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400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 3271

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Revised

CLOTH, KNITTED NYLON STRETCH
Polychloroprene Coated

1. SCOPE:

1.1 Form: This specification covers a polychloroprene-coated, one side only, nylon knit in the form of cloth.

1.2 Application: Primarily for use in fabrication of protective clothing.

2. APPLICABLE DOCUMENTS: The following documents form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods

2.2 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.2.1 Federal Specifications:

PPP-P-1136 - Packaging and Packing of Coated (Plastic; Rubber) and Laminated Fabrics

2.2.2 Federal Standards:

FED-STD-191 - Textile Test Methods
FED-STD-601 - Rubber: Sampling and Testing

2.2.3 Military Specifications:

MIL-A-5540 - Adhesive, Polychloroprene

2.2.4 Military Standards:

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Base Cloth: Shall be plain jersey, circular-knit nylon 6-6 stretch yarns made from hexamethylene diamine and adipic acid.

3.1.2 Coating Compound: Shall contain not less than 60% by volume of polychloroprene (See 4.5.1); the remainder consisting of softeners, curing agents, anti-oxidants, and reinforcing materials. The coating shall be suitably pigmented during compounding so that the cured compound shall meet the requirements of 3.2. The compound shall be compatible with the base cloth and shall contain no waxes or other ingredients that may bloom to the surface to adversely affect the coating adhesion and cementability of the finished cloth. The ingredients of the compound shall be water insoluble after curing. The coating compound, when cured in sheet form to the same degree of cure and in the same manner as the finished product, shall have properties specified in Table I.

3.1.2.1 After application of the foundation coat, which shall be compatible with the base cloth and the remainder of the coating compound to produce the adhesion specified, the coating compound shall be applied by a spreader or calender coating operation on the side showing lengthwise ribs, crosswise courses.

3.1.2.2 The cured polychloroprene coating may be lightly dusted. The dusting powder shall be whiting, talc, zinc stearate, or other finely divided mineral matter which does not support mildew growth.

3.2 Properties: Cloth shall conform to the requirements in Table I and the following; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

TABLE I

Property	Requirement	Test Method
Base Cloth:		
Color	Natural	
Weight	2.2 - 2.5 oz per sq yd (78 - 85 g/m^2)	FED-STD-191, Method 5041
Coating Compound		
Tensile Strength		
Initial, min	1300 psi (9 MPa)	4.5.2
Loss After 96 hr Aging, max	10%	4.5.3
Loss After 96 hr Weathering, max	20%	4.5.4
Elongation		
Initial, min	500%	4.5.2
Loss After 96 hr Aging, max	10%	4.5.3
Loss After 96 hr Weathering, max	20%	4.5.4
Coated Cloth:		
Weight, max	13 oz per sq yd (440 g/m^2)	FED-STD-191, Method 5041
Breaking Strength, 2-in. (50 mm) wide strip, min 1/		
Wales direction	55 lb (245 N)	FED-STD-191, Method 5102
Course direction	20 lb (90 N)	
Elongation at break, 2-in. (50 mm) wide strip, min 1/		
Wales direction	100%	FED-STD-191, Method 5102
Course direction	300%	
Coating Thickness	0.007 - 0.0105 in. (0.18 - 0.267 mm)	FED-STD-601, Method 2011 and 4.5.5
Coating Adhesion in Wales Direction, min	8 lb (35 N)	FED-STD-191, Method 5970 and 4.5.6
Modulus at 75% Elongation, max		
Wales direction	15 lb (68 N)	4.5.7
Course direction	5 lb (22 N)	

TABLE I (continued)

Property	Requirement	Test Method
Resistance to Flexing	No tears, separation or water leaks	4.5.8
Resistance to Low Temperature	No cracking or water leaks	4.5.9
Tension Set, max	20%	4.5.10

Note: 1. Breaking strength and elongation shall be determined simultaneously on the same specimen.

3.2.1 Length: The coated cloth shall be furnished in rolls. The minimum length of a roll shall be 100 yd (90 m), the maximum number of pieces in a roll shall be 4, and the length of the shortest piece in a roll shall be not less than 10 yd (9 m).

3.2.2 Width: Shall be as specified by purchaser.

3.2.3 Color: The coated side of the cloth shall match Sage Green 1565.

3.2.3.1 Sage Green 1565 is a manufacturer identification number for that color.

3.2.3.2 Matching: The color shall match the standard sample under artificial daylight having a color temperature of 7500°K and shall be a good approximation to the standard sample under incandescent lamplight at 2800°K.

3.3 Quality: Cloth, as received by purchaser, shall be clean, evenly woven, as free from foreign materials as commercially practicable, and free from imperfections detrimental to usage of the cloth.

