INCH-POUND
MIL-PRF-IWCS
JUNE 2014 (updated 24 SEP 14)

PURCHASE DESCRIPTION

INCLEMENT WEATHER COMBAT SHIRT (IWCS)

1. SCOPE

1.1 Scope. This document covers the requirements for the Inclement Weather Combat Shirt (IWCS). The shirt is designed to provide flame resistance and inclement weather protection needed for wear in field and combat operations.

1.2 Garment Classification. The shirt shall be of the following types and sizes as specified.

Type I	IWCS, Woodland, Marine Corps Pattern (MARPAT) Camouflage Printed
Type II	IWCS, Desert, MARPAT Camouflage Printed
Type III	IWCS, Navy Working Uniform (NWU) II, Desert Digital Camouflage Printed
Type IV	IWCS, NWU III, Woodland Digital Camouflage Printed

1.2.1 Schedule of sizes. The IWCS shall be constructed in the following sizes (see 6.2).

SCHEDULE OF SIZES

Small	**Medium**	**Large**	**X-Large**
Regular	Regular	Regular	Regular
	Long	Long	Long

AMSC N/A **FSC 8415**

Comment, suggestions, or questions on this document should be addressed to: Marine Corps Systems Command, Program Manager Marine – 113, Product Manager – Infantry Combat Equipment, Clothing Team, 2200 Lester Street, Quantico, VA 22134

GOVERNMENT INTELLECTUAL PROPERTY AND TRADEMARK RIGHTS NOTIFICATION:

This notice is to advise you that the Government possesses intellectual property/trademark rights in the following Marine Corps patterns and logos (hereafter collectively referred to as "intellectual property"): The Eagle, Globe and Anchor (EGA) logo, including the EGA logo as it appears embedded in the fabric pattern. The Government further has title to the invention disclosed and claimed in United States Design Patent No. D491,372 issued on 15 June 2004 for

"Camouflage Pattern for Sheet Material and Uniforms." The Government claims exclusive ownership of the above mentioned intellectual property. Therefore, no entity other than the Government, or those contracted by or having obtained proper permission or licenses from the Government to do so, are permitted to produce, sell, or transfer in any manner any items (clothing or non-clothing) containing or copying, in whole or in part, the intellectual property. Doing so will be considered an infringement on the Government's intellectual property rights and will be subject to legal action.

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 cited in sections 3, 4 and 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Government 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.

FEDERAL STANDARDS

FED-STD-4B	Glossary of Fabric Imperfections
FED-STD-595C	Colors Used in Government Procurement

COMMERCIAL ITEM DESCRIPTIONS

A-A-50198	Thread: Gimp, Cotton, Buttonhole
A-A-55126	Fastener Tapes, Hook and Loop, Synthetic
A-A-55195	Thread: Para-Aramid, Spun, Intermediate Modulus
A-A-55217B	Thread, Aramid, Spun Staple
A-A-55634	Zippers (Fasteners, Slide Interlocking)
A-A-59826	Thread, Nylon

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-83429B	Cloth, Plain and Basket Weave, Aramid
DPSCM 4155.3	Quality Systems Requirements

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Ave. Philadelphia, PA 19111-9054.)

Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III

(Copies of this document are available from the procuring activity issuing the invitation for bids or request for proposal.)

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

Drawing Number	Drawing Description	Drawing Date
2-1-2525	Woodland MARPAT- 4 color (Coyote 476)	12-Jul-2004
2-1-2526	Woodland MARPAT- 4 color (Green 474 with EGA symbol)	12-Jul-2004
2-1-2527	Woodland MARPAT- 4 color (Black 477)	12-Jul-2004
2-1-2528	Woodland MARPAT- 4 color (Khaki 475)	12-Jul-2004
2-1-2529	Desert MARPAT- 4 color (Light Tan 479)	12-Jul-2004
2-1-2530	Desert MARPAT- 4 color (Urban Tan 478)	12-Jul-2004
2-1-2531	Desert MARPAT- 4 color (Light Coyote 481 with EGA symbol)	12-Jul-2004
2-1-2532	Desert MARPAT- 4 color (Highland 480)	12-Jul-2004

(Copies of drawings are available from the U.S. Army Research, Development & Engineering Command, Natick Soldier Center, ATTN: AMSRD-NSC-IP-D, Natick, MA 01760)

Commercial US Governmentally Controlled Performance Specification Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III.

(Copies are available from Program Manager – Special Operations Forces (SOF) Survival, Support and Equipment Systems, Natick Soldier Center, Natick, MA 01760.)

CODE OF FEDERAL REGULATIONS

Title 40, part 798.4500 (Primary Eye Irritation)
Title 40, part 798.4100 (Dermal Sensitization)
Title 40, part 798.4470 (Primary Dermal Irritation)

TEXTILE FIBER PRODUCTS IDENTIFICATION ACT

(Applications for copies should be addressed to U.S. Government Printing Office, Superintendent of Documents, Mail stop: SSOP, Washington, DC 20402-9328, or this reference may be found on the Internet at www.access.gpo.gov/nara/cfr/cfr-table-search.html.)

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

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC 8	Colorfastness to Crocking: AATCC Crockmeter Method
AATCC 15	Colorfastness to Perspiration
AATCC 16.2	Colorfastness to Light: Carbon-Arc
AATCC 16.3	Colorfastness to Light: Xenon-Arc
AATCC 20A	Fiber Analysis: Quantitative
AATCC 22	Water Repellency Spray Test
AATCC 61	Colorfastness to Laundering, Home and Commercial: Accelerated
AATCC 70	Water Repellency: Tumble Jar Dynamic Absorption Test
AATCC 81	pH of the Water Extracted from Wet Processed Textiles
AATCC 96	Dimensional Changes in Commercial Laundering of Woven and Knitted Fabrics except Wool
AATCC 135	Dimensional Change of Fabric after Home Laundering
AATCC Evaluation Procedure 6	Instrumental Color Measurement
AATCC Evaluation Procedure 9	Visual Assessment of Color Difference of Textiles

(Copies should be obtained from the American Association of Textile Chemists and Colorists, PO Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D76	Standard Specification for Tensile Testing Machines for Textiles
ASTM D737	Standard Test Method for Air Permeability of Textile Fabrics
ASTM D1424	Standard Test Method for Tearing Strength of Cloth by Falling Pendulum Type (Elmendorf) Apparatus
ASTM D2256	Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method
ASTM D2594	Standard Test Method for Stretch Properties of Knitted Fabrics Having Low Power
ASTM D3511	Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Brush 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 D5034	Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Grab 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
ASTM F1930	Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin

(Copies should be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19426-2959).

MISCELLANEOUS

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

(Applications for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308).

NFPA 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting

(Copies should be obtained from Customer Sales/Member Services, custserv@nfpa.org, 1-800 344-3555 or 1-617-770-3000).

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

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

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

(Applications for copies should be addressed to U.S. Army Center for Health Promotion and Preventive Medicine, Attn: MCHB-DC-TTE, Bldg E-2100, Aberdeen Proving Grounds, MD 21010-5422.)

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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3), 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 Material. The materials and components for the shirt shall conform to applicable specifications, standards and requirements specified herein.

3.3.1 Fiber and fabric identification. Each roll of finished cloth shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations under the Textile Fiber Products Identification Act. Each roll shall indicate cloth type. Testing shall be as specified in paragraph 4.4.1.

3.3.1.1 Fiber Content (all types). The fibers for all fabric types shall be made of virgin material and the use of recycled or recovered materials is prohibited. The contractor shall keep this information on file for the duration of the contract.

3.3.2 Material requirements (all fabrics). All cloth shall conform to the requirements in Table I-IV when tested as specified in paragraph 4.4.1.

3.3.2.1 Basic material.

3.3.2.1.1 Basic material, stretch woven. The basic material for construction of the torso and collar shall consist of a flame resistant (FR) rayon/para-aramid/nylon/spandex blend conforming to TenCate style Defender M Stretch or equal (see 6.7 for suggested source of supply). The weave shall be twill. Fabric shall be printed with the appropriate camouflage pattern (as specified in the solicitation) and conform to the requirements as specified Table 1.

TABLE I. Material Requirements for Cloth, Stretch Woven

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Weight, ounces per square yard (max)	6.3	ASTM D3776
Fiber content	See 3.3.2.1.1	AATCC 20A
Weave	See 3.3.2.1.1	Visual
Breaking Strength, pounds (min), Initial (no laundering) Dry Warp Fill	 115 70	ASTM D5034
Tear Strength, pounds (min) Warp Fill	 6.5 6.5	ASTM D1424
Air Permeability, cfm (min)	50	ASTM D737
Colorfastness (min) Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Crocking	 4 4 4 (color change) 3-4 (staining) 4 (dry)[2/] 3 (wet)[2/]	 AATCC 61 Test 1A[1/] AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 8

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Dimensional Stability, Commercial Laundering 5 cycles (max) Warp Fill	 5.0% 5.0%	AATCC 96[3/]
Drying Time, minutes (max)	60	Internal Method[6/]
Moisture Vapor Transmission, per square meter per 24 hours (min)	1200	ASTM E96 Test B
Pilling Appearance after 5 Laundering Cycles (min)	3	ASTM D3511, AATCC 96[3/]
Spray Rating (min) Initial After 5 Launderings	 100, 100, 100 90, 90, 90	AATCC 22 AATCC 96[3/]
Vertical Flame, Initial (warp and fill) After Flame, seconds (max) Char Length, inches (max) Melt/Drip	 2 5 None	ASTM D6413
Vertical Flame, After 25 Laundering Cycles (warp and fill) After Flame, seconds (max) Char Length, inches (max) Melt/Drip	 2 5 None	ASTM D6413 AATCC 135[4/]
Percent Stretch Fabric Stretch (min) (fill direction)	5%	ASTM D2594 (loose fitting comfort stretch procedure)[5/]

1/ Except that 1993 AATCC Standard Reference Detergent (non-phosphate) without optical brightener shall be used.
2/ Finished cloth shall show fastness to crocking equal to or better than 4 (dry) and 3 (wet) for all colors, except Black which shall have a rating not lower than 1.5.
3/ Launder according to AATCC 96 VIc, Drying A, except no pressing is performed after drying.
4/ Launder according to AATCC 135, 3, V, Aiii.
5/ Extend the specimen to the maximum amount (percentage) if the sample does not extend to the amount specified in the test procedure.
6/ See 4.4.5.1.

