

INCH-POUND

MIL-DTL-1688G
23 September 2008
 SUPERSEDING
 MIL-R-1688F
 26 April 1990

DETAIL SPECIFICATION

ROPE, FIBROUS, CLIMBING TYPE, NYLON

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers nylon rope used for mountaineering operations.

1.2 Classification. The rope will be furnished in the following sizes as specified (see 6.2):

Sizes (Circumference)

3/4 inch
 1-1/8 inches
 1-1/4 inches
 1-1/2 inches

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in section 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this standard, whether or not they are listed.

2.2 Government documents.

FEDERAL STANDARDS

FED-STD-191	- Textile Test Methods
FED-STD-595/34094	- Green, Flat or Lusterless

COMMERCIAL ITEM DESCRIPTION

A-A-59622	- Tags, Shipping and Stock
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(Copies of these documents are available online at <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Philadelphia, ATTN: DSCP-NASA, 700 Robbins Avenue, Philadelphia, PA 19111-5096 or email to dscpg&inspeccomments@dlamail . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil .

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

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQ Z1.4 - Sampling Procedures and Tables for Inspection by Attributes

(Copies of this document are available from www.asq.org or the American Society for Quality, 611 East Wisconsin Avenue, Milwaukee, WI 53202.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.3.

3.2 Government and contractor purchase. The requirements specified in 3.9 and 3.10 apply only to rope purchased directly by the Government. All other requirements apply both to rope purchased by a contractor as a component for an end item and to rope purchased directly by the Government.

3.3 Materials. The rope shall be fabricated from a minimum of 6 denier per filament, bright, virgin, continuous filament, light and heat-resistant polyamide (nylon) having a minimum 6.5 grams per denier strength. The nylon shall be a long chain polymer made of hexamethylene diamine and adipic acid or its derivatives, or a long chain polymer of epsilon amino caprioic acid. Mixtures of nylon fiber types (6 or 66) in any one rope shall be prohibited. It is encouraged that recycled material be used when practical as long as it meets the requirements of this specification.

3.4 Construction and physical requirements. The rope shall be of three strand construction and conform to the requirements specified herein and in table I. each strand shall be made of the same size of three ply yarns. All strands shall have an equal numbers of yarns. The singles yarn shall be between 2500 and 8000 denier. The single yarn, when measured in the three ply, shall be left-hand or "S" lay and shall have a minimum of 22 turns per foot. The lay of the rope shall be right-hand or "Z" lay. The rope shall be heat set and shall not show more than a 5 percent residual shrinkage when tested as specified in 4.4.4. The rope shall be fabricated without knots or splices in the singles yarns, ply yarns, strands, or rope.

TABLE I. Physical requirements

Sizes (circumference) (inches) +1/8 , -1/16	Diameter approximate (inches) <u>1/</u>	Length feet per lb minimum <u>2/</u>	Breaking strength minimum minimum (pound)	Elongation minimum (percent)	Length per 10 turns	
					maximum (inches)	Minimum (inches)
³ / ₄	¹ / ₄	47.0	1300	35.0	7.8	7.0
1-1/8	3/8	23.0	3150	35.0	12.4	11.1
1-1/4	7/16	17.0	4500	35.0	14.3	12.9
1-1/2	¹ / ₂	8.5	6500	35.0	17.2	15.1

1/ Not a specification requirement, included for information only.

2/ A minus tolerance of 10 percent is allowed for dyed rope.

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3.4.1 Breaking strength after heat aging. The loss in breaking strength after heat aging of the rope shall not exceed 10.0 percent of the initial breaking strength when tested as specified in 4.4.4.

3.4.2 Hardness. The finished rope shall have a hardness of 20 ± 5 pounds when tested as specified in 4.4.4.

3.5 Extraneous material. No extraneous material shall be added for the purpose of weighting the rope. The extractable matter of the finished rope shall not exceed 4.0 percent when tested as specified in 4.4.4.

3.6 Color. Unless otherwise specified (see 6.2), the rope shall be dyed with color chip number 34094 per FED-STD-595.

3.6.1 Colorfastness. The dyed and finished rope shall show fastness to weathering equal to or better than a rating of "fair" when tested as specified in 4.4.4.

