

## NOTICE

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## SPECIFICATION FOR CLOTH, NYLON, TRILAMINATE, WATERPROOF MOISTURE VAPOUR PERMEABLE (WMVP), MULTICAM®

### 1.1 Scope

This specification covers the requirements for nylon trilaminate fabric, waterproof moisture vapour permeable (WMVP) with the MULTICAM® camouflage pattern.

***Note: It is known that the APECS Trilaminate MULTICAM® (MIL-PRF-32142) material distributed by 1947 LLC (www.1947llc.com) fully meets the requirements within this specification.***

### 1.2 Classification

The fabric must be classified as: Cloth, Nylon, Trilaminate, Waterproof, Moisture Vapour Permeable (WMVP), MULTICAM®

### 1.3 Applicable Documents

The following documents form part of this specification to the extent specified, and are supportive of this specification when referenced; all other document references are to be considered supplemental information only. In the event of a conflict between the documents referenced and the contents of this specification, then the contents of this specification must take precedence:

*CAN/CGSB Standards (email: [ncr.cgsb-ongc@pwgsc.gc.ca](mailto:ncr.cgsb-ongc@pwgsc.gc.ca))*

- CAN/CGSB-4.2-M Textile Test Methods

*FED Standards (Download Documents: <http://assist.daps.dla.mil/quicksearch/>)*

- FED-STD-191A Federal Standard for Textile Test Methods
- FED-STD-595C - Colors Used in Government Procurement

*American Association of Textile Chemists and Colorists Standards ([www.aatcc.org](http://www.aatcc.org))*

- AATCC Test Method 16 Colourfastness to Light
- AATCC Test Method 76 Electrical Surface Resistivity of Fabrics
- AATCC Test Method 118 Oil Repellency: Hydrocarbon Resistance Test

*American Society for the Testing of Materials ([www.astm.org](http://www.astm.org))*

- ASTM D 3886 Standard Test Method for Abrasion Resistance of Textile Fabrics (Inflated Diaphragm Apparatus)
- ASTM F 392 Standard Test Method for Rubber Property - Adhesion to Substrate Material
- ASTM D 413 Standard Practice for Conditioning Flexible Barrier Material for Flex Durability

1.4 Order of Precedence

In the event of any inconsistency in contract documents such as contract, specification and sealed patterns, the order of precedence must be contract, specification, and sealed pattern. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification must take precedence. For any inconsistency in technical details between languages, the language of the original document, which in this case is English, must take precedence. Nothing in this document supersedes applicable laws and regulations, unless a specific exemption has been obtained.

1.5 Definitions

Earth Tone	By definition, earth tone is considered a color scheme that draws from a color palette of browns, tans, grays, greens, oranges, whites and some reds. The colors in an earth tone scheme are muted and flat in an emulation of the natural colors found in soils, moss, trees and rocks. For the purpose of this specification, the earth tone color (where specified) must be based on the predominantly brown, tan and gray color series (lusterless) within FED STD-595C, where those colors do not include any elements of orange, red and white.
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**2.0 REQUIREMENTS**

2.1 Fabric Structure

This fabric must be a trilaminate structure. The exterior face must be a tightly woven, plain weave, nylon fabric which is laminated to a waterproof moisture vapour permeable (WMVP) membrane. The inside face (reverse side) of the WMVP membrane must be laminated to a polyester or nylon tricot fabric. This 3-layer fabric composite does not require a separate lining when made up into a garment.

2.1.1 Finish

A finish may need to be applied to the fabric in order to provide the oil and water repellency properties required in Table 1. Such a finish must not adversely affect the hand or stiffness of the fabric.

2.1.2 Testing

When tested in accordance with the applicable test methods, the trilaminate, waterproof, moisture vapour permeable (WMVP) fabric must comply with the requirements specified in Table 1.

2.1.3 Sealing

The fabric must be capable of having its sewn seams sealed, with tape, in a waterproof durable fashion. The tape on the sealed seams must not peel off or separate with wear and/or normal maintenance. Sealed seams, when exposed to chemicals must not delaminate or show any visible signs of loss of integrity, and must retain a minimum level of hydrostatic and water resistance properties.

2.1.4 Delamination

The fabric must not show any visible signs of delamination or loss of film during the life of the garment. Delamination is defined as the undesirable separation of the components of bonded or laminated fabrics as evidenced through bubbles, cracks, or formation of holes and loose edges on any of the layers. Separation of substrate from film at the moment of failure or immediately preceding failure during hydrostatic resistance, tensile, puncture and tear testing is not considered to be delamination.

2.2 Workmanship

The material covered by this specification must be free of imperfections or blemishes such as may adversely affect its appearance or serviceability. For inspection purposes, imperfections and blemishes are considered defects when clearly visible at a normal inspection distance of approximately 1 m (3.3 ft) under good, preferably Northern Light, lighting conditions.

2.3 Yarns

The fiber content of the yarns in the outer face woven fabric must be 100% nylon. The yarns used for the inner face tricot fabric must be composed of nylon or polyester.