3.3.2.1.2 Basic material, stretch woven laminate. The basic material for construction of the sleeves, upper chest, elbow patch and raglan underarms shall consist of a FR rayon/para-aramid/nylon/ modacrylic/lyocell/spandex/ePTFE blend conforming to TenCate style Defender M Stretch Laminate or equal (see 6.7 for suggested source of supply). The weave shall be twill. Fabric shall be printed with the appropriate camouflage pattern (as specified in the solicitation) and conform to the requirements as specified Table II.

TABLE II. Material Requirements for Cloth, Stretch Woven Laminate

CHARACTERISTIC	REQUIREMENT	TEST METHOD

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Weight, ounces per square yard (max)	11.6	ASTM D3776
Fiber content	See 3.3.2.1.2	AATCC 20A
Weave	See 3.3.2.1.2	Visual
Breaking Strength, pounds (min), Initial (no laundering) Warp Fill	 115 70	ASTM D5034
Tear Strength, pounds (min) Warp Fill	 11 8	ASTM D1424
Air Permeability, cfm (max)	5	ASTM D737
Colorfastness (min) Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Crocking	 4 4 4 (color change) 3-4 (staining) 4 (dry)[2/] 3 (wet)[2/]	 AATCC 61 Test 1A[1/] AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 8
Dimensional Stability, Commercial Laundering 5 cycles (max) Warp Fill	 5.0% 5.0%	AATCC 96 [3/]
Drying Time, minutes (max)	60	4.4.1.1
Moisture Vapor Transmission, per square meter per 24 hours (min)	900	ASTM E96 Test B
Pilling Appearance after 5 Laundering Cycles (min)	3	ASTM D3511, AATCC 96[3/]
Spray Rating (min) Initial After 5 Launderings	 100, 100, 100 90, 90, 90	AATCC 22 AATCC 96[3/]
Thermal Protective Performance, cal/cm^2 (min) with spacer	10	NFPA 1971
Thermal Shrinkage (warp and fill) (max)	10%	NFPA 1971
Vertical Flame, Initial (warp and fill) After Flame, seconds (max) Char Length, inches (max) Melt/Drip	 2 5 None	ASTM D6413
Vertical Flame, After 25 Laundering Cycles (warp and fill) After Flame, seconds (max) Char Length, inches (max)	 2 5	ASTM D6413 AATCC 135[4/]

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Melt/Drip	None	

1/ Except that 1993 AATCC Standard Reference Detergent (non-phosphate) without optical brightener shall be used.
2/ Finished cloth shall show fastness to crocking equal to or better than 4 (dry) and 3 (wet) for all colors, except black which shall have a rating not lower than 1.5.
3/ Launder according to AATCC 96 VIc, Drying A, except no pressing is performed after drying.
4/ Launder according to AATCC 135, 3, V, Aiii.

3.3.2.1.3 Alternative elbow backing fabric requirements has been deleted in its entirety.

3.3.2.1.4 Cuff material. The material for construction of the sleeve cuffs shall consist of a modacrylic/lyocell/para-aramid/ nylon blend conforming to TenCate stretch jersey knit (see 6.7 for suggested source of supply) or equal and shall conform to the requirements specified in Table IV.

TABLE IV. Material Requirements for Cuff Material.

CHARACTERISTIC	REQUIREMENT	TEST METHOD
Weight, ounces per square yard(max)	7.6	ASTM D3776
Fiber content	See 3.3.2.1.4	AATCC 20A
Fabric construction	See 3.3.2.1.4	Visual
Bursting Strength, pounds (min)	80	ASTM D 3787
Colorfastness (min) Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Color Change Staining Crocking	 4 4 4 3-4 3	 AATCC 61 Test 1A 1/ AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 15 AATCC 8
Dimensional Stability, Commercial Laundering 5 cycles (max) Wales Courses	 8.0% 8.0%	AATCC 96 2/
Drying Time, minutes (max)	60	4.4.1.1
Pilling Appearance after 5 Laundering Cycles (min)	3	ASTM D3511, AATCC 96 2/
Vertical Flame, Initial (wales and courses) After Flame, seconds (max) Char Length, inches (max) Melt/Drip	 2 5 None	 ASTM D6413
Vertical Flame, After 25 Laundering Cycles (wales and courses)		ASTM D6413

After Flame, seconds (max) Char Length, inches (max) Melt/Drip	2 5 None	AATCC 135[3/]
Spectral Reflectance	See 3.3.6.4	4.4.1.3

1/ Except that 1993 AATCC Standard Reference Detergent (non-phosphate) without optical brightener shall be used.
2/ Launder according to AATCC 96 VIc, Drying A, except no pressing is performed after drying
3/ Launder according to AATCC 135, 3, V, Aiii.

3.3.3 Color (all types).

3.3.3.1 Cloth, Type I. The cloth shall be dyed and printed with the warp effect side as the face. The cloth shall be dyed to a ground shade approximating Khaki 475. The Woodland camouflage pattern shall be obtained by roller or screen-printing using either three or four rollers or screens, as appropriate for the Green 474, Khaki 475, Coyote 476 and Black 477 areas of the pattern. Resin bonded pigments are not permitted except for a small amount of carbon black pigment may be used to meet the black shade providing all other requirements are met.

3.3.3.2 Cloth, Type II. The cloth shall be dyed and printed with the warp effect side as the face. The cloth shall be dyed to a ground shade approximating Light Tan 479. The Desert camouflage pattern shall be obtained by roller or screen-printing using either three or four rollers or screens, as appropriate for the Urban Tan 478, Light Tan 479, Highland 480 and Light Coyote 481 areas of the pattern. Resin bonded pigments are not permitted.

3.3.3.3 Cloth, Type III. The cloth shall be dyed and printed with the warp effect side as the face. The cloth shall be dyed to NWU II as specified in "Commercial US Governmentally Controlled Performance Specification Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III."

3.3.3.4 Cloth, Type IV. The cloth shall be dyed and printed with the warp effect side as the face. The cloth shall be dyed to NWUIII as specified in "Commercial US Governmentally Controlled Performance Specification Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III."

3.3.3.5 Cloth knit cuff. The cloth shall be dyed Coyote 498.

3.3.4. Color matching .

3.3.4.1. Visual matching. The color and appearance of the camouflage printed cloth and dyed knit cloth, and garments shall match the standard sample when viewed using AATCC Evaluation Procedure 9, Option A, under filtered tungsten lamps that approximate artificial daylight D75 illuminant with a color temperature of 7500 ± 200 K with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under horizon lamplight at 2300 ± 200 K.

3.3.4.2 Instrumental color matching. Instrumental color matching is used as a tool to quantify shade evaluation if visually shade is rated unacceptable. All the colors in the Woodland

MARPAT shall be instrumentally measured except for Khaki and all the colors in the Desert MARPAT shall be measured except for Highland given the areas of these exempted colors are too small for accurate instrumental readings. Each measured color shall match the standard sample. See 4.4.1.4.2 for evaluation procedure and acceptance requirements.

3.3.4.3 Colorfastness. The finished camouflage printed cloth and dyed cloth shall show fastness to: light (after 40 AATCC standard fading hours or 170 Kilojoules); laundering (after 4 cycles); and perspiration (acid and alkaline) and crocking (wet and dry). The colorfastness of the cloth shall be equal to or better than the standard sample, or equal to or better than the ratings specified in Tables I-IV.

3.3.5 Pattern execution (Types I-IV).

3.3.5.1 Pattern execution (Types I-II). The pattern for woodland and desert MARPAT shall reproduce the standard sample in respect to design, colors, and registration of the respective areas. The pattern repeat of the camouflage printed finished cloth shall be 35 ± 1 ½ inches. Each pattern area shall show solid coverage; skitteriness exceeding that shown on the standard sample in any of the printed areas will not be acceptable. When the standard sample is not referenced for pattern execution, a pattern drawing will be provided, and the pattern of the finished cloth shall match that of the drawing.

3.3.5.2 Pattern execution (Types III-IV). The pattern for NWU II and NWU III shall be executed as specified in "Commercial US Governmentally Controlled Performance Specification Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III."

3.3.6 Spectral reflectance.

3.3.6.1 Cloth, Type I. The finished cloth shall meet the spectral reflectance values (in percent) for the visible/near infrared wavelength range, 600 to 860 nanometers (nm) for the colors specified in Table V as applicable, when tested as specified in 4.4.5.3.

TABLE V. Cloth, Type I, Spectral reflectance requirements (percent)

Wavelengths	Black 477		Coyote 476 & Khaki 475		Green 474	
Nanometers	Min.	Max.	Min.	Max.	Min.	Max.
600	--	10	8	18	3	10
620	--	10	8	18	3	10
640	--	10	8	18	3	9
660	--	10	8	18	3	12
680	--	10	10	22	3	14
700	--	10	18	33	5	18
720	--	10	22	45	7	20
740	--	10	30	55	12	28
760	--	10	35	65	18	36
780	--	10	40	75	26	44
800	--	10	45	80	34	52

820	--	10	50	86	42	60
840	--	10	55	88	53	68
860	--	10	60	90	56	74

3.3.6.2 Cloth, Type II. The finished cloth shall meet the spectral reflectance values (in percent) for the visible/near infrared wavelength range, 700 to 860 nanometers (nm) for the colors specified in Table VI, when tested as specified in 4.4.4.3.

