

MIL-C-0020079G(SH)  
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 SUPERSEDING  
 MIL-C-0020079F(SH)  
 3 June 1980  
 USED IN LIEU OF  
 MIL-C-20079E  
 15 May 1975  
 (See 6.7)

## MILITARY SPECIFICATION

### CLOTH, GLASS; TAPE, TEXTILE GLASS; AND THREAD, GLASS

This limited coordination military specification has been prepared by the Naval Sea Systems Command based upon currently available technical information but it has not been approved for promulgation as a coordinated revision of MIL-C-20079E. It is subject to modification. However, pending its promulgation as a coordinated military specification, it may be used for acquisition.

#### 1. SCORE

1.1 Scope. This specification covers fibrous glass cloth, tape, and sewing thread for use as thermal insulation components.

1.2 Classification. Fibrous glass cloth, tape, and sewing thread shall be of the following types and classes, as specified (see 6.2.1).

##### Type I - Cloth.

- Class 1 - Satin weave - light weight.
- Class 2 - Satin weave - heavy weight (resin treated).
- Class 3 - Plain weave - light weight.
- Class 4 - Plain weave - light weight - pre-applied re-wet adhesive.
- Class 5 - Modified plain weave - light weight.
- Class 6 - Modified plain weave - light weight - pre-applied re-wet adhesive.
- Class 7 - Modified plain weave - medium weight.
- Class 8 - Modified plain weave - medium weight - pre-applied re-wet adhesive.
- Class 9 - Plain weave - heavy weight.
- Class 10 - Plain weave - heavy weight - aluminized.

##### Type II - Tape.

- Class 1 - Plain weave, untreated.
- Class 2 - Plain weave, (resin) treated.
- Class 3 - Knitted, untreated.
- Class 4 - Two-ply, untreated.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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Type III - Sewing thread.

Class 3 - Medium weight - polytetrafluoroethylene (PTFE)  
coated - sintered (for machine sewing).

Class 4 - Heavy weight - polytetrafluoroethylene (PTFE)  
coated - unsintered for hand sewing.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-636 - Boxes, Shipping, Fiberboard.

MILITARY

MIL-A-3316 - Adhesives, Fire-resistant, Thermal Insulation.

STANDARDS

FEDERAL

FED-STD-191 - Textile Test Methods.

FED-STD-595 - Colors.

MILITARY

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

MIL-STD-129 - Marking for Shipment and Storage.

2.1.2 Other Government documents. The following other Government documents form a part of this specification to the extent specified herein.

UNIFORM CLASSIFICATION COMMITTEE AGENT

Uniform Freight Classification Ratings, Rules and Regulations.

(Application for copies should be addressed to the Uniform Classification Committee Agent, Tariff Publication Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

U. S. COAST GUARD (USCG)

Specification 164.009 Incombustible Materials for Merchant Vessels.

(Application for copies should be addressed to the Commandant (MMT), U. S. Coast Guard Headquarters, 400 Seventh Street, S.W., Washington, DC 20591.)

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(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

\* AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 579 - Woven Glass Fabrics, Specifications and Tests for.  
(DoD Adopted)

D 1448 - Micronaire Reading of Cotton Fibers, Test for.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

### 3. REQUIREMENTS

3.1 First article. When specified, a sample shall be subjected to first article inspection (see 4.3 and 6.3).

3.2 Material. Fibrous glass cloth, tape, and sewing thread shall be manufactured from fibrous glass yarn. Unless otherwise specified (see 6.2.1), type I, class 2 cloth and type II, class 2 tape shall be treated with a resin (see 6.2.1 and 6.5). Type II tapes, classes 1 and 2 may contain one end or wale of organic yarn.

3.2.1 Yarn. The yarn shall be made from continuous filament glass fiber. Yarns used to weave type I, classes 3 through 10, and type II, class 4 shall be low twist yarns made with continuous filament fibers that have been texturized to provide soft high bulk characteristics.

3.2.2 Fiber diameter. The average diameter of the glass fibers used for the yarns shall not exceed the following values:

	Maximum average
Type I	
Class 1	0.00021
Class 2	0.00036
Classes 3-10	0.00025
Type II	
Classes 1-3	0.00036
Class 4	0.00025

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3.3 Type I, cloth.

3.3.1 Class 1, light weight, untreated. Class 1, light weight cloth shall be woven with an eight harness satin weave.

3.3.2 Class 2, heavy weight, resin treated. Class 2, heavy weight cloth shall be woven with a 4 harness (crowfoot) satin weave.

3.3.3 Classes 3, 4, 9, and 10. Classes 3, 4, 9, and 10 shall be plain weave fabrics.

3.3.4 Classes 5, 6, 7, and 8. Classes 5, 6, 7, and 8 shall be modified two end plain weave fabrics.

3.3.5 Classes 4, 6, and 8. Classes 4, 6, and 8 shall be adhesive treated.

3.3.6 Classes 3, 5, 7, and 9. Classes 3, 5, 7, and 9 shall be cleaned but shall have no treatment.

3.3.7 Mechanical requirements. Cloth shall conform to the requirements specified in table I. A tolerance of plus or minus 10 percent will be permitted in the specified weight of all classes except for class 2 which shall be plus or minus 15 percent.