2.4 Dyeing and Printing

The cloth(s) must be dyed to a ground shade either matching or approximating Cream 524 and then overprinted with the MULTICAM® camouflage pattern by roller or screen printing in a manner that gives the required degree of colour fastness and a uniform, good penetration of colour in the fibres and fabric as follows:

- (a) When the ground shade is dyed to match Cream 524, the remaining colors are obtained by subsequent printing using six rollers or screens, as appropriate for the Tan 525, Pale Green 526, Olive 527, Dark Green 528, Brown 529 and Dark Brown 530 areas of the pattern;
- (b) When the ground shade is dyed to approximate Cream 524 all seven colors of the camouflage pattern are obtained by subsequent printing using seven rollers or screens to match all seven colors; and
- (c) Resin bonded pigments are not be used.

2.4.1 Inner Knit Fabric Colour

The inner knit fabric must be an earthtone colour that matches the MULTICAM® camouflage pattern.

2.5 Spectral Reflectance

Spectral reflectance data must 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 band width must be less than 26 nm at 860 nm. Reflectance measurements must be made by either the monochromatic or polychromatic mode of operation. When the polychromatic mode of operation is used, the spectrophotometer must operate with the specimen diffusely illuminated with the full emission of a continuous source that simulates either CIE Source A or CIE Source D65. Measurements must be taken on a minimum of two (2) different areas and the data averaged. The measured areas should be at least 15 cm (6 in) away from the selvage. The specimen must be viewed at an angle no greater than 10 degrees from normal, with the specular component included. Specimens must be oriented in different directions during testing. When possible, the specimens tested must not contain the same warp or filling yarns when presented to the sample port. Photometric accuracy of the spectrophotometer must be within 1 percent and wavelength accuracy within 2 nanometers. The diameter for standard aperture size used in the color measurement device must be 9.4869 mm (0.3725 in) or larger. Any color having spectral reflectance values falling outside the limits at four or more of the wavelengths specified must be considered a test failure.

Wavelength, Nanometers (nm)	Cream 524 and Tan 525	Pale Green 526, Olive 527 and Brown 529	Dark Green 528 and Dark Brown 530
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	Min.	Max.	Min.	Max.	Min.	Max.
600	22	44	12	30	3	11
620	24	45	12	30	3	11
640	24	45	12	32	4	12
660	25	45	12	32	4	12
680	28	45	14	34	4	13
700	28	46	14	34	6	16
720	30	48	16	36	6	20
740	32	50	18	36	10	25
760	36	50	20	40	14	30
780	38	52	22	40	18	35
800	40	54	22	42	22	40
820	44	56	24	44	24	42
840	46	57	26	44	27	43
860	48	58	28	46	29	45

Table 1: Testing Requirements for Finished Fabric

Property	Test Method	Requirement	Minimum Acceptable	Maximum Acceptable
Mass (g/m <sup>2</sup> )	CAN/CGSB-4.2 Test Method 5.1	185	Must be sufficient to support tailoring details of the garment without exceeding the maximum acceptable	203
Tear Strength (N) after 5 washes (Note 1)	CAN/CGSB-4.2 Test Method 12.1		Warp: 35 Weft: 25	
Stiffness (gf.cm <sup>2</sup> /cm)	Kawabata Evaluation System (Note 2): Bending Property (B Mean) Sensitivity: 5x1 Specimen width: 10 cm	Length: 0.600 Width: 0.300	Must be of sufficient stiffness to support tailoring details of the garment without exceeding maximum values	Length: 1.000 Width: 0.500
Dimensional Stability (%) after 5 washes (Note 1)	CAN/CGSB-4.2 Test Method 67 Laundering per: CAN/CGSB-4.2 Test Method 58 III E (50°C, normal agitation, tumble dry normal setting)			Warp: 5.0 % Weft: 5.0 %
Hydrostatic Resistance (kPa) Face (side to be facing outward in garment) to be against water for test: a. initial; b. after 20 washes (Note 1) c. after ageing (70°C & 95% RH for 168 hrs) then flexing (at 20°C).	CAN/CGSB-4.2 Test Method 26.5  and ASTM Textile Test Method F 392 Flexing is carried out for one hour, or 2700 cycles (Note 3)		For all conditions: Average = 600	

Property	Test Method	Requirement	Minimum Acceptable	Maximum Acceptable
<p>Water Resistance face (side to be facing outward in garment) to be against water for test: a. initial; b. after 20 washes (Note 1) c. after ageing (70°C &amp; 95% RH for 168 hrs) then flexing (at 20°C)</p>	<p>Maintain test conditions at 10 psi (68.95 kPa) for 10 minutes using the equipment required for CAN/CGSB-4.2 Test Method 26.5  and  ASTM - Textile Test Method F392 Flexing is carried out for one hour, or 2700 cycles (Note 3)</p>	<p>For all conditions: no leakage</p>		
<p>Abrasion Resistance (kPa) Face and Back are tested separately using new specimens</p>	<p>ASTM Textile Test Method D 3886 (modified): The abradant is to be the same surface of the fabric under test (face abraded by face, back abraded by back); specimens to be abraded for 10,000 cycles.  Following abrasion test: 1. Hydrostatic Resistance CAN/CGSB-4.2 Test Method 26.5 2. Water Resistance using equipment for CAN/CGSB-4.2 Test Method 26.5 10 min/10psi (68.95 kPa)</p>	<p>Face: no leakage Back: no leakage</p>	<p>Face: average 600 Back: average 600</p>	