TABLE VI. Cloth, Type II, Spectral reflectance requirements (percent)

Wavelengths	Lt. Tan 479		Lt. Coyote 481 &Highland 480		Urban Tan 478	
Nanometers	Min.	Max.	Min.	Max.	Min.	Max.
700	38	53	19	41	25	44
720	38	54	20	41	25	45
740	39	55	20	42	25	46
760	40	56	21	42	26	47
780	41	57	21	42	27	48
800	43	58	22	43	28	50
820	45	59	23	4	30	52
840	48	62	24	46	33	55
860	50	65	25	48	36	58

3.3.6.3 Cloth, Types III-IV. The finished cloth shall meet the spectral reflectance values (in percent) for the visible/near infrared wavelength range, for the colors specified in "Commercial US Governmentally Controlled Performance Specification Camouflage Print Performance Specification for AOR 1, AOR 2, NWU II, and NWU III."

3.3.6.4 Cloth, knit cuff. The finished cloth shall meet the spectral reflectance values (in percent) for the visible/near infrared wavelength range, 600 to 860 nanometers (nm) for Coyote 498 specified in Table V, when tested as specified in 4.4.4.3.

TABLE VII. Cloth, Cuff, Spectral reflectance requirements

	Reflectance values (percent)	
Wavelengths	Coyote 498	
Nanometers	Min.	Max.
600	8	18
620	8	18
640	8	18
660	8	18
680	10	22
700	18	33
720	22	45
740	30	55

760	35	65
780	40	75
800	45	80
820	50	86
840	55	88
860	60	90

3.3.7 Dimensional stability.

3.3.7.1 Dimensional stability (Cloth Types I-IV). The shrinkage in warp and filling direction of the cloth shall be not greater than 5.0 percent for individual sample unit and not greater than 5.0 percent for the lot average when tested as specified in 3.3.2 and 4.4.4. The fabric shall not elongate. Manufacturers must compensate for actual fabric shrinkage in order to deliver finished, treated garments complying with the dimension requirements specified in 4.4.8.

3.3.7.2 Dimensional stability (Cloth, cuff). The shrinkage in course and wale direction of the knit shall be not greater than 10.0 percent for individual sample unit and not greater than 8.0 percent for the lot average when tested as specified in 3.3.2 and 4.4.4.3. Manufacturers must compensate for actual fabric shrinkage in order to deliver finished, treated garments complying with the dimension requirements specified in 4.4.8.

3.3.8 pH (all types). The pH value of the water extract of all the finished cloth and garments shall be no lower than 5.0 nor higher than 8.5 when tested as specified in 4.4.4.3.

3.3.9 Toxicity. All finished cloth and garments shall not present a dermal health hazard when used as intended and tested as specified in 4.4.4.

3.3.10 Ground shade/printed seconds/dyed seconds/mill seconds. Ground shade cloth shall be dyed in conformance with the specified basic material and shall meet the physical, mechanical, and dimensional requirements of the respective finished fabric. Printed seconds shall be defined as cloth that has been rejected only for defects pertaining to color, infrared reflectance, or camouflage print patterns, which are cited in the specified basic material requirements. Dyed seconds shall be defined as cloth that has been rejected only for defects pertaining to color or infrared reflectance, which are cited in the specified basic material requirements. Mill seconds shall be cloth that has been rejected for visual defects only, and dyed to match ground shade (see 3.5.2) under seam types. Mill seconds finished firsts may contain slubs and knots (see 4.4.6 and FED-STD-4B for all other fabric defects which constitute seconds).

3.3.10.2 Disposal of ground shade/printed seconds/dyed seconds/mill seconds/rejected garments. All scraps, irregulars, extra material, and garments containing the aforementioned intellectual property/trademarks which are not utilized for Government contracts or a purpose authorized in writing by the Government, shall be destroyed and not sold or transferred in any manner. This restriction applies to the prime contractor, as well as all subcontractors. Contractor shall be prepared to certify as to the method and execution of the destruction of all scraps, seconds,

irregulars, extra material, and garments containing the aforementioned intellectual property/trademarks.

3.3.11 System level performance. The product provided shall meet the salient characteristic of the Purchase Description, and shall conform to the cited standard sample, specifications and quality assurance practices. The Government reserves the right to require proof of such conformance. The IWCS design must provide the following system level performance characteristics when tested as specified in 3.3.11.1 and 4.4.

3.3.11.1 Instrumented manikin test. The IWCS shall be tested according to ASTM F1930 and subjected to 4 second exposure at 2.0 cal/cm^2/sec heat flux. The IWCS (medium-regular size) shall be tested after one (1) and twenty-five (25) laundering cycles according to AATCC 135, 3, V, Aiii. It shall be tested with cotton t-shirt underneath the IWCS and a plate carrier over the IWCS and FR trousers (e.g. FR combat ensemble or FR Army combat trouser). The IWCS shall have no more than 5% total burn injury prediction including 2nd and 3rd degree burns. As an alternative, testing may be conducted without a plate carrier over the IWCS. When conducting testing without the plate carrier, the IWCS shall have no more than 25% total burn injury prediction including 2nd and 3rd degree burns. Only the burn sensors located under the IWCS shall be used in the calculation. The burn sensors in the legs and head sections should be excluded from the total burn injury calculation as these sensors are not covered and protected by the IWCS. This test shall be conducted during First Article Testing (FAT) and when a significant change is made to the garment design or materials. The change is determined to be significant by the Marine Corps Systems Command.

3.4 Design and construction.

3.4.1 Design. The IWCS shall be a flame resistant, wind resistant, water repellent pullover shirt intended to provide environmental protection in wet and windy conditions. It shall provide protection against wind, blowing sand and light rain/snow, and utilize Types I-IV printed camouflage fabrics that feature moisture management, and fabric breathability. The covered areas of the IWCS (areas under the ballistic vest) shall be constructed using fabric as specified in 3.3.2.1.1. The uncovered areas of the shirt (areas not covered by the ballistic vest, i.e. sleeves and neck) shall provide both warmth and water repellency and shall be constructed using fabric as specified in 3.3.2.1.2. The shirt shall meet all material and system level flame resistant (FR) requirements for flame protection as specified in 3.3.11.1. The IWCS must be compatible with current Marine Corps flame resistant organizational gear (FROG) items including the FR combat ensemble (FRCE), and enhanced flame resistant combat ensemble (EFRCE). FROG items also consist of a long-sleeve t-shirt, mid-weight fleece long sleeve shirt, gloves, and light and mid-weight balaclavas. The IWCS must also be compatible with the ballistic vests (improved modular tactical vests (IMTV) and plate carrier (PC)).

The shirt front shall consist of a slide fastener front closure and a stand up mock turtleneck collar. The front slide fastener closure shall be equipped with a slide fastener garage. Slide fastener shall be equipped with slide fastener pulls. Each sleeve shall have a vertical patch pocket. The pockets shall be constructed with a bottom bellow, sewn eyelet drainage hole located in the bottom bellow, and a concealed two-button closure flap(see Fig 1). Pockets shall

be superimposed with a 2" x 2" loop fastener tape for attachment of rank tab and infrared tab (see Fig 1). . The shoulder yoke provides water resistant protection. The stretch woven torso extends from the shoulder chest yoke seam to the shirt hem, and is designed to provide moisture management and improved comfort when worn under body armor. The shirt sleeves shall be sewn with knit cuffs with sewn monkey palms . All zippers shall have pull tabs approximately 1.5 inches in length. The back of the shirt shall have a waterproof shoulder yolk with a stretch woven torso extending from the shoulder chest yoke seam to the shirt hem. (See Figures 1-3).3.4.2 Components.

3.4.2.1 Thread. The thread for the bobbin/needle/looper shall be aramid, Tex Size 40 conforming to A-A-55217 or as an alternate, para-aramid spun staple thread, Tex Size 40 conforming to A-A-55195, Type I, may be used. Gimp for reinforcement of buttonholes shall be commercial size Ticket No. 8 (Tex size 210) with a minimum breaking strength of 6.5 lbs. when tested as specified in 4.4.2. This size and type of gimp provides durability and shape retention to the eyelet and buttonhole, gimp shall conform to A-A-50198. All buttons shall be attached using A-A-59826, Thread, Nylon. Button attachment thread and Gimp be tested according to ASTM D-2256, except testing speed shall be 12 ⍰ 0.5 in./min and a 10 inch gauge shall be used.

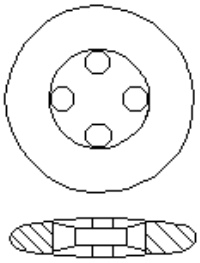
3.4.2.1.1 Thread colorfastness and color. All thread shall be non-staining and show good colorfastness to laundering. The thread color shall be Khaki P-1 (C.A. 66019 or approximating color chip 30277 or FED STD-595) for Cloth Type II and III and Camouflage Green 483 (approximating color chip 34094 of FED-STD-595) for Cloth Type I and IV.

3.4.2.2 Fastener tape, loop. The loop fastener tapes on the exterior of the right and left sleeve pockets shall be 2" x 2" wide and shall conform to type II, class 1 of A-A-55126. The loop tape color shall be Khaki P-1 (C.A. 66019 or approximating color chip 30277 or FED STD-595) for IWCS Types II and III and Camouflage Green 483 (approximating color chip 34094 of FED-STD-595) for IWCS Types I and IV. Cut edges shall be finished so that they do not ravel for the life of the garment.

