordance with ASTM-D-1776 and tested in that environment. The specimen size shall be 6-inches by 6-inches; three (3), separate specimens shall be used for each of the face side and back side tests. A fabric shall be considered Passing only when tests on both the face side and the back side meet the respective test pass/fail criteria on all individual specimens tested.

4.4.3.1.2 Face side wicking test. The test specimen shall be laid flat on a glass plate with back side up (i.e., inner or skin surface when used in a garment). One (1) drop of 0.10 + 0.01 milliliters of distilled water at 70oF + 2o F shall be placed in the center of the test specimen using a pipettor and a stopwatch/timer immediately started. The test specimen shall then be immediately turned over on the glass plate with test specimen face side up. The diameter of the wicked water area (denoted by a darkened water mark) shall be measured at a total elapsed time of 10 seconds. The specimen shall be considered passing if the diameter of the wicked water area (darkened water mark) is equal to or greater than 0.4 inches.

4.4.3.1.3 Back side sorption test. The test specimen shall be laid flat on a glass plate with back side up (i.e., inner or skin surface when used in a garment). One (1) drop of 0.10 + 0.01 milliliters of distilled water at 70oF + 2 o F shall be placed in the center of the test specimen using a pipettor and a stopwatch/timer immediately started. The water (denoted as a darkened water mark) shall be observed and the time for the water mark to disappear (water sorption, denoted as a lightened water mark approximating the shade of the basic material) shall be recorded. The specimen shall be considered passing if the water sorption (disappearance of the darkened water mark) is 5 seconds or less.

4.4.3.2 Wicking. Wicking data will be collected using the following procedure. A sample size of 6 inches by 1 inch will be cut with the 6 inch cut measured in the Wale direction. A 500 ml Erlenmeyer flask shall be filled with 200 ml of colored water (food coloring used shall be a contrasting color to the cloth material to make the water level visible on the sample). The top edge of the sample will be pierced with a long straight pin and the sample then suspended from the top of the flask. After 1 minute remove the sample from the flask and measure water level on sample in inches and record. Return sample to the flask. Repeat the following measurement at 3 minutes, 5 minutes and each 5 minute interval until the water level reaches 6 inches or 1 hour has elapsed. Values are reported as inches per hour. A minimum of 3 samples shall be tested with the average value reported along with each individual measurement. This test shall be repeated in the Course direction.

4.4.3.3 Drying Time Test Method.

4.4.3.3.1 Apparatus and Materials. Wringer (motor driven)(see 4.4.3.3.4). Laboratory balance, accurate to 0.01g. White AATCC Textile Blotting Paper, 25 x 25 cm (see 4.4.3.3.4). Water, distilled. 250 ml glass beaker.

4.4.3.3.2 Test Specimens. The fabric samples and blotting paper should be conditioned at 65 +/- 2% RH and 70 +/- 2ºF for a minimum of 4 hours. 3 test specimens per sample, 2 x 2 inches.

4.4.3.3.3 Drying time test procedure.

1. Test shall be run in standard conditions, 65 +/-2% RH and 70 +/- 2ºF.
2. Weigh the conditioned specimen using a laboratory balance accurate to 0.01g.
3. Place 100 mls of distilled water into a 250 ml glass beaker.
4. Submerge the specimen in the beaker of water for 30 minutes. Make certain that the specimen is completely submerged to insure complete wetting.
5. Remove the specimen and sandwich it between two pieces of unused blotting paper. Pass the sandwich through the wringer with a dead weight load of 27.7 +/- 0.5 kg.
6. Immediately place specimen on the balance with top door of the balance open, side doors closed and record wet weight either to the nearest 0.01 or 0.1 grams. (Degree of dryness shall be determined by the user.) Manually monitor weight at set intervals until dry or use an automated balance with capability to weigh specimen until dry (see 4.4.3.3.4). Record time to dry.
7. Repeat for remaining specimens. Average the 3 specimens.

4.4.3.3.4 Drying time test notes.

1. Wringer, (motor driven) see AATCC 70 footnote 11.2.
2. Blotting Paper see AATCC footnote 11.3.
3. Suitable Automation Software for a balance, Labtronics Inc., Web: www.labtronics.com

4.4.4 Toxicity assessment. The contractor must furnish information (see 4.4.4.1) certifying that the finished product is composed of materials which have been safely used commercially OR which provide sufficient toxicity data to show compatibility with prolonged, direct skin contact. At a minimum, toxicity data should include results from a primary dermal irritation study in laboratory animals and a repeated insult human patch test (Modified Draize Procedure). The latter must be conducted under the supervision of a qualified dermatologist using at least 100 free-living individuals.

4.4.4.1 Toxicity Documents. All finishes/chemicals used to process the garment shall be identified and accompanied by the appropriate Material Safety Data Sheet (MSDS) information. The use of chemical recognized by the Environmental Protection Agency (EPA) as known human carcinogens is prohibited.

**5. PACKAGING**

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.1). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point’s packaging activities within the Military Service or Defense Agency, or within the military service’s system commands. Packaging data retrieval is available from the managing Military Department’s or Defense Agency’s automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

**6. NOTES**

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

6.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this document, including any amendments.

b. Types, classes and sizes required (see 1.2).

c. National stock number.

d. Applicable Government patterns and drawings, including revisions (see 3.4.2.1).

e. When first article sample is required (see 4.2 and 6.2).

f. Number of first article inspection samples (see 4.2.1)

g. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2 and 2.3).

h. Packaging requirements (see 5.1)

6.2 First article. When first article inspection (see 4.2) is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be first article sample, a first production item, or a standard production item from the contractor’s current inventory, and the number of items to be tested as specified in 4.2.1. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for pending contract. Bidders should not alternate submit bids unless specifically requested to do so in the solicitation.

6.3 Suggested Sources.

Basic and cuff fabric:

Longworth Industries, Inc., 575 Air Tools Drive, Suite K, Southern Pines, NC 28387

Woven and adhesive labels:

Bell Label, 777 Main St., Lewiston, ME 04240, (207) 784-2961

ITW Graphics, 375 New State Rd., Manchester, CT 06042, (860) 533-5107

6.4 Key words.

Flame resistant

Underwear

Moisture wicking

Undershirt



**FIGURE 1**



**FIGURE 2**