

AEROSPACE MATERIAL SPECIFICATION

SAE AMS3271

REV. B

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Superseding AMS3271A

Cloth, Knitted Nylon Stretch
Polychloroprene Coated

RATIONALE

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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.

1.3 Safety – Hazardous Materials: While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The applicable issue of referenced publications shall be the issue in effect on the date of the purchase order.

2.1 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

2.1.1 Federal Specifications:

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

2.1.2 Federal Standards:

FED-STD-191 – Textile Test Methods

FED-STD-601 – Rubber: Sampling and Testing

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2.1.3 Military Specifications:

MIL-A-5540 – Adhesive, Polychloroprene

2.1.4 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 1.

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 following requirements; tests shall be performed on the product supplied and in accordance with specified test methods, insofar as practicable:

3.2.1 Base Cloth:

3.2.1.1 Color

Natural

3.2.1.2 Weight

2.2 – 2.5 ounces/
square yard
(78 - 85 g/m²)

FED-STD-191,
Method 5041

3.2.2 Coating Compound

3.2.2.1 Tensile Strength

3.2.2.1.1	Initial, minimum	1300 psi (9 MPa)	4.5.2
3.2.2.1.2	Loss After 96 hours Aging, maximum	10%	4.5.3
3.2.2.1.3	Loss After 96 hours Weathering, maximum	20%	4.5.4
3.2.2.2	Elongation		
3.2.2.2.1	Initial, minimum	500%	4.5.2
3.2.2.2.2	Loss After 96 hours Aging, maximum	10%	4.5.3
3.2.2.2.3	Loss After 96 hours Weathering, maximum	20%	4.5.4
3.2.3	<u>Coated Cloth:</u>		
3.2.3.1	Weight, maximum	13 ounces/ square yard (440 g/m ²)	FED-STD-191, Method 5041
3.2.3.2	Breaking Strength, 2-inch (50.8 mm) wide strip, minimum		FED-STD-191, Method 5102
3.2.3.2.1	Wales direction	55 pounds force (245 N)	
3.2.3.2.2	Course direction	20 pounds force (89 N)	
3.2.3.2.3	Breaking strength and elongation shall be determined simultaneously on the same specimen.		
3.2.3.3	Elongation at break, 2-inch (50.8 mm) wide strip, minimum		FED-STD-191, Method 5102
3.2.3.3.1	Wales direction	100%	
3.2.3.3.2	Course direction	300%	
3.2.3.4	Coating Thickness	0.007 – 0.0105 inch (0.18 – 0.267 mm)	FED-STD-601, Method 2011 and 4.5.5
3.2.3.5	Coating Adhesion in Wales Direction, minimum	8 pounds force (36 N)	FED-STD-191, Method 5970 and 4.5.6
3.2.3.6	Modulus at 75% Elongation, maximum		4.5.7

- 3.2.3.6.1 Wales direction 15 pounds force
(67 N)
- 3.2.3.6.2 Course direction 5 pounds force
(22 N)
- 3.2.3.7 Resistance to Flexing No tears, separation, 4.5.8
or water leaks
- 3.2.3.8 Resistance to Low Temperature No cracking or water 4.5.9
leaks
- 3.2.3.9 Tension Set, maximum 20% 4.5.10
- 3.2.3.10 Length: The coated cloth shall be furnished in rolls. The minimum length of a roll shall be 100 yards (91 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 yards (9 m).
- 3.2.3.11 Width: Shall be as specified by purchaser.
- 3.2.3.12 Color: The coated side of the cloth shall match Sage Green 1565.
- 3.2.3.12.1 Sage Green 1565 is a manufacturer's identification number for that color.
- 3.2.3.12.2 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 evenly woven, as free from foreign materials as commercially practicable, and free from imperfections detrimental to usage of the cloth.
- 3.3.1 Imperfections: Acceptability of each lot of cloth shall be based on the following lists:

3.3.1.1 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 inch (25 mm) in length, any direction, (clearly visible at approximately 3 feet (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

3.3.1.2 Uncoated Side:

Any hole
Dropped stitch or run
Snag or pull affecting coating

3.3.1.3 Imperfections shall be counted regardless of their proximity to each other except where two or more imperfections represent a single local condition of the cloth, in which case only the more serious imperfection shall be counted. A continuous imperfection shall be counted as one imperfection for each warpwise yard (metre) or fraction thereof in which the imperfection 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. 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 for all technical requirements are acceptance tests and 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 ingredients and/or processing 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, contracting officer, or request for procurement.

4.3 Sampling and Testing: Shall be as follows:

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 pounds (454 kg) and may be packaged in smaller quantities and delivered under the basic lot approval provided lot identification is maintained.

4.3.1.2 When a statistical sampling plan has 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 yard (1 m). 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 I.

TABLE I

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 I. The following conditions are not acceptable:

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 yards (1.8 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 3.2 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 inches (229 mm) length, full width.

- 4.3.2.1.2 Cured Coating Compound: 2 square feet (0.2 m²) with a thickness of 0.07 – 0.08 inch (1.8 – 2.0 mm).

- 4.3.2.1.3 Coating Adhesion Test: Two pieces 12 x 12 inches (305 x 305 mm) taken from coated cloth prior to curing. The two pieces shall be placed together, coating to coating, except for a 1-inch (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 yard (1 m), full width.

- 4.3.2.1.5 Lot Size: Shall be expressed in units of 1 linear yard (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 ingredients and/or processing 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 and elongation of cured coating compound shall be determined in accordance with FED-STD-601, Methods 4111 and 4121, respectively, before and after exposure to accelerated aging and weathering tests. The Type III die shall be used.
- 4.5.3 Accelerated Aging of Coating Compound: Test specimen shall be subjected to 96 hours $\pm$ 0.5 aging in accordance with FED-STD-601, Method 7111, Oxygen Pressure Test.
- 4.5.4 Accelerated Weathering of Coating Compound: Test specimen shall be stretched to 10% elongation, exposed to the weathering unit for 100 hours $\pm$ 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-inch (51-mm) wide specimen tested in the wales direction.
- 4.5.7 Modulus of Coated Cloth: Shall be determined on specimens 2.0 inches $\pm$ 0.5 (51 mm $\pm$ 13) by 3 inches $\pm$ 0.5 (76 mm $\pm$ 13) with a 1-inch (25-mm) gage length inscribed. Testing shall be done on a low capacity testing machine (50 pounds force [222 N] maximum) at a rate of 2 inches (51 mm) per minute. The machine shall be operated to stretch the gage marks to 2 inches (51 mm) and then immediately reversed to decrease the gage length to 1.75 inches (44.4 mm). The number of pounds force (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 inches (203 mm) wide and at least 8 inches (203 mm) long in the course direction, shall be marked with a 6-inch (152-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 minute, 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 hours at a height of 5 feet (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 $-40^{\circ}\text{C} \pm 1$ ($-40^{\circ}\text{F} \pm 2$) for 30 minutes $\pm$ 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 minutes at a height of 5 feet (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 hours $\pm$ 0.1. The elongation shall be released at a rate of 0.5 inch (13 mm) per minute. After allowing the specimen to recover for not less than three hours, 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 foot-candles (269 lx) of natural or artificial light.