3.4.2.3 Slide fasteners. All IWCS front slide fasteners (Types I-IV) shall be Coyote 498. The front slide fastener shall finish 10 inches in length. Slide fasteners shall be Type I, Style 4, Size 5 continuous chain element fastener and shall conform to A-A-55634.

3.4.2.3.1 Slide fastener thong. The slide fastener thong shall be constructed using basic material as specified in paragraph 3.3.2.1.1, stretch woven. The slide fastener thong shall finish 1-1/2" long.

3.4.2.4 Buttons. The buttons shall be dull finish, 4-hole, 30 ligne, and shall be in accordance with the following button style:



The color of the buttons shall be a good match to Coyote 498.

3.4.3 Labels. The IWCS shall contain two permanent labels as specified below. All permanent label inscription, legibility, label material, and label attachment method shall last the expected life of the garment.

3.4.3.1 Flame Resistant Organizational Gear (FROG) label. Each shirt shall have a woven FROG label (see figure 7), 63 mm x 63 mm, cut single, fused edge, manufactured by IbisTek Bell Label or equal. The woven FROG label must be sewn on each IWCS at the right lower front (as worn), to the left of the IWCS combination label and 1 ½" above the hem.

3.4.3.2 IWCS combination label (all types). A separate combination label (see figure 6) shall contain size, body measurement, identification, and care information as specified below. The information needed to designate size and body measurement in the top portion of the combination label is specified in the Table VIII. The label color shall be Coyote 498. The inscription shall have a minimum font size of 10 points. The inscription legibility, label, and label attachment method shall last the expected life of the garment. The combination label shall be stitched on all four sides. The combination label shall be attached to the right lower front (as worn), ¾" to the left of the side seam and 1 ½" above the bottom hem. Label size shall be no longer than 4" and no wider than 2".

Size: The size – length designation (with abbreviation, see 6.8), body measurements, and stock number shall be included on the combination label. Information for each size is specified in Table VIII and shall be centered at the top of the label.

Identification: List one corresponding IWCS type ordered:

Type I	Inclement Weather Combat Shirt (IWCS) Woodland MARPAT Stretch woven fiber content Laminate fiber content Knit fiber content
	Or
Type II	Inclement Weather Combat Shirt (IWCS) Desert MARPAT

Stretch woven fiber content
Laminate fiber content
Knit fiber content

Or

Type III — Inclement Weather Combat Shirt (IWCS)
NWU II Desert Digital Camouflage Printed
Stretch woven cloth fiber content
Laminate fiber content
Knit fiber content

Or

Type IV — Inclement Weather Combat Shirt (IWCS)
NWU III Woodland Digital Camouflage Printed
Stretch woven cloth fiber content
Laminate fiber content
Knit fiber content

Contract Information:
Contract Number
Contractor Name

Care Information:
DO NOT BLEACH, STARCH, DRY CLEAN, OR HOT PRESS
1. Washing. Machine wash using Permanent Press Cycle or hand wash in warm water using mild detergent that does NOT contain optical brighteners. Rinse completely. Do not overload the machine.
2. Drying. Tumble dry on low heat. Do not overload the dryer.
3. Fabric softener. The use of fabric softeners in not recommended due to potential to adversely affect the flame protection.

3.4.3.3 Size and body measurements.

TABLE VIII. Size and Body Measurements.

Location	Size	Measurement
Chest (Size of Shirt)	Small	33 to 37 inches
	Medium	37 to 41 inches
	Large	41 to 45 inches
	X-Large	45 to 49 inches
Height (Length of Shirt)	Regular	67 to 71 inches
	Long	71 to 75 inches

3.4.3.4 Garment Lot Designation. For garment manufacturing traceability, each shirt shall have a lot designation in accordance with lot Numbering procedure as specified in DPSCM 4155.3, Quality Systems Requirements. The lot number shall be stamped inside the shirt sleeve on below the exterior elbow patch. Batch designation is not acceptable. The ink shall not be visible from the outside of the garment.

3.4.3.5 Hang Tag Bar Code Label. Each shirt shall have an individual bar code placed on a paper tag for personal clothing items. The paper tag shall be standard bleached sulfate having a basis weight of 100 pounds. The paper used for the tags shall have a smooth finish to accept thermal transfer and direct printing. The tags shall have a hole and shall be attached to each item by a fastener. The tags shall be clearly legible and readable by a scanner. The bar-coding element shall be a 13 digit national stock number (NSN). There shall be a 12 digit UPC number assigned for each NSN by the contracting activity. UPC will be provided as Government Furnished Information. The initials "UPC" must appear beneath the code. The bar-code for NSN and UPC printing shall be a medium to high code density and shall be located so that it is completely visible on the item when it is folded and/or packaged as specified and shall cause no damage to the item. The UPC code must also be placed on all shipping cartons on which the NSN appears. See Figure 6 for an example of the hang tag label.

3.5 Patterns. The Government shall furnish a complete set of patterns which show directional line markings for proper assembly. The Government patterns are to be used as a guide for cutting contractor's working patterns. Minor modifications are permitted to accommodate manufacturing procedures; however, the design and finished measurements must be maintained.

3.5.1 List of pattern parts. Standard patterns provide a seam allowance of 3/8 inch for single needle seams and 1/2 inch for double needle seams. Pockets and pocket flaps shall be located in accordance with marks on patterns and figures. The pattern parts listed in Table IX are provided for first quality fabrics and to ensure that the pattern set is complete.

TABLE IX. List of Pattern Parts – First Quality.

Material	Nomenclature	Pattern Abbreviation	Cut Number
Stretch Woven	Back	IWCS-BACK_BTM	1
	Front	IWCS-FRONT_BTM	1
	Collar	IWCS-COLLAR	1
	Zipper Flap	IWCS-ZIPPER_FLAP	1
Laminate	Yoke	IWCS-YOKE	2
	Sleeve	IWCS_SLEEVE	2
	Elbow Patch	IWCS_ELBOW_PATCH	2
	Sleeve Pocket	IWCS-SLEEVE_POCKET	2
	Sleeve Pocket Flap	IWCS-SLV_PKT_FLAP	2
Cuff Material	Sleeve Cuff	IWCS-SLEEVE_CUFF	2

3.5.2 Parts cut from ends and from ground shade. . Printed seconds shall be defined as cloth that has been rejected only for defects pertaining to color, infrared reflectance, or camouflage print patterns, which are cited in the specified basic material requirements.

3.6 Configuration. The following specifications are needed to provide uniform appearance, comfort and durability in combat operations. End item IWCS construction and appearance shall conform to the requirements of this document and the finished dimensions in Tables XIV (see 4.4.8) and figures 1 – 6 to maintain item configuration and compliance to component and end item tests (see 4.4).

3.6.1 Seaming and stitching. Seaming shall be consistent, exhibit a uniform appearance and shall conform to the ASTM D-6193 stitch types listed in Table X below. The backside of all seams (inside garment) shall be flat with no protruding seam allowance or raw edges to create irritation, discomfort or poor appearance. To maintain durability and functionality, the seams shall be sewn with 10-14 stitches per inch for all outside visible stitching. Thread ends shall be secured by a minimum of 1/4" backstitched or 1/2" overlap when broken stitches are repaired. Overedge or pre-hemming shall be 6–10 stitches per inch. All bartacks shall be positioned and sized in accordance with Table Xa, all bartacks shall have a ± 1/16 inch size tolerance. Material edges must not ravel. Raw edges may be turned-in, turned-under or serged to prevent raveling. No raw edges are allowed. No raw edges on outside, or on inside along double needle seams, or greater than 1/8 inch on inside of garment are allowed. All thread ends shall be trimmed to ¼ inch or less. All loose threads shall be removed.

3.6.1.1 Seam strength. Finished garments shall conform to the following minimum seam strength requirements when tested according to ASTM D5034. The seam strength for seams joining unlaminated stretch fabric to unlaminated stretch fabric shall be at least 65 pounds. For seams which run perpendicular to the warp direction of the laminated stretch woven fabric, the seam strength shall be at least 90 pounds. For seams which run perpendicular to the fill direction of the laminated stretch woven fabric, the seam strength shall be at least 60 pounds.

3.6.1.2 Seam Types.

TABLE X. Seam Types

Seam Placement	Seam Type	Gage	Stitch Type
Sleeve/side/armhole seams	SSa-2	3/16 to 9/32 inch	301 or 401 and 504
Yoke seams	LSbm-4	3/16-1/4 inch	301 or 401 and 504
Attach collar and cuffs	SSae-2	1/8-3/16 inch from edge	504 and 301
Attach elbow patches	LSd-2	two rows 3/16 to 1/4 inch apart	301
Attach slide fasteners	SSaa-1	1/4 inch from edge	301or 401

Seam Placement	Seam Type	Gage	Stitch Type
Top stitching for pocket, collar, sleeve opening at cuff, and slide fastener openings	SSe-2	1/8 to 1/4 inch from the edge (uniform throughout the garment)	301
Label/loop fastener attachment	LSbj-1	1/8 to 3/16 inch from edges	301
Bottom hem	EFb-2	1/16 to 1/8 inch from edge	301 or 401
Attach 2" x 2" loop fastener tape	Box-X	1/8 to 3/16 inch from edge	301

TABLE Xa. Bartacks

Size (Inches)	Stitches/bartack	Location
3/8	20-27	Slide fastener pulls
3/8	20-27	Base of front slide fastener

3.7 Workmanship. The finished shirt shall conform to the quality of product established by this specification and be free from defects as specified in 4.4.