3.7 pH. The pH value of the rope shall be within the range of 5.0 to 9.0 when tested as specified in 4.4.4.

3.8 Identification. Each coil of rope shall have a ticket (identification tag) attached for identification purposes. The ticket shall conform to the requirements of A-A-59622 and shall contain the following information:

National stock number
Nomenclature
Specification number
Length
Size (circumference)
Contract number and date
Contractor's name
Date of manufacture (month and year)

3.9 Put-up. Unless otherwise specified (see 6.2), the rope shall be put-up in coils in lengths specified in table II for the respective sizes (circumference). The rope, when put-up in coils as specified in table II, shall be in one continuous piece and so wound that each turn and layer is free from entanglement. The ends of all rope shall be cut off squarely and securely whipped or heat sealed to prevent fraying or untwisting.

TABLE II. Put-up coil length.

Rope size (circumference in inches)	Coil length (feet)	
	minimum	maximum
$\frac{3}{4}$	196	204
1-1/8	196	204
1-1/4	117	123
1-1/2	117	123

3.10 Workmanship. The material shall be manufactured and processed in a manner that will insure its meeting all the requirements of this specification..

4. VERIFICATION

4.1 Certificates of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

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

- First article inspection (see 4.3).
- Conformance inspection (see 4.4).

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4.3 First article inspection. when a first article is required (see 3.1 and 6.2), it shall be examined for the defects specified in 4.4.2 and 4.4.3 and tested for the characteristics specified in 4.4.4.

4.4 Conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with ASQ Z1.4. Unless otherwise specified, the Acceptable Quality Limits (AQLs) listed in this section shall be used to establish the sample sizes, however, the acceptance number shall be zero.

4.4.1 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this specification or applicable purchase document.

4.4.1.1 Component and material certification. A certificate of compliance may be acceptable as evidence that the characteristics listed in table III conform to the specified requirements.

TABLE III. Component tests.

Characteristic	Requirement paragraph
Material	3.4
Denier per filament	3.4
Grams per denier strength	3.4
Light and heat resistant yarn	3.4
Fiber types mixtures	3.4
Strand construction	3.5
Denier of singles	3.5
Lay of singles	3.5
Turns per foot (singles)	3.5

4.4.2 End item visual examination. The rope shall be examined for the defects listed in table IV. All defects shall be counted regardless of their proximity to each other. The lot size shall be expressed in units of coils of rope. The sample unit shall be one coil of rope. One hundred feet shall be examined on each coil of rope. The inspection level shall be II (see 6.5), and the acceptable quality limits (AQLs), expressed in terms of defects per hundred units, shall be 1.5 for major defects and 4.0 for total (major and minor combined) defects. Any critical defect found during sampling shall be cause for rejection of the lot represented by the sample.

TABLE IV. End item visual defects.

Examine	Defect	Classification		
		Critical	Major	Minor
Appearance and workmanship	Any cut	1		
	Chafed or damaged	2		
	Kink	3		
	Knot (singles, ply, strand, or rope)	5		
	Broken or loose end (singles, ply, strand, or rope)	6		
	Bulged strand	7		
	Spliced or otherwise secured to make a continuous length	8		
Color	Other than specified		101	
	Resists and/or spotty dyeing			201
	Specific shade not within established tolerances			202
	Uneven			203
Cleanness	Spot or stain, clearly visible ^{1/}			204
Identification	Omitted, incorrect, illegible, or not as			205

^{1/} At normal inspection distance (approximately 3 feet).

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4.4.3 End item length and winding examination. The rope shall be examined for the defects listed below. The lot size shall be expressed in units of coils of rope. The sample unit shall be one coil of rope. Defects shall be as listed below. The inspection level shall be S-3, and the AQL, expressed in terms of defects per hundred units, shall be 4.0. the required length of the coil (see table II) shall be determined using the following formula:

$W \times L = \text{Length per coil in feet.}$

When W = the net weight of the coil in 0.1 pound.