3.3.1 Acceptance quality levels (AQL) for the cloth shall be as specified in 4.3.1.3 and by purchaser.

3.3.2 Imperfections: Acceptability of each lot of cloth shall be based on defects listed in Table II.

TABLE II

Defects

Coated Side:

Any cut, hole, tear, or abrasion
Any pinhole
Any uncoated area
Any scorch or burn
Any blister, tunnel, or delamination of coating
Splice mark clearly visible on coated side
Any lump or heavily-coated area
Crease or wrinkle resulting in doubling or adhesion of surfaces that cannot be corrected by manual pressure
Uneven coating: thin area where coating is missing or noticeably thinner
Slub, slug, kink, or knot resulting in coating streak or uneven coating
Any spot, stain, or streak over 1 in. (25 mm) in length, any direction, (clearly visible at approximately 3 ft (1 m))
Any foreign matter which on removal leaves an uncoated or poorly coated area
Width less than minimum specified
Any objectionable odor (not characteristic of coating compound)
Ripples, waviness, dimensional distortion
Edges not cut straight, folded or rolled
Variation in color or coating
Tackiness (coating will adhere and not readily unroll)
Color not as specified, sample off shade, uneven, or mottled

Uncoated Side:

Any hole
Dropped stitch or run
Snag or pull affecting coating

3.3.2.1 Defects shall be counted regardless of their proximity to each other except where two or more defects represent a single local condition of the cloth, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each warpwise yard (metre) or fraction thereof in which the defect occurs.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of the cloth shall supply all samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.6. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the cloth conforms to the requirements of this specification.

4.2 Classification of Tests: Tests to determine conformance to all technical requirements of this specification are classified as acceptance tests and as preproduction tests and shall be performed prior to or on the initial shipment of cloth to a purchaser, on each lot, when a change in material, or processing, or both requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.1 For direct U.S. Military procurement, substantiating test data and, when requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling:

4.3.1 For Acceptance Tests: Each lot of cloth shall be visually examined as specified in 4.3.1.3 for quality (3.3) and sampled at random for all other tests; the number of determinations for each requirement shall be as specified in the applicable test procedure, or, if not specified therein, not less than three.

4.3.1.1 A lot shall be all cloth made under essentially the same conditions, produced in a single production run, and presented for vendor's inspection at one time. An inspection lot shall not exceed 1000 lb (450 kg).

4.3.1.2 When a statistical sampling plan and acceptance quality level (AQL) have been agreed upon by purchaser and vendor, sampling shall be in accordance with such plan in lieu of sampling as in 4.3.1 and the report of 4.6 shall state that such plan was used.

4.3.1.3 Yard-by-Yard Examination of Cloth: Sample unit for this examination (See 4.5.11) shall be 1 yd (1 m). Acceptance quality level (AQL) shall be 10.0 defects per 100 units. Inspection level shall conform to MIL-STD-105, Level II. The number of rolls over which the sample yardage shall be distributed shall be as specified in Table III.

TABLE III

Lot Size Yards or Metres	Sample Size, Rolls	Acceptance Number
1 to 1,200, incl	3	0
Over 1,200 to 3,200, incl	5	0
Over 3,200 to 10,000, incl	8	0
Over 10,000 to 35,000, incl	13	0
Over 35,000 to 150,000, incl	20	1
Over 150,000	32	2

4.3.1.3.1 If a lot contains fewer than three rolls, each roll in the lot shall be examined.

4.3.1.4 Examination for Length:

4.3.1.4.1 Individual Roll Length: The unit of product shall be one roll. The number of rolls to be examined and the acceptance number shall be in accordance with Table III. The following conditions shall be considered defects:

Any roll not having the coated side of the fabric facing as specified
Any roll (gross length) less than minimum or more than maximum specified
Any roll (gross length) more than 2 yd (2 m) less than gross length marked on ticket
Any splices or seams in any roll (if not allowed)
Any roll containing more than specified number of pieces
Any piece in roll less than minimum specified length
Any piece in roll less than minimum specified width

4.3.1.4.2 Total Yardage in Samples: The rolls examined shall be those selected for examination of individual rolls as specified in 4.3.1.3. The lot shall be unacceptable if the total of the gross lengths of the rolls in the sample is less than the total of the gross lengths marked on the tickets.

4.3.2 For Preproduction Tests: Shall be as agreed upon by purchaser and vendor.

4.3.2.1 Samples for Testing: Property requirements specified in Table I apply to the average of the determinations made on a unit of product for test purposes as specified in the applicable test methods. Sample units for testing shall be as follows:

4.3.2.1.1 Base Cloth: 9 in. (225 mm) length, full width.

4.3.2.1.2 Cured Coating Compound: 2 sq ft (0.2 m^2) with a thickness of 0.07 - 0.08 in. (1.8 - 2.0 mm).

4.3.2.1.3 Coating Adhesion Test: Two pieces 12 x 12 in. (300 x 300 mm) taken from coated cloth prior to curing. The two pieces shall be placed together, coating to coating, except for a 1-in. (25-mm) wide separation along a wales edge (allowed by insertion of paper). The specimen shall be cured in the same manner and degree of cure as the finished product. If specimens prepared by vendor are not available, specimens may be prepared using adhesive conforming to MIL-A-5540 or adhesive referenced in FED-STD-191, Method 5970.