3.8 Toxicity Statement. The blouse and trousers shall show no toxicity (see 4.4.4).

4. VERIFICATION

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

1. First article inspection (see 4.2)
2. Quality conformance inspection (see 4.3)

4.2 First article inspection. The first article, submitted in accordance with 3.1, shall be inspected for compliance with design, configuration, workmanship, and dimensional requirements. The presence of excessive defects, as defined by contract, (see 4.1 and 6.3) or failure to pass any test shall be cause for rejection of the first article.

4.3 Quality conformance inspection. Sampling for inspection shall be performed in accordance with ANZI/ASQC Z1.4, as defined by contract, except where otherwise indicated.

4.4 Component and end item inspection. In accordance with 4.1, the components and end items shall be tested in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable procurement documents. The government reserves the right to inspect all components and end items to determine conformance to requirements. A certification of compliance may be acceptable as evidence that the IWCS meets the requirements of the specification. When Certificates of

Compliance are submitted, the QAR will conduct in-process inspections and review records to audit compliance of IWCS production and verify the performance requirements of this specification. The Government reserves the right to periodically inspect such items to determine the validity of the certification in accordance with this specification and applicable procurement documentation.

4.4.1 Thread breaking strength and elongation test. The thread shall meet the requirement stated in 3.4.2.1.1 when tested according to ASTM-D-2256, except testing speed shall be 12 ± 0.5 in./min and a 10 inch gauge shall be used.

4.4.2 Thread colorfastness test. The thread shall meet the requirements stated in 3.4.2.1.1 when tested according to AATCC-61, Test 3A (4 cycles).

4.4.3 Seam strength. The seams shall meet the requirements stated in 3.6.1.1 when tested according to ASTM D5034.

4.4.4 Toxicity test. The finished shirt shall be composed of materials which have been safely used commercially and 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 utilizing the method that follows:
The finished blouse and trouser shall be tested for dermal toxicity as follows:

a. Title 40, Code of Federal Regulations, 1994 Edition; Part 798.4100 - Dermal Sensitization
Part 798.4470 - Primary Dermal Irritation
Part 798.4500 - Primary Eye Irritation
Marzulli, F and H. Maibach, "Contact Allergy: Predictive Testing in Humans," Advances in Modern Toxicology, Volume 4, pp353-372, 1977.

b. As an alternative to animal and human testing, the contractor may provide information, which certifies that the material, components and garment is composed of chemicals and/or materials, which have been safely used commercially where prolonged, repeated skin contact has occurred.

4.4.4.1 Toxicity. The contractor must furnish information (see 4.4.4.2) 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.

4.4.4.2 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 chemicals recognized by the Environmental Protection Agency (EPA) as known human carcinogens is prohibited.

4.4.4.3 Material and garment testing. The cloth and/or garment shall be tested for characteristics listed in Tables I-IV. The testing shall be performed using the test methods as specified in Tables X - XIV. All test reports shall contain the individual values utilized in expressing the final results. For material testing, the sample unit shall be five (5) continuous yards full width of the finished cloth, for all physical and chemical tests. For garment testing, the sample unit shall be one shirt per lot randomly sampled. The lot shall be considered unacceptable if one or more sample units fail to meet any requirements specified.

TABLE XI. Material Testing Requirements for Stretch Woven

Characteristic	Requirements Paragraph	Test Method
Weight	3.3.2.1.1	ASTM D 3776
Fiber content	3.3.2.1.1	AATCC 20A
Weave	3.3.2.1.1	Visual
Breaking Strength	3.3.2.1.1	ASTM D 5034
Tear Strength	3.3.2.1.1	ASTM D 1424
Air Permeability	3.3.2.1.1	ASTM D 737
Colorfastness Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Color Change Staining Crocking	3.3.2.1.1	 AATCC 61 Test 1A AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 15 AATCC 8
Dimensional Stability, after Commercial Laundering (5 cycles)	3.3.2.1.1	AATCC 96
Drying Time	3.3.2.1.1	4.4.1.1
Moisture Vapor Transmission Initial	3.3.2.1.1	ASTM E96 Test B
Pilling Appearance (after 5 commercial laundering cycles)	3.3.2.1.1	AATCC 96 using ASTM D 3511 pilling standard
Spray Rating	3.3.2.1.1	AATCC 22 AATCC 96
Stretch Properties %	3.3.2.1.1	ASTM D2594
Vertical Flame (Initial/After 25 laundering cycles) After Flame Char Length Melt/Drip	3.3.2.1.1	ASTM D6413, AATCC 135
Spectral Reflectance	3.3.6	4.4.1.3
Visual Color Matching	3.3.4.1	AATCC Evaluation Proceedure 9, Option A, 4.4.1.4.1 1/, 2/
Instrumental Color Matching	3.3.4.2	4.4.1.4.2

1/ One determination per sample unit and results reported as “pass” or “fail”.

2/ The color and appearance of the finished cloth shall evaluated using AATCC Evaluation Procedure 9, Option A, with source simulating article daylight D75 illuminant with the color temperature of 7500 ±200 K illumination of 100 ± 20 foot candles under incandescent lamplight at 2856 ± 200 K.

TABLE XII. Material Testing Requirements for Stretch Laminate

Characteristic	Requirements Paragraph	Test Method
Weight	3.3.2.1.2	ASTM D 3776
Fiber content	3.3.2.1.2	AATCC 20A
Weave	3.3.2.1.2	Visual
Breaking Strength	3.3.2.1.2	ASTM D 5034
Tear Strength	3.3.2.1.2	ASTM D 1424
Air Permeability	3.3.2.1.2	ASTM D 737
Colorfastness Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Color Change Staining Crocking	3.3.2.1.2	 AATCC 61 Test 1A AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 15 AATCC 8
Dimensional Stability, after Commercial Laundering (5 cycles)	3.3.2.1.2	AATCC 96
Drying Time	3.3.2.1.2	4.4.1.1
Moisture Vapor Transmission Initial	3.3.2.1.2	ASTM E96 Test B
Pilling Appearance (after 5 commercial laundering cycles)	3.3.2.1.2	AATCC 96 using ASTM D 3511 pilling standard
Spray Rating	3.3.2.1.2	AATCC 22 AATCC 96[2/]
Thermal Protective Performance	3.3.2.1.2	NFPA 1971[1/]
Thermal Shrinkage	3.3.2.1.2	NFPA 1971[1/]
Vertical Flame (Initial/After 25 laundering cycles) After Flame Char Length Melt/Drip	3.3.2.1.2	ASTM D6413, AATCC 135
Spectral Reflectance	3.3.6	4.4.1.3
Visual Color Matching	3.3.4.1	AATCC Evaluation Proceedure 9, Option A, 4.4.1.4.1[2/,3/]
Instrumental Color Matching	3.3.4.2	4.4.1.4.2[2/,3]

1/Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement. When Certificates of Compliance (COC) are submitted the Government reserves the right to inspect such items to determine the validity of the certification. If a significant change is made to the garment design or materials (as determined by the Marine Corps Systems Command (MARCORSYSCOM)) COC verification testing may be conducted.
2/ One determination per sample unit and results reported as "pass" or "fail".
3/ The color and appearance of the finished cloth shall evaluated using AATCC Evaluation Procedure 9, Option A, with source simulating article daylight D75 illuminant with the color temperature of 7500 ±200 K illumination of 100 ± 20 foot candles under incandescent lamplight at 2856 ± 200 K.

TABLE XIV. Material Testing Requirements for Knit Cuff

Characteristic	Requirement Paragraph	Test Method
Weight	3.3.2.1.4	ASTM D 3776
Fiber content	3.3.2.1.4	AATCC 20A
Fabric construction	3.3.2.1.4	Visual
Bursting Strength	3.3.2.1.4	ASTM D 3787
Colorfastness Laundering (after 4 cycles) Light (40 hours or 170 kilojoules) Perspiration (acid and alkaline) Color Change Staining Crocking	3.3.2.1.4	 AATCC 61 Test 1A AATCC 16.2 Option 1 or AATCC 16.3 Option 2 AATCC 15 AATCC 15 AATCC 8
Dimensional Stability, after Commercial Laundering (5 cycles)	3.3.2.1.4	AATCC 96
Drying Time	3.3.2.1.4	4.4.1.1
Pilling Appearance (after 5 commercial laundering cycles)	3.3.2.1.4	AATCC 96 using ASTM D 3511 pilling standard
Vertical Flame (Initial/After 25 laundering cycles) After Flame Char Length Melt/Drip	3.3.2.1.4	ASTM 6413, AATCC 135
Spectral Reflectance	3.3.6	4.4.1.3
Visual Color Matching	3.3.4.1	AATCC Evaluation Procedure 9, Option A 1/, 2//
Instrumental Color Matching	3.3.4.2	AATCC Evaluation Procedure 6

1/ One determination per sample unit and results reported as "pass" or "fail".
2/ The color and appearance of the finished cloth shall evaluated using AATCC Evaluation Procedure 9, Option A, with source simulating article daylight D75 illuminant with the color

temperature of 7500 ±200 K illumination of 100 ± 20 foot candles under incandescent lamplight at 2856 ± 200 K.

TABLE XV. Garment System Testing Requirements

Characteristic	Requirement Paragraph	Test Method
Dimensional stability	3.3.7	AATCC 96
pH	3.3.8	AATCC 81
Toxicity	3.3.9	4.4.1.5, 4.4.1.5.1 1/
Seam Strength	3.6.1.1	ASTM D5034
Flammability (After 1 and 25 laundering cycles) Instrumented Manikin Test (4 second flame exposure)	3.3.11	ASTM F1930, AATCC 135 1/

1/Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement. When Certificates of Compliance (COC) are submitted the Government reserves the right to inspect such items to determine the validity of the certification. If a significant change is made to the garment design or materials (as determined by the Marine Corps Systems Command (MARCORSYSCOM)) COC verification testing may be conducted.