TABLE I. Requirements for cloth (type I).

Class	Description	Weight ounces per square yard <sup>1/</sup>			Yarn <sup>2/</sup>		Breaking strength, minimum (min) pounds per inch of width <sup>3/</sup>			
		Untreated	Basic cleaning	Treated <sup>4/</sup>	Warp ends	Filling picks	As received		After heating to 900°F for two hours	
							Warp	Filling	Warp	Filling
1	Satin weave light weight	8.65	-----	-----	56 ± 2	53 ± 2	200	180	60	60
2	Satin weave heavy weight	12.7	N.A.*	13.5	48 ± 2	32 ± 2	300	255	70	60
3	Plain weave light weight	N.A.*	8.5	N.A.*	18 ± 2	14 ± 2	100	45	35	15
4	Plain weave light weight pre-applied re-wet adhesive	8.5.	N.A.*	14.5	18 ± 2	14 ± 2	100	45	35	15
5	Modified plain weave light weight	N.A.*	8.5	N.A.*	18 ± 2	14 ± 2	100	40	35	15
6	Modified plain weave light weight pre-applied adhesive	8.5.	N.A.*	14.5	18 ± 2	14 ± 2	100	40	35	15
7	Modified plain weave medium weight	N.A.*	12.8	N.A.*	20 ± 2	16 ± 2	100	60	--	--
8	Modified plain weave medium weight, pre-applied re-wet adhesive	12.8	N.A.*	22	21 ± 2	16 ± 2	125	80	--	--
9	Plain weave heavy weight	N.A.*	17.7	N.A.*	20 ± 2	14 ± 2	200	100	60	30
10	Plain weave heavy weight aluminized <sup>5/</sup>	N.A.*	17.7	20.5	20 ± 2	14 ± 2	200	100	--	--

See footnotes at top of next page.

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\*Not applicable.

<sup>1/</sup>See 4.6.2.

<sup>2/</sup>See 4.6.4.

<sup>3/</sup>See 4.6.5.

<sup>4/</sup>See 3.3.8. Increase in weight results from the respective treatments: resin, adhesive or aluminized as applicable.

<sup>5/</sup>See table II for additional requirements for class 10.

### 3.3.8 Treatments.

\* 3.3.8.1 Basic cleaning. All type I fabrics, except classes 1, 2, 4, 6, and 8 shall be heat treated or chemically cleaned to remove weaving starches and lubricants prior to use as an untreated cloth lagging or untreated insulation pad fabric.

3.3.8.2 Resin treated. Type I, class 2 shall be treated with a resin which has been shown to perform satisfactorily for the purposes intended.

3.3.8.3 Rewettable adhesives. Type I, classes 4, 6, and 8 shall have a minimum of 70 percent deposit of adhesive applied. The treated fabric shall then have the characteristics that conform to the following requirements of MIL-A-3316, class 1: toxicity and irritancy, adhesive strength, flexibility, paintability, and fire resistance.

3.3.8.4 Aluminizing. Aluminum foil, 0.001 inch thick minimum shall be laminated to type I, class 10 cloth with a flame retardant adhesive (see table II).

\* 3.3.8.5 Coloring. When specified (see 6.2.1), classes 3, 5, 7, and 9 of type I fabrics shall be identified with red coloring (to match red Nos. 31158-31136 or 31302 of FED-STD-595) for purposes of non-asbestos identification (see 6.1.1). The red material shall be flame-resistant, non-toxic, and mechanically equivalent to non-colored material of the same class, as determined previously during separate comparative testing (see 4.6.8.1 and 4.6.11.1). Fabric shall retain its color at 200°F (see 4.6.12). Red coloring shall retain its permanence during normal installation and use (see 4.6.13).

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TABLE II. Additional requirements of type I, class 10 cloth.

Test	Specification	Method	Requirements		Tolerance
			Warp	Fill	
Thickness <sup>1/</sup>	FED-STD-191	5030	0.040 inches	-----	plus or minus 10 percent
Mullen burst <sup>2/</sup>	FED-STD-191	5122	500 lb/in <sup>2</sup>	-----	minimum
Ignition loss <sup>3/</sup>	ASTM D 579		3.1 percent	-----	maximum
Flame resistance <sup>4/</sup>	FED-STD-191	5903	*	-----	maximum
Delamination <sup>5/</sup>	-----	-----	No delamination		-----

\*After flame - 0 second.  
 Char length - 0 inches.  
 After glow - 0 second.  
 Flame travel - 1.5 inches.