4.3.2.1.4 Coated Cloth: One continuous yd (1 m), full width.

4.3.2.1.5 Lot Size: Shall be expressed in units of 1 linear yd (1 linear m) and the sample size (number of sample units) shall be as specified below. The lot shall be unacceptable if any unit fails to meet any requirement specified. All test reports shall contain the individual values utilized in expressing the final result.

Lot Size	Sample Size
Up to 800, incl	2
Over 800 to 22,000, incl	3
Over 22,000	5

4.4 Approval:

4.4.1 Sample cloth shall be approved by purchaser before cloth for production use is supplied, unless such approval be waived by purchaser. Results of tests on production cloth shall be essentially equivalent to those on the approved sample cloth.

4.4.2 Vendor shall use ingredients, manufacturing procedures, processes, and methods of inspection on production cloth which are essentially the same as those used on the approved sample cloth. If necessary to make any change in ingredients, in type of equipment for processing, or in manufacturing procedures, vendor shall submit for reapproval a statement of the proposed changes in material or processing, or both and, when requested, sample cloth. Production cloth made by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Test Methods:

4.5.1 Polychloroprene in Coating Compound: Shall be determined in accordance with FED-STD-601, Method 1511, using the following conversion formula:

$$\text{Vol \%} = \frac{\text{wt \% of polychloroprene} \times \text{specific gravity of sample}}{1.27}$$

4.5.2 Tensile Strength and Elongation of Coating Compound: Tensile strength of cured coating compound shall be determined before and after exposure to accelerated aging and weathering tests. Tensile strength and elongation shall be determined in accordance with FED-STD-601, Methods 4111 and 4121, respectively. The Type III die shall be used.

4.5.3 Accelerated Aging of Coating Compound: Test specimen shall be subjected to 96 hr ± 0.5 aging in accordance with FED-STD-601, Oxygen Pressure Test Method 7111.

4.5.4 Accelerated Weathering of Coating Compound: Test specimen shall be stretched to 10 percent elongation, exposed to the weathering unit for 100 hr ± 0.5, and tested in accordance with FED-STD-601, Method 7311.

4.5.5 Coating Thickness: Shall be determined using the coated cloth thickness minus the knitted base cloth thickness.

4.5.6 Coating Adhesion: Shall be determined on a 2-in. (50-mm) wide specimen tested in the wales direction.

4.5.7 Modulus of Coated Cloth: Shall be determined on specimens 2.0 in. ± 0.5 (50 mm ± 12) by 3 in. ± 0.5 (75 mm ± 12) with a 1-in. (25-mm) gage length inscribed. Testing shall be done on a low capacity testing machine (50 lb [220 N] max) at a rate of 2 in. (50 mm) per minute. The machine shall be operated to stretch the gage marks to 2 in. (50 mm) and then immediately reverse to decrease the gage length to 1.75 in. (44 mm). The number of pounds (N) indicated on the test machine at the 75% elongation shall be recorded as the modulus.

4.5.8 Resistance to Flexing: A specimen 8 in. (200 mm) wide and at least 8 in. (200 mm) long in the course direction, shall be marked with a 6-in. (150-mm) gage length in the center of the course direction. The length of the course direction shall be governed by the clamps of the flexing machine. After the specimen has been subjected to 1000 flexing cycles at 50% stretch in the course direction at a speed of 10 cycles per min., the specimen shall be examined for evidence of tears in the coating and separation of the coating from the cloth. The specimen shall then be tested for water leaks in accordance with FED-STD-191, Method 5516. The water shall be applied for 3 hr at a height of 5 ft (1.5 m).

4.5.9 Low Temperature Resistance: Shall be determined in accordance with FED-STD-191, Method 5874. Test specimen shall be subjected to a temperature of -40°C ± 1 (-40°F ± 2) for 30 min. ± 3 and examined for evidence of cracking. Testing for water leaks shall be done in accordance with FED-STD-191, Method 5516. The water shall be applied for 5 min. at a height of 5 ft (1.5 m).

4.5.10 Tension Set: A specimen, identical with the modulus specimen of 4.5.7, shall be maintained at 100% elongation in the course direction for 16 hr ± 0.1. The elongation shall be released at a rate of 0.5 in. (12.5 mm) per minute. After allowing the specimen to recover for not less than 3 hr, the gage length shall be measured and the percent tension set determined.

4.5.11 Yard-by-Yard Examination: In addition to inspecting both sides of the cloth for visual defects, the coated side shall be given a separate through-light inspection for pinholes, light areas, and windows. The through-light inspection shall be performed in a darkened area using the lighting conditions described in 4.5.11.1. During the examination when the surface of the coated cloth is in contact with the light table, the illumination in the darkened room shall not exceed 25 ft-candles (270 lx) of natural or artificial light.