4.4.5 Test Methodology

4.4.5.1 Drying time testing method.

4.4.5.1.1 Apparatus.

4.4.5.1.1.1 Wringer. Motor driven, see AATCC 70 footnote 11.2.

4.4.5.1.1.2 Laboratory balance. Accurate to 0.01 grams.

4.4.5.1.2 Materials.

4.4.5.1.2.1 White AATCC blotting paper. 25 x 25 cm, see AATCC 70 footnote 11.3.

4.4.5.1.2.2 Water, distilled.

4.4.5.1.2.3 Glass beaker, 250mL.

4.4.5.1.3 Test Specimens. The fabric samples and blotting paper should be conditioned at 65 ± 2% RH and 70 ± 2ºF for a minimum of 4 hours. Three (3) 2x2 inches samples should be cut per fabric tested.

4.4.5.1.4 Procedure. Test shall be run in standard conditions, 65 ± 2% RH and 70 ± 2ºF.

a. Weigh the conditioned specimen using a laboratory balance accurate to 0.01g. A wire mesh kitchen/bathroom sink strainer may be used by placing it on the weighing pan of the lab balance in an inverted manner and taring its weight before the measurement of any specimen weight.

b. Place 100 mls of distilled water into a 250 ml glass beaker.

c. Submerge the specimen in the beaker of water for 30 minutes. Make certain that the specimen is completely submerged to insure complete wetting.

d. 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.

e. 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. Manually monitor weight at set intervals until dry or use an automated balance with capability to weigh specimen until dry (Suitable Automation Software for a balance, Labtronics Inc., Web: www.labtronics.com). Record time to dry.

f. Repeat for remaining specimens. Average the 3 specimens.

4.4.5.2 Instrumented manikin testing. The IWCS shall be tested according to ASTM F1930 as specified in 3.3.11.

4.4.5.3 Spectral Reflectance. Initial cloth shall meet requirements specified in 3.3.6. Spectral reflectance shall be measured and reported on the initial cloth. Certificate of compliance will be accepted on garments and subject to Government verification. If finished garments are rejected for shade, spectral reflectance will be measured on cloth in the finished garments. Spectral reflectance data shall be determined on the face side and shall be obtained from 600 to 860 nanometers (nm) at 20 nm intervals on a spectrophotometer relative to the barium sulfate standard, the preferred white standard. Other white reference materials may be used provided they are calibrated to absolute white, e.g. magnesium oxide or vitrolite tiles. The spectral bandwidth shall be less than 26 nm at 860 nm. Reflectance measurements may be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode is used, the spectrophotometer shall operate with the specimen diffusely illuminated with the full emission of a source that simulates either CIE source A or CIE source D65. The specimen shall be measured as a single layer, backed with six layers of the same fabric and shade. Measurements shall be taken on a minimum of two different areas and the data averaged. The measured areas should be taken at least 6 inches away from the selvage. The specimen shall be viewed at an angle no greater than 10 degrees from the normal, with the specular component included. Photometric accuracy of the spectrophotometer shall be within 1 percent and the wavelength accuracy within 2 nm. The standard aperture size used in the color measurement device shall be 0.3725 inches in diameter. Any color having spectral reflectance values outside the limits at four or more of the wavelengths specified shall be considered a test failure.

4.4.5.4 Color Matching.

4.4.5.4.1 Visual color matching (all types and classes). The color and appearance of the Type I, Type II, Type III, and Type IV camouflage printed and dyed knit cloth for cuffs shall match the standard sample when viewed using AATCC Evaluation Procedure 9, Option A, under filtered tungsten lamps that approximate artificial daylight D75 illuminant with a color temperature of 7500 ± 200 K with illumination of 100 ± 20 foot candles, and shall be a good match to the standard sample under horizon lamplight at 2300 ± 200 K.

4.4.5.4.2 Instrumental color matching (all types and classes). Instrumental color matching is used as a tool to quantify shade evaluation if visually shade is rated unacceptable. All the colors in the Woodland MARPAT shall be instrumentally measured except for Khaki and all the colors in the Desert MARPAT shall be measured except for Highland given the areas of these exempted colors are too small for accurate instrumental readings. The solid colored knit fabric shall be instrumentally measured. Each measured color shall match the standard sample using AATCC Evaluation Procedure 6. A color difference greater than a $\Delta E_{CMC} = 1.5$, when using a ΔE_{CMC} (2:1) ratio (D65 / 10°) units as compared to the standard sample, shall be basis for rejection.

4.4.6 End Item visual examination. Finished end item IWCS shall be examined for defects in shade, design, material, construction, and workmanship. The finished shirt shall be visually defects in accordance with examination descriptions as specified in Table XVI and described in FED-STD-4B – Glossary of Fabric Imperfections.

Table XVI. End Item Visual Examination.

Examination	Defect Description
Bartacks	Bartacks or bartacks missing, insecure, misplaced, not specified size, stitches loose or broken, bartack/backtack not serving intended purpose
Cleanliness	Any spot, streak, or stain of a permanent nature on any portion of a garment which would be visible when garment is worn.
	Removable spot, streak, or stain on outside of shirt.
	Thread ends not trimmed throughout garment.
	Any holding or basting threads visible on outside of the finished garment when applicable.
Component Part	Component part omitted, distorted, defective, full, tight, or twisted; any part of shirt caught in any unrelated stitching, the edge of any component part required to be forced out or having folds of more than 1/8 inch. Fullness creating unwanted permanent fold, pleat, or crease in fabric or garments, shade variations within or between parts. 1/
Component and assembly	Any defective component. 1/
	Any required operation omitted or improperly performed. 1/
Evenness 2/	Collar front points vary by more than 1/8 inch, collar curls, puckers, pleats, or twists. End of collar and edge of front facing out of alignment by more than 1/8 inch.
	Sleeve lengths vary by more than ½ inch.

Examination	Defect Description
	Hem uneven by 1/2 inch or more at hem edge.
	Uneven by 1/4 inch or more at top of collar 3/
	Uneven by 1/2 inch or more at hem edge 3/
	Hem uneven by 1/2 inch or more at hem edge.
Hems	Hems at shirt bottom twisted, wavy, omitted or not as specified.
	Hem width at shirt bottom less than 1/2" or more than 3/4". Hem measurement taken from top fold to bottom fold.
Labels	Omitted, incorrect, illegible, not attached where specified; bar-codes omitted, not readable by scanner; human-readable interpretation (HRI) omitted or illegible; bar code not visible on folded, packaged item; bar code attachment causes damage to the item.
Loop Tape	Loop color or size not as specified
Material defects and damages	Any smash, multiple float or loose slub
	Cut, tear, mend, burn, needle chew, or hole
	Area of poor dye penetration, color/dyestreak, broken or missing yarn, visible mend, thin place, color not as specified, or shade bar 1/
	Hole, slub, exposed drill hole, run, spots and/or stains, slubs, knots, misweave 3/
Patches	Elbow, patches omitted, not attached as specified, or not positioned as specified in pattern Thread ends not trimmed throughout garment
Packaging	Any shirt not packaged in accordance with the contract or purchase order Any holding or basting threads visible on outside of the finished garment when applicable.
Pockets and Flaps	Pocket companions not uniform in size or shape
	Pockets twisted, curled or puckered, not stitched or located as specified
	Pocket flap not completely covering pocket opening, not positioned as specified.
	Sleeve pockets out of horizontal or vertical alignment by more than ½"
Shaded part	Variation in shade within an outside part 1/
	Any part required to be cut from one piece of material shaded 1/. Note: Parts suspected as being shaded shall be examined at a distance of 3 feet against the background of the other parts and colors of the garment. When shade difference is readily discernible under these examining conditions, it shall be scored as a shaded part.
Slide fastener	Closing, zipper length, opening length, color, or thong, not as specified, color not as specified Slide fastener missing, or non functional
Seams and Stitching	Missing, broken or skipped stitches. 1/

Examination	Defect Description
	Seam twisted, pleated, or puckered. 1/
	Part of garment caught in any unrelated operation or stitching. 1/
	Thread breaks secured by stitching back of break less than ½".
	Ends of all seams and stitches, when not caught in other seams or stitching, uneven or backtack less than ½".
	Thread color not as specified
	Gage of stitching uneven or not as specified.
	More than 1/8 inch up to 1/4 inch.
	Open seams more than ¼ inch.
	Not specified seam or stitch type
Stitch tension	Tight tension (stitches break when normal strain is applied to the seam or stitching)
	Missing, broken or skipped stitches 1/
Stitches per inch (to be scored only when the condition exists on major portion of the seam)	Less than minimum specified: One stitch Two or more stitches
	More than maximum specified
Bartacks	Bartack omitted.
	Any bartack insecure, or not serving intended purpose:
	Any loose, incomplete or broken stitches
	Length or width not as specified
Label/Tags	Bar code omitted or not readable by scanner
	Human-readable-interpretation (HRI) omitted or illegible.
	Not attached to location specified.
	Length or width not as specified.
	Not properly placed, i.e. nonfunctional
Lot numbering	Incorrect, altered, or illegible

1/ This defect shall be scored as a major when seriously affecting the serviceability/function. Parts suspected as being shaded shall be examined at a distance of three feet against the background of the other parts and colors of the garment. When the shade difference is readily discernible under these conditions it shall be scored as a shaded part.
2/ On double stitched seams, a seam is considered open when one or both sides of the seam are open. Raw edge not securely caught in stitching shall be classified as an open seam.
3/ Evenness can be determined by comparing measurements of companion parts or by aligning parts and measuring the difference in lengths as described below. When evenness defects are found, the garment shall be laid flat on a measuring surface and the difference in lengths recorded. Evenness for the collar shall be assessed by folding the collar at center back and align the collar halves at the front setting seam. Front collar edges shall be compared for height. Evenness of the sleeves shall be aligned from top of shoulder seam or collar joining seam if a raglan construction, smoothed down along the sleeve crease to sleeve hem edge. The aligned sleeve lengths shall be visually inspected for evenness of sleeve lengths.