<sup>1/</sup> See 4.6.3.  
<sup>2/</sup> See 4.6.6.  
<sup>3/</sup> See 4.6.7.  
<sup>4/</sup> See 4.6.8.  
<sup>5/</sup> See 4.6.9.

3.3.9 Width. The nominal width of the cloth shall be as specified (see 6.2.1), with the following tolerances:

\* Up to and including 40 inches - plus or minus 1/2-inch.  
 Over 40 inches but not including 60 inches - plus or minus 3/4-inch.  
 60 inches and over - plus or minus 1-inch.

3.3.10 Put-up. Unless otherwise specified (see 6.2.1), the cloth shall be furnished in 50 + 5 yards (yds) rolls. The minimum length in a spliced roll shall be 4 yds and a spliced roll shall contain no more than 3 pieces per 50 yd length.

3.3.11 Fire resistance. All classes shall meet the requirement for incombustibility as specified by USCG 164.009 both before and after treatment except for classes 4, 6, 8, and 10 which shall not be required to meet this requirement after treatment (see table I). After treatment, classes 4, 6, 8, and 10 shall, however, exhibit an after flame and after glow of zero seconds maximum, a char length of zero inches maximum and a flame travel of 1-1/2 inches maximum when tested as specified in 4.6.8.

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3.4 Type II, tape.

3.4.1 Class 1, woven, untreated; class 2, woven, treated; class 4, two-ply, untreated. Class 1, untreated tape and class 2, resin treated tape shall be a plain weave. Class 4, untreated tape shall be a two-ply weave. For each class, the ends shall be properly interlocked with the picks to insure that there shall be no raveling of the tape edges.

3.4.1.1 Basic cleaning. Type II, class 4 material may be heat or chemically cleaned to remove weaving starches and lubricants.

3.4.2 Class 3, knitted untreated. Class 3 tape shall be knitted. The wales shall be properly interlocked with the courses to insure that there shall be no raveling of the tape edges.

3.4.3 Mechanical requirements. Tape shall conform to the requirements specified in table III. A tolerance of plus or minus 10 percent will be permitted in the specified weight of the tape.



TABLE III. Requirements for tape (type II).

Class	Weight per square Yd, ounces—		Tape <sup>2/</sup>	Yarn <sup>3/</sup>		Breaking strength, <sup>4/</sup> min lb per inch of width—				Abrasion resistance min cycles to failure	
	Untreated	Treated	Thickness inch	Warp ends or wales per inch	Filling picks or courses per inch	As received		After heating to 900°F for 2 hours		As received	After heating to 900°F for 2 hours
						Warp	Filling	Warp	Filling		
1	5.80	----	0.007 ± 0.001	42 ± 2	32 ± 2	150	---	40	---	----	----
2	5.80	7.05	.007 ± .001	42 ± 2	32 ± 2	150	---	40	---	----	----
3 <sup>5/</sup>	4.50	----	.007 ± .001	23 ± 2	16 ± 2	40	---	21	---	----	----
3 <sup>5/</sup>	8.00	----	.015 ± .002	15 ± 2	13.5 ± 2	70	---	21	---	----	----
3	11.25	----	-----	10 ± 2	22 ± 2	15	---	9	---	----	----
4	70 + 10 percent	----	.125 ± 10 percent	42 ± 2	12 ± 1	300	---	100	---	x <sup>(a)</sup>	0.75 x <sup>(a)</sup>

(a) - Number of cycles to failure after heating shall be 75 percent of average value obtained for same tape when tested as received (see 4.6.12).

- 1/ See 4.6.2.  
 2/ See 4.6.3.  
 3/ See 4.6.4.  
 4/ See 4.6.5.  
 5/ See 6.2.1

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3.4.4 The construction of the tape shall be such that there shall be no distortion of the tape such as curling (see 4.6.11).

3.4.5 Width. The nominal width of the tape shall be as specified (see 6.2.1). A tolerance of plus or minus 1/8 inch will be permitted in the specific width of the tape. For class 4, tape over 3 inches in width shall have a tolerance of plus or minus 3/16 inch.

3.4.6 Put-up. Unless otherwise specified (see 6.2.1), the tape shall be furnished in 50 yd rolls. For class 4, tape shall be furnished in 100 ft rolls. The minimum length of each piece in a spliced roll shall be 4 yards and no spliced roll shall contain more than 3 pieces.

3.4.7 Fire resistance. All classes shall meet the requirements for incombustibility as specified by USCG 164.009.

3.5 Type III, sewing thread.

3.5.1 Class 3 and class 4. Thread shall be PTFE treated.

3.5.1.1 Class 3 and class 4 thread shall have the properties specified in table IV. A tolerance of plus or minus 10 percent will be permitted in the specified yards/pounds and diameter.

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TABLE IV. Requirements for type III, classes 3 and 4 thread.