Property	Test Method	Requirement	Minimum Acceptable	Maximum Acceptable
Moisture Vapour Permeability resistance (mm) equivalent still air (average) a. initial; b. after ageing (70°C & 95% RH for 168 hrs); and c. after 20 washes (Note 1).	CAN/CGSB-4.2 Test Method 49-99 option 1 (4 specimens)			For all conditions: Average 19
Colour Fastness to Light	AATCC Technical Manual Test Method 16 Option E	Sample Grey Scale 4 after 40 AATCC Fading Units		Sample Grey Scale 3 after 40 AATCC Fading Units
Colour Fastness to Crocking Colour Change	CAN/CGSB-4.2 Test Method 22 Test 6.1 and 6.2			Wet & Dry: Grey Scale 3
Colour Fastness to Laundering	CAN/CGSB-4.2 Test Method 19.1 Test #2			Colour Change and Staining Grey Scale 3
Oil Repellency a. as received; and b. after 5 washes (Note 1).	AATCC Technical Manual Test Method 118		a. Rating 5 b. Rating 4	
Water Repellency a. as received; and b. after 5 washes (Note 1).	CAN/CGSB-4.2 Test Method 26.2		a. 100 b. 90	
Delamination After: a. colourfastness to laundering test; b. water resistance tests (initial); c. ageing, (70°C & 95% RH for 168 hrs) treatment; d. ageing and flexing treatment; e. 20 launderings; and f. each chemical treatment for chemical resistance test.	Visual evaluation: View specimens under the conditions described in CAN/CGSB-4.2 Test Method 46 and 47	No Delamination		Delamination, as described in Section 2.1.4, measuring less than 5 mm in any direction and greater than 75 mm apart is the maximum degree of delamination acceptable.

Property	Test Method	Requirement	Minimum Acceptable	Maximum Acceptable
Resistance to Chemicals (kPa): a. Jet fuel in accordance with CAN/CGSB-3.22; b. Degreasers, cleaning agent (methyl ethyl ketone 99.8% assay); c. Insect repellent (DEET) liquid in accordance with CAN/CGSB-15.19 (75%); and d. Insect repellent (DEET) cream, 32%.	See Note 4 for chemical exposure test method. Following exposure test: 1. Hydrostatic Resistance CAN/CGSB-4.2 Test Method 26.5 2. Water Resistance using equipment for CAN/CGSB-4.2 Test Method 26.5 10 min/10psi (68. 95 kPa)	No Leakage	350	

## Notes:

1. Washing must be carried out in accordance with CAN/CGSB-4.2 No. 58, washing procedure III (500C, synthetic detergent, normal agitation) and drying procedure E (tumble dry, normal setting). The last wash cycle is to be carried out without detergent.
2. The Kawabata bending test is to be carried out on new fabric. A new roll or bolt of fabric must be submitted to the laboratory. The laboratory must cut test specimens from fabric taken directly from the new roll or bolt. It is imperative that the new fabric and the test specimens be handled as little as possible prior to conducting the Kawabata bending test. References for test procedure: (i) Kawabata, S (1980) The Standardization and Analysis of Hand Evaluation (2nd Edition), Chapter IV. Measurement of the Mechanical Properties of Fabrics, para 2.2 Bending property; and (ii) KES Kato Tech Co. Ltd, Manual for Tensile & Shear Tester, KES-FB-1.
3. When subjecting samples to ASTM F 392 flexing treatments, the long dimension of each specimen must be cut in the lengthwise, or warp direction of the fabric.
4. Test Procedure for Chemical Resistance of Fabric and Taped Seams - Fabric or taped-seam samples of sufficient size and quantity to carry out the following tests will be prepared. Five new specimens from each sample must be tested separately to each chemical. The chemicals must be placed on the side of the fabric that is intended to be the outer face side:
  1. For liquid chemicals, a quantity of 100 ml/m<sup>2</sup> of the test liquid must be placed on the top of the test fabric and spread as evenly as possible over the whole surface using a plastic squeegee. As much as possible of the test fabric should be covered with chemical, but leaving a border of one (1) cm width uncontaminated. This should ensure that none of the applied chemical seeps outside the weight, after it is applied;

2. For the non-liquid cream, a quantity of 50 g/m<sup>2</sup> of the chemical must be placed on the top of the test fabric and spread as evenly as possible over the whole surface using a plastic squeegee. A border of one (1) cm width must be left uncontaminated;
3. The whole test area must then be covered with a glass plate and weighted to a total pressure of 6.895 kPa (1 psi);
4. This weighted cover must be left in place for two (2) hours; and
5. The fabric must then be submitted to hydrostatic resistance testing, and must comply with the requirements in Table 1. All five (5) specimens must pass. Note that the side of the fabric that was exposed to the chemical will be facing the water in testing.