4.4.7 Product Conformance. The product provided shall meet the salient characteristic of Purchase Description, and shall conform to the cited standards, specifications and quality assurance practices. The Government reserves the right to require proof of such conformance.

4.4.8 End item finished dimensions. IWCS shall conform to the finished measurements listed in Table XVII as defined in 4.3.

TABLE XVII. Finished Dimensions (inches).

.Measurement	Size	Length		Tolerance
		Regular	Long	
Half Chest 1/	Small	24 - 3/4	24 3/4	+/- ½
	Medium	26 - 3/4	26 - 3/4	+/- ½
	Large	28 - 3/4	28 - 3/4	+/- ½
	X-Large	30 - 3/4	30 - 3/4	+/- ½
Back Length 2/	Small	28	29 - 1/2	+/- ½
	Medium	28 - 1/2	30	+/- ½
	Large	29	30 - 1/2	+/- ½
	X-Large	29 - 1/2	31	+/- ½
Sleeve Length 3/	Small	25	26	+/- ½
	Medium	26	27	+/- ½
	Large	27	28	+/- ½
	X-Large	28	29	+/- ½
Half Sweep 4/	Small	20	20	+/- ½
	Medium	22	22	+/- ½
	Large	24	24	+/- ½
	X-Large	26	26	+/- ½
Half Sleeve Cuff 5/	Small	3 - 3/4	3 - 3/4	+/- ¼
	Medium	4	4	+/- ¼
	Large	4 - 1/4	4 - 1/4	+/- ¼
	X-Large	4 - 1/2	4 - 1/2	+/- ¼
Collar Height at Center Back 6/	Small	2 - 1/4	2 - 1/4	+/- ¼
	Medium	2 - 1/4	2 - 1/4	+/- ¼
	Large	2 - 1/4	2 - 1/4	+/- ¼
	X-Large	2 - 1/4	2 - 1/4	+/- ¼

The garment shall be zipped and placed flat upon a table and measured as follows:

1/ Half Chest – With shirt zipped up, measure from side seam folded edge to folded edge across shirt chest in line with pit of armhole (bottom of seam).
2/ Back Length – Along center back measure from collar seam to bottom edge of shirt (in line with grain of fabric for straight line).
3/ Sleeve Length – Fold sleeve along underarm seam, measure along folded underarm seam from the underarm sleeve inseam to the bottom of the sleeve cuff.

4/ Half Bottom Width – Measure from side seam folded edge to folded edge across shirt bottom at bottom edge.
5/ Half Sleeve Cuff – Measure at bottom of cuff along edge from folded edge to folded edge.
6/ Collar Height at Center Back – Measure along center back of collar from setting seam to top of collar.

4.4.9 End item acceptance testing. The IWCS shall be tested for the system level characteristics as outline in section 3. Garments shall be randomly sampled. Construction seconds can be utilized for destructive end item testing. Testing shall be performed as specified in 4.4.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or purchase order (see 6.2). When actual packaging of material is to be performed by Department of Defense (DoD) personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department 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 Intended use. The IWCS is intended for wear by military personnel of the United States Marine Corps and United States Navy.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this document, including any amendments.
b. Types and sizes required (see 1.2).
c. Specific issue of individual documents referenced (see section 2).
d. Instructions on source of supply FROG patch (see 3.4.3.1)
e. Details of first article inspection including type of unit, the number of units and timing (see 3.1, 4.2 and 6.3).
f. Conformance inspection acceptance quality limits and criteria (see 4.3)
g. Packaging requirements (see 5.1).
h. Standard sample (see 3.2 and 6.4)

6.3 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of 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 include specific instructions in all

acquisitions documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Standard sample. For standard samples, address the procuring activity issuing the invitation for bids or request for proposal.

6.5 Subject term (key word) listing.
Camouflage
Clothing
Desert
Flame Resistant
Marine Corps
Navy
Uniform
Utility
Woodland

6.6 Figures.

Figure 1	Shirt front view
Figure 2	Shirt back view
Figure 3	Shirt elbow patch
Figure 4	Combination label
Figure 5	FROG label
Figure 6	Hang tag label

6.7 Suggested source of supply, fabric.

TenCate Protective Fabrics
6501 Mall Blvd.
Union City, GA 30291

6.8 Size abbreviation. The size abbreviation on the IWCS label shall show the combination of one of each of the following size and length abbreviations shown below. The combination of the two elements shall be designated as Size – Length; for example Small Regular abbreviated designation shall be SR, X-Large Long abbreviated designation is XLL.

Size	Size Abbreviation	Length	Length Abbreviation
Small	as S	Regular	as R
Medium	as M	Long	as L
Large	as L		
X-Large	as XL		