Class	Yds/lb plus or minus 10 percent		Coating min percent	Tensile min	Type finish	Type thread	Thread diameter (inch)	Type sewing
	Before treatment	After treatment						
3	1700	1500	12	20 lb	Fully sintered	2 twist	0.021	Machine
4	1330	1150	12	50 lb	Unsintered	Braided	0.027	Hand

3.5.1.2 Put-up. Unless otherwise specified (see 6.2.1), class 3 thread shall be furnished in 2 pounds per package plus or minus 10 percent on appropriate machine head sewing spool, maximum 2 splices per spool. Class 4 thread shall be furnished in 1/2 pound per pack plus or minus 10 percent on paper tubes for ease in hand sewing, with no splices.

3.6 Identification of item. Each roll or spool as applicable shall have a label attached in such a manner as to remain in place and be clearly legible until all material has been removed. The label shall be legibly stamped or typed with water insoluble ink and shall contain the following information.

Stock number  
 Nomenclature (type and class)  
 Specification number  
 Yardage or footage (as applicable)  
 Contract number and date  
 Contractor's name  
 Name of contracting agency

3.7 Workmanship. The finished cloth, tape, and thread shall conform to the quality and grade of product established by this specification. The occurrence of defects shall not exceed the applicable acceptance quality levels specified herein.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

- (a) First article inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

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**4.3 First article.**

4.3.1 First article. If more than one weave or type of cloth, tape, or thread is acquired at any one time, the first article shall consist of one roll of each cloth, tape, or spool of thread as applicable.

4.3.2 First article inspection. First article inspection shall consist of the examinations of 4.4.1 and 4.7.1 and tests specified in 4.6 and 4.9. A first article inspection report shall be submitted in accordance with the data ordering document (see 6.2.2).

4.4 Quality conformance inspection for cloth and tape. Inspection shall be in accordance with 4.4.1, 4.5, and 4.6. For purpose of sampling, an inspection lot shall consist of all cloth or tape of the same type ready for inspection or shipment at one time.

**4.4.1 Inspection of the end item cloth and tape.**

4.4.1.1 Examination of the end item (cloth and tape). Defects found during the examination shall be classified in accordance with 4.4.1.1.1, 4.4.1.1.2, and 4.4.1.1.3. The cloth and tape shall be examined visually to determine conformance with the requirements of this specification.

4.4.1.1.1 Yard-by-yard examination. The required yardage of each roll of cloth or tape shall be inspected to both sides and visual defects classified in accordance with tables V or VI as applicable. When the total yardage in the roll does not exceed 50 yds, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 50 yds, only 50 yds shall be examined. All defects found shall be counted regardless of their proximity one to another, except where two or more defects represent a single local condition of the cloth or tape, in which case only the more serious defect shall be counted. A continuous defect shall be counted as one defect for each linear yd or fraction thereof in which it occurs. The unit of product for this examination shall be 1 linear yd. The acceptable quality level (AQL) shall be 2.5 major and 6.5 total defects (major and minor combined) per 100 units (yds) for cloth less than 50 inches in width, and 1.5 major and 2.5 total defects per 100 units for tape. The lot size shall be expressed in units of 1 linear yd. Inspection level for all sampling shall be level II of MIL-STD-105. The sample size shall be taken proportionately from the number of rolls selected in accordance with inspection level S-2.

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TABLE V. Classification of defects (woven cloth and tape).

Defects	Classification	
	Major	Minor
Bias or bowed filling - distorted from horizontal by more than 3 inches and clearly visible <sup>1/</sup>		X
Baggy, ridgy, or wavy - clearly visible <sup>1/</sup>	X	
Hole, cut, or tear	X	
Spots, streaks, stains:		
Clearly visible, <sup>1/</sup> 2 inches or more in combined directions	X	
Clearly visible, <sup>1/</sup> less than 2 inches but greater than 1/4 inch in combined directions		X
Smash - any	X	
Broken or missing ends or picks:		
3 or more contiguous, regardless of length	X	
2 contiguous, 2 inches or more in length	X	
2 contiguous, less than 2 inches in length		X
Single, complete pick or single end, 9 inches or over		X
Floats and skips:		X
2 inches or more in combined warp and filling directions	X	
Less than 2 inches in combined warp and filling directions		X
Thick area over 2 inches in length and 1/2 inch or more in width		X
Thin area over 2 inches in length and 1/2 inch or more in width	X	
NOTES:		
(1) Thick warp and filling yarns caused by gluing broken yarns together will not be considered as a defect.		
(2) Resin deposits caused by stoppage of finishing machine will not be considered as a defect, provided the cloth or tape is covered by resin.		
Selvage defects - curled or folded under		X
Crease - hard embedded and folded over on self	X	
Brittle or fused area - any	X	
Delamination of aluminum coating over 1 inch square	X	

<sup>1/</sup>At normal inspection distance (approximately 3 feet).

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TABLE VI. Classification of defects (knitted tape).