L = the lot average of the weight-length relationship (length/pound) as specified in table I.

Defects

Length of rope is less than specified or more than length specified (see table II).

Length of rope on coil is more than 6 feet less than the length indicated on the ticket.

Improperly or not firmly wound resulting in kinking, knotting, entangling, or slippage during unwinding, or otherwise affecting free unhampered unwinding of rope.

Any end frayed or not cut off squarely or neatly.

Any end not securely whipped or heat sealed.

4.4.4 End item testing. The end items shall be tested for the characteristics listed in table V. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in table V shall be followed. When the data in the "Number of determinations" and "Results reported as" columns are not specified in table V, they shall be as required by the referenced test method. The physical and chemical values specified in section 3 apply to the average of the determinations made on a sample unit for test purposes as specified in the applicable test methods. The lot size shall be expressed in units of coils of rope. The sample unit shall be one coil of rope. The sample size shall be in accordance with table VI. The lot shall be unacceptable if one or more sample units fail to meet any requirement. All test reports shall contain the individual values utilized in expressing the final results. Tests to determine compliance with document requirements may be made under prevailing atmospheric conditions. In case of dispute, tests shall be made upon material that has reached equilibrium under standard conditions as defined in FED-STD-191.

TABLE V. End item tests

Characteristic	Requirement reference	Test method	Number of determinations per sample unit	Results reported as
Number of strands	3.5	Visual	1	Pass or fail
Lay of rope	3.5	Visual	1	Pass or fail
Shrinkage	3.5	6010	-	-
Circumference	Table I	6003	-	-
Length per pound	Table I	6004	-	-
Breaking strength:				
Initial	Table I	6015 <u>1/</u>	-	-
After heat aging (percent strength)	3.5.1	6015 and 4.5.1	2	Average of 2 determinations to nearest 10 lb. calculated to nearest 0.1 percent
Elongation	Table I	6015	-	-
Length per 10 turns	Table I	6000	-	-
Hardness	3.5.2	6020	-	-
Extractable matter	2.6	2611 <u>2/</u>	2	Average of 2 determinations to nearest 0.1 percent
Colorfastness to weathering	3.7.1	5671 <u>3/</u>	1	Pass or fail
pH	3.8	2811	-	-

1/ Failures in tests tend to occur at or near the end of the free length, but may occur in the mid-span between the splices. Failures occurring within the eye splice shall be disregarded and another specimen shall be tested from the same sample unit (see figure 1).

2/ Except that a 5-gram specimen shall be used and the extract solvent shall be petroleum ether.

3/ The specimens shall be exposed for 40 standard fading hours.

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TABLE VI. Sample size.

Lot size (coil of rope)	Sample size (sample units)
15 and under	2
16 up to and including 40	3
41 up to and including 110	5
111 up to and including 300	7
301 up to and including 500	10
501 and over	15

4.5 Methods of inspection.

4.5.1 Breaking strength after heat aging. Two breaking strength specimens, prepared as specified in method 6015 of FED-STD-191, shall be heated for 5 days in a convection air oven at $175^{\circ} \pm 2^{\circ}$ F. After aging, the specimens shall be allowed to reach equilibrium under standard conditions before being tested for strength. Breaking strength shall be determined in accordance with Method 6015 of FED-STD-191. The percent change in strength shall be calculated based on the average strengths initially and after heat aging.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from then managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contracting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The rope is intended to be used for mountaineering operations.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Size (circumference) required (see 1.2).
- c. When a first article is required (see 3.1, 4.3, and 6.3).
- d. Color, if other than specified (see 3.6).
- e. Put-up, if other than specified (see 3.9).
- f. Packaging requirements (see 5.1).

6.3 First article. When a first article is required, it must be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for selection, inspection, and approval of the first article.

6.4 Subject term (key word) listing.

Coils
Cordage
Equipment, mountaineering

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6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Army – GL

Navy – MC

Preparing activity:

DLA – IS

(Project 4020-2008-001)

Review activities:

Army – AR, MD

Navy – AS

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST online database at <http://assist.daps.dla.mil> .