Custodian: Navy- MC

Preparing activity: Navy- MC

FIGURE 1. Shirt front view

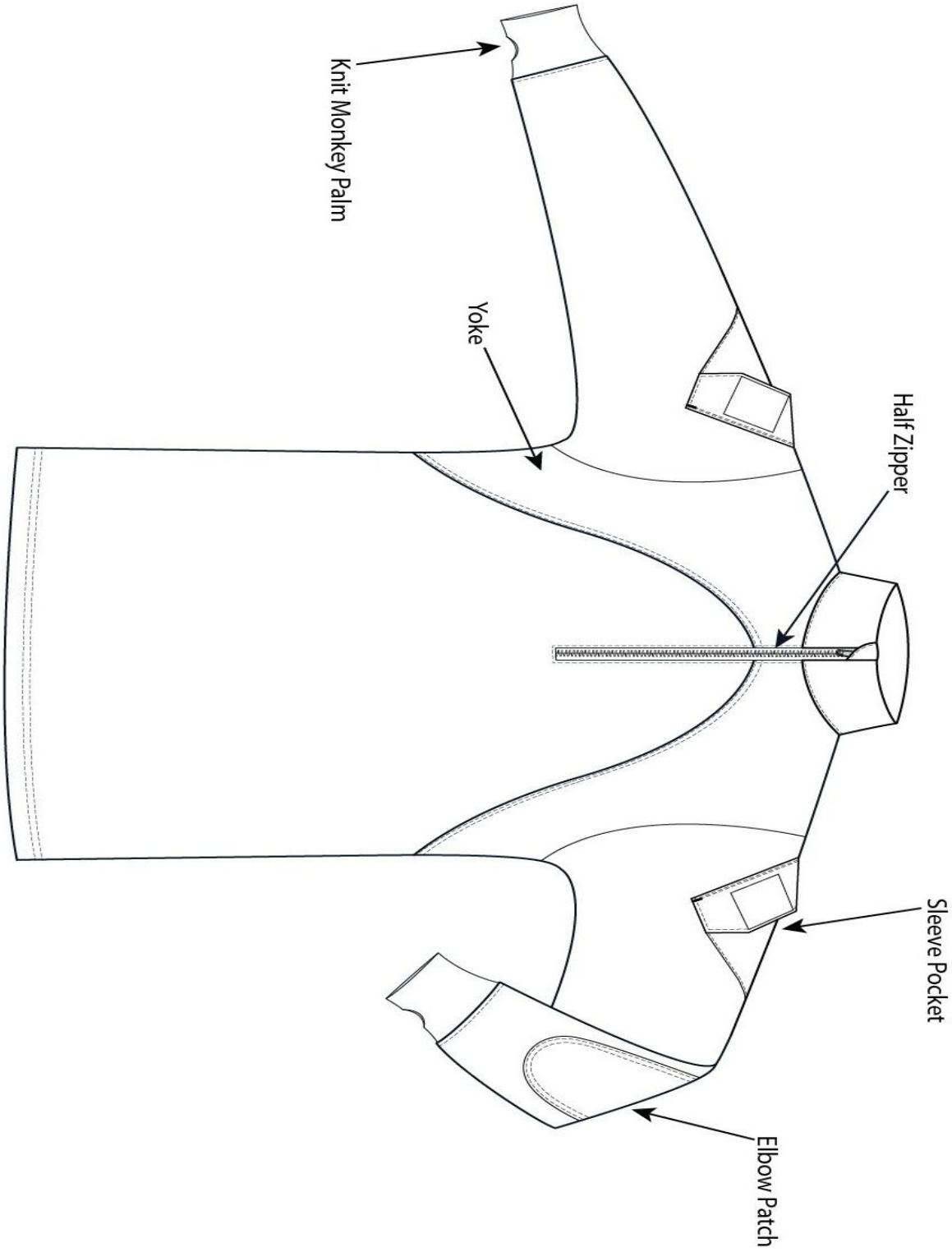


FIGURE 2. Shirt back view

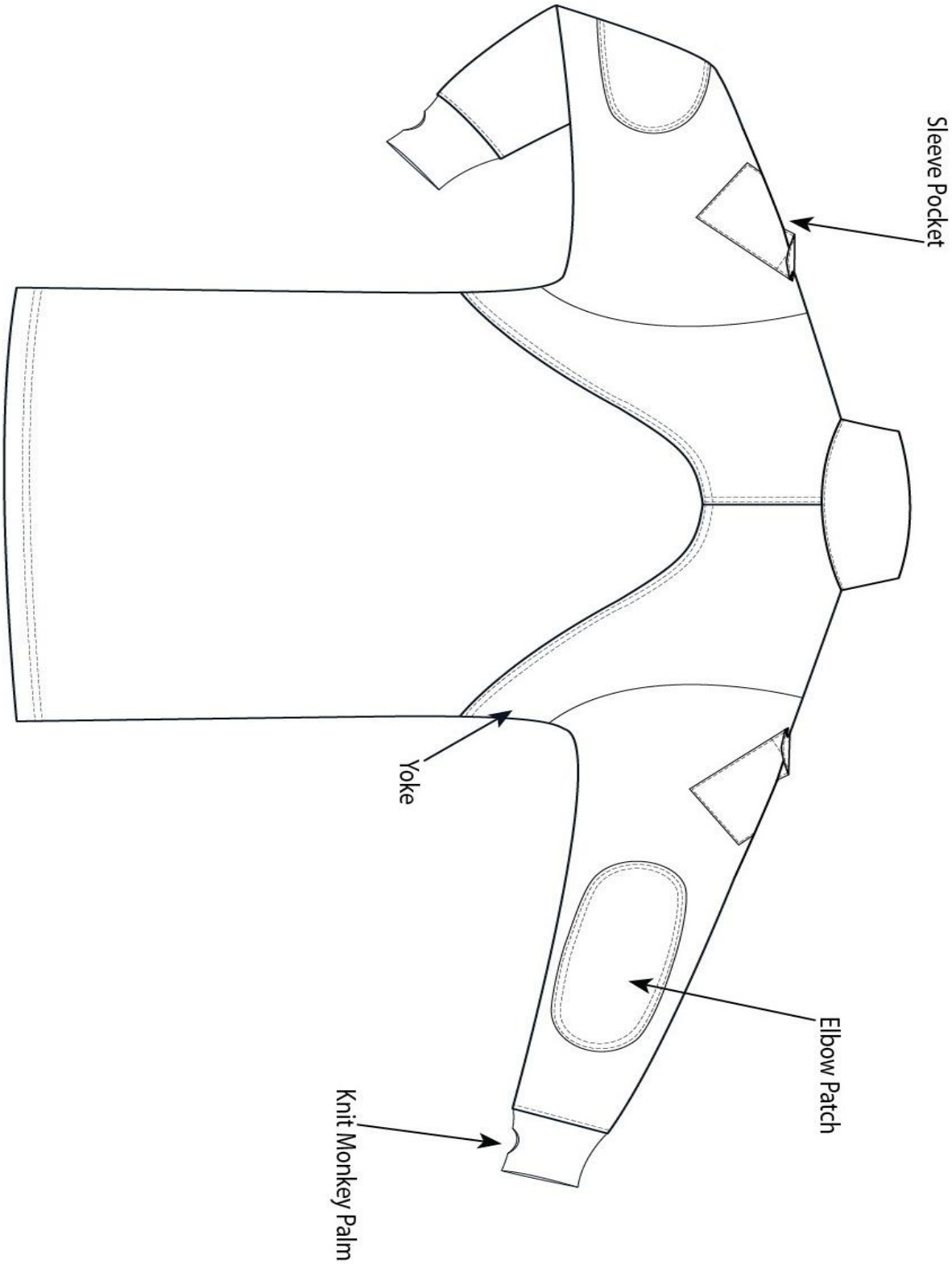
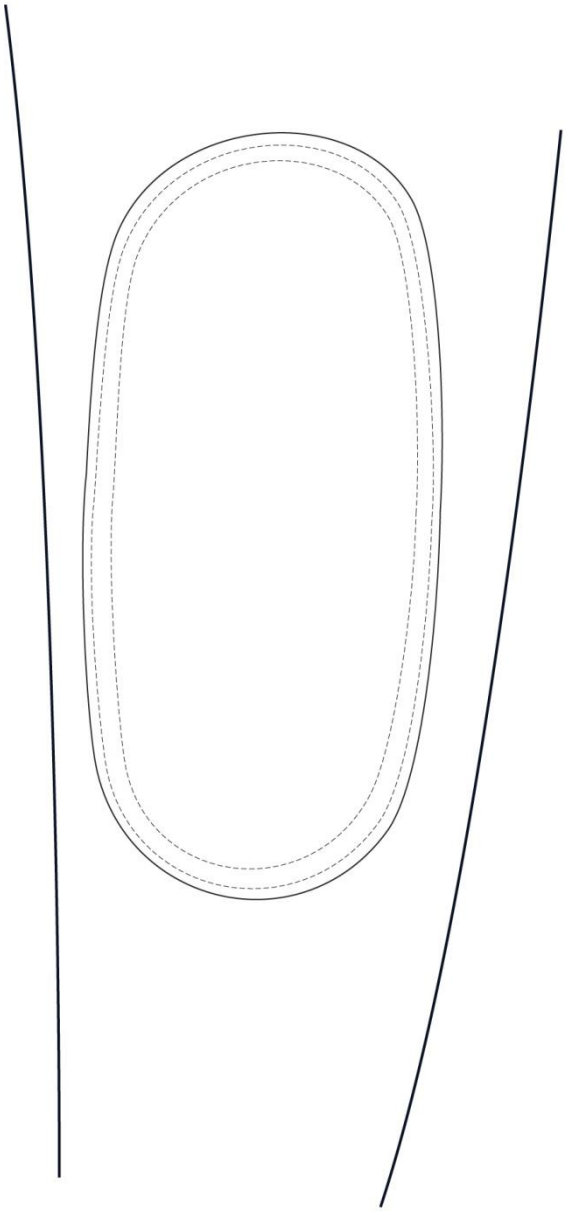


FIGURE 3. Elbow Patch



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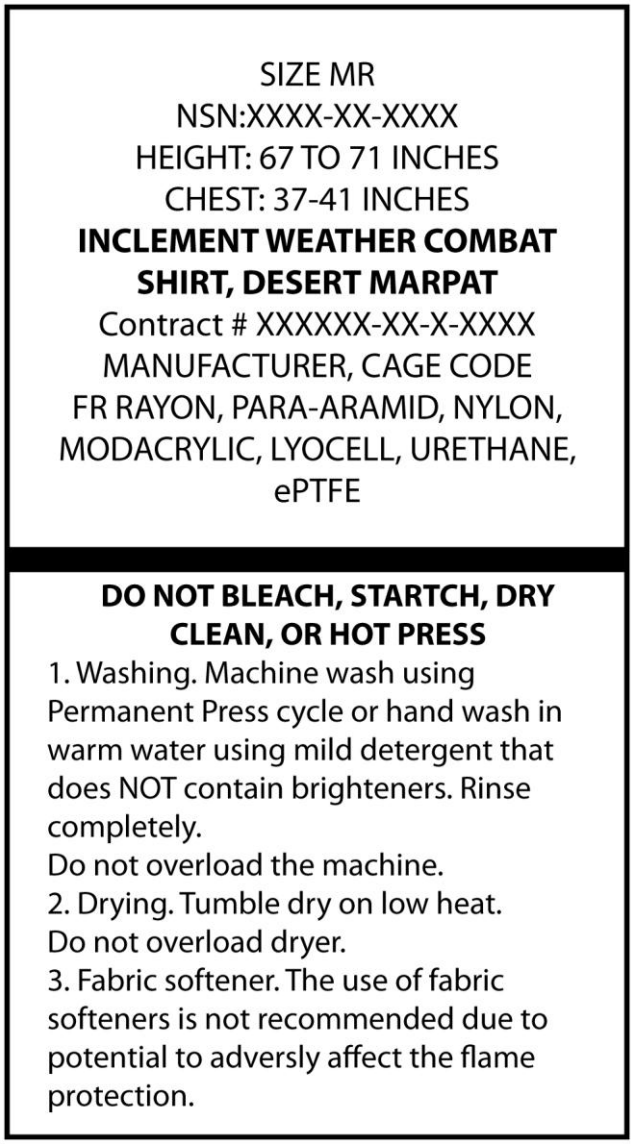

FIGURE 4. Combination label

Type I and Type II

Type III and Type IV

FIGURE 5. FROG labels

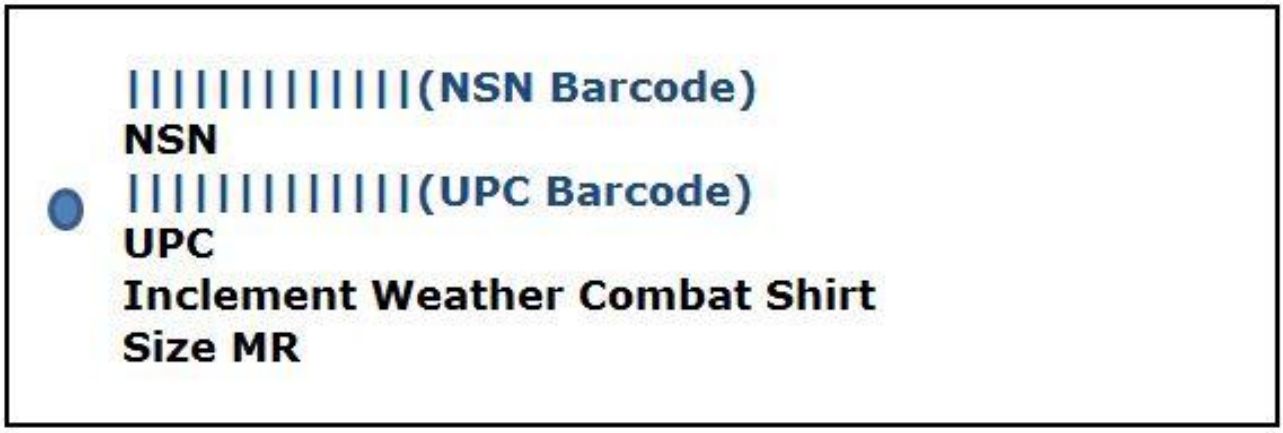

FIGURE 6. Hang tag label