Defects	Classification	
	Major	Minor
Coarse yarn, clearly visible <sup>1/</sup>		X
Fine yarn clearly visible <sup>1/</sup>	X	
Run or dropped stitch - any	X	
End out	X	
Pulled stitch		X
Any thin places or unevenness of fabric resulting in a weak area	X	
Unevenness of fabric, clearly visible <sup>1/</sup> but not resulting in a weak area		X
Abrasion resulting in a weak area	X	
Hole, cut or tear - any	X	
Weak place, clearly visible <sup>1/</sup>	X	
Slub, slug, or gout more than 3 times the thickness of normal yarn		X
Crease - hard embedded and folded over on self		X
Edges cut, torn, folded, or rolled - any	X	
Edges scalloped or uneven		X
Spots, stain, or streak, clearly visible and more than 1 inch or more combined directions		X

<sup>1/</sup>At normal inspection distance (approximately 3 feet).

4.4.1.1.2 Overall examination. Each defect listed below shall be counted not more than one in each roll examined. The unit of product for this examination shall be one roll. The lot size shall be expressed in units of 1 linear yd. The AQL shall be 4.0 for all the listed defects. The number of rolls in the sample shall be selected in accordance with inspection level S-2 of MIL-STD-105.

Defects

Uneven weaving or knitting throughout roll  
 Width beyond specified tolerances  
 Selvage curled, folded, rolled, or slack continuously or intermittently throughout the roll  
 Overall uncleanness  
 Objectionable odor (odor of chemicals commonly used in finishing compounds shall not be regarded as objectionable)  
 Finish not uniform in color

4.4.1.1.3 Examination for length.

4.4.1.1.3.1 Individual rolls. The rolls shall be examined for gross length. Any gross length found to be less than the specified minimum length or any gross length found to be more than 2 yds below the gross length marked on the ticket shall be considered as a defect with respect

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to length. For all tapes and for cloth when specified, any roll containing pieces shorter than specified, or more than the maximum number of pieces specified, shall also be considered as a defect with respect to length. The lot size shall be expressed in units of 1 linear yd. The sample size shall be expressed in number of rolls. The AQL shall be 4.0. The number of rolls in the sample shall be selected in accordance with inspection level S-2 of MIL-STD-105.

4.4.1.1.3.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual gross lengths of rolls in the sample (see 4.4.1.1.3.1) is less than the total of the gross lengths marked on the tickets.

\* 4.4.1.1.4 Examination for color.

\* 4.4.1.1.4.1 Individual rolls. A random one yard sample of each lot shall be visually inspected for color. In the event that the color does not meet the requirements of 3.3.8.5, the lot shall be rejected.

4.5 Testing of the end item (cloth and tape). The method of testing specified in FED-STD-191, wherever applicable, and as listed in section 4.6 shall be followed. The physical values specified in section 3 apply to the average of the determinations made on a unit of product for test purposes as specified in the applicable test method. The sample size for all tests listed in section 4.6 (excluding trapezoidal tear, mullen burst, ignition loss, and flame spread index) shall be in accordance with inspection level S-1 of MIL-STD-105. For these tests the lot size shall be expressed in units of 1 linear yd and the sample size shall be expressed in number of rolls. The AQL for these characteristics shall be 6.5. For the mullen burst, ignition loss, and flame spread, the sample size shall be in accordance with inspection level S-3 of MIL-STD-105. For these four tests, the lot size and sample size shall be expressed in the number of rolls. The lot shall be unacceptable if one or more units of products fail to meet any of these four test requirements. The unit of product for test purposes shall be 1 linear yd of cloth or 8 linear yds of tape, and the unit of product for testing purposes for type I, class 10 cloth, shall be 2 linear yds.

4.6 Test procedures - cloth and tape.

4.6.1 Fiber diameter. The diameter of the fiber shall be determined by either of the following methods:

- (a) Microscopic. Diameter of fibers shall be determined microscopically on the basis of measuring 50 random fibers. The average diameter for purposes of determining conformance shall be the average of all measurements.
- (b) Air flow. The air flow method as measured by the micronaire instrument in accordance with ASTM D 1448, with the addition that the micronaire unit must be calibrated for the purpose of testing fibrous glass.

4.6.2 Weight of cloth and tape.

4.6.2.1 Untreated cloth and tape. The weight shall be determined in accordance with method 5040 or 5041 of FED-STD-191.

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4.6.2.2 Treated cloth and tape. The weight of the treated cloth and tape shall be determined in accordance with method 5040 or 5041 of FED-STD-191; then the samples shall be placed in an oven adequately vented in such a manner as to insure complete circulation of the atmosphere of the entire oven chamber, preferable by fan or other forced circulation methods. The oven shall be maintained at 800°F until all the synthetic resin coating has been removed. The samples shall be removed and allowed to cool to room temperature. The weight of the samples without the resin coating shall then be determined.

4.6.3 Thickness of type I, class 10 cloth and type II, classes 1, 2, and 3 tapes. The thickness of the cloth and tape shall be determined in accordance with method 5030 of FED-STD-191.

4.6.4 Construction of cloth and tape.

4.6.4.1 Woven cloth and tape. The number of warp yarns and filling yarns per inch shall be determined in accordance with method 5050 of FED-STD-191.

4.6.4.2 Knitted tape. The number of wales and courses per inch shall be determined in accordance with method 5070 of FED-STD-191. For class 3 knitted tape, the shellac shall be applied for a distance of 1-5/8 inches while the fabric is in an extended position.

4.6.5 Breaking strength of cloth and tape.

4.6.5.1 Except as otherwise specified hereinafter, breaking strength shall be determined in accordance with method 5104 of FED-STD-191. In case of cloth, specimens shall be cut in both warp and filling directions; in the case of tape, only the warp yarns shall be tested. Five tests shall be made upon each sample and the results averaged to give the breaking strength of the sample.

4.6.5.2 In order to prevent the jaws of the testing machine from cutting the cloth, the ends of each specimen shall be coated with rubber or painted with thick shellac for a distance of 1-5/8 inches from each end and allowed to dry in the air before ravelled to the 1 inch width, and small pieces of manila paper or soft cotton twill fabric shall be inserted between the specimen and the face of each jaw.

4.6.5.3 For determining the breaking strength after heating, a muffle furnace with accurate automatic temperature control shall be used. For cloth, two specimens 6 inches long and 8 inches wide shall be cut, one with the 6 inch dimension parallel to the warp and the other with the dimension parallel to the filling. In the case of tape, a suitable number of specimens 6 inches long and the full width of the tape shall be taken. The specimens shall be supported on a wire screen or perforated metal plate at least 1/2 inch above the floor of the furnace and not more than five specimens shall be superimposed upon one another. The furnace thermocouple shall be centrally located not more than 1/2 inch above the topmost specimen.



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4.6.5.4 Specimens shall be introduced into the furnace with the temperature not over 200°F, and with the furnace door partly open, the temperature shall be gradually raised to 500°F, and maintained at this point until all smoking ceases. The total time consumed in this operation shall be not less than 1 nor more than 2 hours. Specimens shall be removed from the furnace and the temperature increased to 900°F. The specimens shall be replaced in the furnace, and shall be maintained at 900°F for 2 hours, after which they shall be removed, allowed to cool to room temperature, and the required breaking strength strips cut and tested as specified in 4.6.5.1.

4.6.6 Mullen burst strength of type I, class 10 cloth. The mullen burst strength of the cloth shall be determined in accordance with method 5122 of FED-STD-191. The faces of both clamping jaws should be covered with fabric reinforced, vulcanized rubber stock (1/4 inch to 3/8 inch thickness) bonded to the surfaces with a suitable metal or rubber cement. In addition, a D-1 type diaphragm should be used.

4.6.7 Ignition loss of type I, class 10 cloth. The ignition loss shall be determined in accordance with ASTM D 579.

4.6.8 Flame resistance.

4.6.8.1 Type I. Before treatment, all classes under type I shall meet the incombustibility test of USCG 164.009. After treatment, classes 1, 2, 3, 5, 7, and 9 shall meet the incombustibility test requirements of USCG 164.009 and classes 4, 6, 8, and 10 shall meet the fire resistance requirements of method 5903 of FED-STD-191.

4.6.8.2 Type II. All classes under type II shall meet the incombustible test requirements of USCG 164.009 both before and after treatment.

4.6.9 Delamination test of type I, class 10 cloth. There shall be no delamination after one hour exposure at 300°F. After this exposure the aluminum foil shall not rip off by hand in pieces larger than one inch square.

4.6.10 Distortion of tape. A sample of the tape, 24 inches in length, shall be spread out across a flat horizontal surface and observed for evidence of distortion such as tendency to curl rather than lie flat.

4.6.11 Abrasion testing of type II, class 4 tape. Testing shall consist of abrading the subject tape on a Wyzenbeck testing machine and shall continue until the total thickness of the sample is penetrated. The number of cycles to achieve penetration shall be recorded. For each subject tape, a total of 4 samples shall be tested for each condition (as received, and after heating to 900°F for 2 hours). Each test will be performed using an abrasive grit size of either 100 or 320 with applied load and tension equal to 4 pounds. Each set of results will be averaged to give the abrasion resistance for the subject tape.

\* 4.6.11.1 Abrasion testing of type I red lagging. Testing shall be conducted using a Wyzenbeck testing machine with an abrasive grit size of 320 and applied load and tension both equal to four pounds (see 3.3.8.5).

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\* 4.6.12 Heat-exposure. Samples of 2-inch sections shall be placed in an electric furnace equipped with calibrated thermocouples. The temperature shall be gradually raised (approximately 25°F to 30°F every 15 minutes) until each of the samples is visually noted to have lost its red coloring (that is turned white). The temperature at which this occurs shall be in accordance with 3.3.8.5.

\* 4.6.13 Moisture-exposure. Sections from a sample shall be immersed in a beaker of distilled water for a three day (72 hour) period. A spectrometer shall be used to measure the extent of red color present in the resultant solutions after removal of the cloths. The test shall produce a virtually colorless solution (see 3.3.8.5).

4.7 Quality conformance inspection for thread. Inspection shall be in accordance with 4.7.1, 4.8, and 4.9. For purposes of sampling, an inspection lot shall consist of all thread of the same type ready for inspection or shipment at one time.

4.7.1 Examination of the end item thread. Defects found during the examination shall be classified in accordance with 4.7.1.1, 4.7.1.2, or 4.7.1.3, whichever is applicable.

4.7.1.1 Examination. The required number of spools shall be examined and visual defects classified as shown in table VII. The unit of product for this examination shall be one spool. The sample size shall be in accordance with inspection level I of MIL-STD-105. The AQL shall be 1.0 major defects and 6.5 total (major and minor combined) defects per 100 units (spools). The lot size shall be expressed in units of one spool each.

4.7.1.2 Examination for length of thread (when thread is purchased on a length per holder basis). The length of thread shall be determined by measuring the entire length of thread on the holder. Measurement may be made over an accurate measuring clock under normal winding tensions. A defect shall be considered to exist if the length of any holder examined is less than specified or less than indicated on the ticket. The unit of product for this examination shall be one spool. The sample size shall be in accordance with inspection level S-3 of MIL-STD-105. The AQL shall be 4.0 defects per 100 units (spools). The lot size shall be expressed in units of one spool each. For all lots consisting of 500 or fewer units the sample size shall be 10 and the acceptance number 1.

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TABLE VII. Classification of visual defects for thread.

Defects	Classification	
	Major	Minor
Contract and identification marking - missing, incorrect, incomplete, illegible, or insecurely attached		X
Cleanness:		
Spot or stain, clearly visible $\frac{1}{1}$		X
Lumps or lint, clearly visible $\frac{1}{1}$		X
Package - cut, torn, chafed, or otherwise defective or damaged package affecting strength of thread or interfering with free, unhampered, unwinding of thread	X	
Winding - improperly or not firmly would resulting in knots, kinks, entangling, or slippage during unwinding or otherwise affecting free unhampered winding of thread	X	

$\frac{1}{1}$  At normal inspection distance (approximately 3 feet).

4.7.1.3 Examination for the net weight per holder (when thread is purchased on a weight basis). A defect with regard to weight shall be considered to exist if the net weight on any one holder is less than the minimum or more than the maximum specified. The unit of product, lot size basis, AQL and inspection level shall be as specified in 4.4.1.1.2.

4.8 Testing of the end item thread. The methods of testing listed in 4.9 shall be followed. The physical and chemical values specified in 3.5 apply to the average of the determinations made on a unit of product for test purposes as specified in the applicable test method. The AQL for each characteristic shall be 6.5 test failures per 100 units. The sample size shall be in accordance with inspection level S-1 of MIL-STD-105. The lot size shall be expressed in units of one spool and the unit of product for test purposes shall be one spool.

#### 4.9 Test procedures - thread.

##### 4.9.1 Breaking strength of thread.

4.9.1.1 The testing machine shall be of the pendulum type. The grips shall consist of highly polished metal cylinders not less than 2 inches in diameter and 2 inches long, having a metal rod or pin attached to each for the purpose of snubbing the specimen to be tested. The initial distance between centers of drums shall be 10 inches, and the drums shall separate at a uniform rate of 12 inches per minute, plus or minus 1/2 inch, under no load. Several yards of thread shall be unwound from the spool and discarded. The test specimen shall be pulled from the side of the spool so as not to disturb the twist. The thread shall be passed three times around each drum so that 1/16 inch space is left between wraps, and the ends knotted or snubbed around the pins provided for this purpose. Five tests shall be made upon each sample and the results averaged to give the breaking strength of the sample.

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4.9.1.2 If a specimen slips in the jaws, breaks in the jaws, breaks at the edge of the jaws or, if for any reason attributable to faulty operation, the result falls markedly below the average for the set, the results shall be disregarded. Another specimen shall then be taken and the result of this break included in the average.

4.9.2 Yards per pound for thread. Thirty yards of thread shall be reeled off on a standard wrap reel. The specimen shall be hung on a wire rod and placed in a furnace at least 1000°F until all the fiber coating is burned off. The thread shall not touch any part of the furnace, and shall be removed before starting to fuse or melt. When cooled to ambient conditions, the specimen shall be weighed to the nearest hundredth gram, and the yardage per pound computed in accordance with method 4010 of FED-STD-191.

4.10 Packaging inspection. An inspection shall be made to determine that the packaging requirements of section 5 and documents referenced therein of this specification are complied with. Defects shall be scored in accordance with table VIII below. The sample unit shall be one shipping container fully prepared for delivery with the exception that it need not be sealed. Defects listed below shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 of MIL-STD-105 and the AQL shall be 4.0 defects per 100 units.

TABLE VIII. Packaging inspection.

Examination	Defects
Markings (Exterior and interior)	Missing, incorrect; illegible; of improper size, location sequence, or method of application
Materials	Any nonconforming component, component missing, damaged, or otherwise defective affecting serviceability
Workmanship	Inadequate application of components such as incomplete closure of container flaps, waterproofing, reinforcing, etc., bulging or distortion of containers
Weight exterior	Gross/net weight exceeds requirements

## 5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government acquisitions. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.6.)

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5.1 Preservation-packaging. Preservation-packaging shall be level A or C as specified (see 6.2.1).

5.1.1 Level A.

5.1.1.1 Unit pack. Rolls of cloth and tape, and spools of thread shall be individually unit packaged by any one of the following methods, with selection of the method at the contractor's option.

- (a) Wrapping in not less than 60-pound minimum basis weight kraft paper. Wrapping shall be secured with gummed or pressure sensitive tape.
- (b) Shrink wrapping. Shrink wrapping may be either by skin or blister packaging.

5.1.1.2 Intermediate pack. Unit quantities in intermediate containers shall be as specified (see 6.2.1). Intermediate containers shall conform to PPP-B-636, class domestic. Boxes shall be closed in accordance with method I as specified in the appendix to the box specification. The gross weight shall not exceed 20 pounds.

5.1.2 Level C. Cloth, tape, and thread shall be packaged in such a manner that will afford protection against deterioration and physical damage during shipment from supply source to the first receiving activity for immediate use. The contractor's normal retail or wholesale preservation-packaging methods may be utilized when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2.1).

5.2.1 Level A. Cloth and tape of one class and width, and thread, of one class only, packaged as specified (see 5.1), shall be packed in containers conforming to class weather-resistant of PPP-B-636. Boxes shall be closed and waterproofed, method V, as specified in the appendix to the box specification. Reinforcing of boxes shall be accomplished by the use of nonmetallic banding or pressure-sensitive tape at the contractor's option.

5.2.2 Level B. Cloth and tape of one class and width, and thread of one class only, packaged as specified (see 5.1), shall be packed in containers conforming to class domestic or class weather resistant of PPP-B-636. Box closures shall be as specified for method I in accordance with the appendix of the box specification.

5.2.3 Level C. Cloth, tape, and thread, packaged as specified (see 5.2), shall be packed in containers, at the lowest rates, in a manner which will insure acceptance by common carrier and will afford protection against physical damage during direct shipment from the supply source to the first receiving activity for immediate use. This level in general shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

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5.3 Marking. In addition to any special marking specified in the contract or order (see 3.6 and 6.2.1), each unit (kraft or shrink wrap) and intermediate package and shipping containers shall be marked in accordance with MIL-STD-129.

## 6. NOTES

6.1 Intended use. The fibrous glass cloth, in type I, classes 1, 2, 3, 4, 5, 6, 7, 8, and 9; tape in type I, classes 1, 2, and 3; and sewing thread in type III, classes 3 and 4, are intended for use in the manufacture of thermal insulation components, such as cloth lagging material or jacket over thermal insulation, a covering or outer layer on removable thermal insulation pads, or as a facing for hull insulation board. Type I, class 10 is used to fabricate safety spray shields and type II, class 4 is intended for use in pipe hanger liner applications.

6.1.1 Red lagging (type I). Red lagging is intended to provide a system for color coding to identify asbestos-free thermal insulation systems.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type and class required (see 1.2).
- (c) When treatment is required for other than the types and classes of material specified (see 3.2).
- (d) When red cloth is required (see 3.3.8.5).
- (e) Width of cloth or tape required (see 3.3.9 and 3.4.5).
- (f) Put-up of cloth and tape, if other than specified (see 3.3.10 and 3.4.6).
- (g) Weight and class of tape required (see table III).
- (h) Class and number of spools of thread required (see 3.5.1.2 and table IV).
- (i) Put-up of thread, if other than specified (see 3.5.1.2).
- (j) Selection of applicable levels of packing and packaging (see 5.1 and 5.2).
- (k) Unit quantities to be packaged in intermediate container (see 5.1.1.2).
- (l) Special marking, if required (see 5.3).

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n) (2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph no.	Data requirement title	Applicable DID no.	Option
4.3.1	First article inspection report	UDI-T-23790	----

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(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L., Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in section 3, 4, or 5 of the specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each acquisition regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 First article inspection. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection as to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Re-wettable treated fabrics are not washable until painted and adhesive will not be permanent until painted.

6.5 Resin treatments that have been found satisfactory are polyvinyl acetate and modified nylon resins.

6.6 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.7 Changes from previous issue. The margins of this specification are marked with an asterisk (\*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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