

INCH-POUND

T-C-2754

February 5, 1990

FEDERAL SPECIFICATION

CORD, POLYESTER, CORELESS

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE

1.1 Scope. This specification covers braided polyester coreless Parachute Cord.

1.2 Classification. The cord shall be of the following types as specified (see 6.2).

Type I - 180 feet per pound

Type II - 120 feet per pound

2. APPLICABLE DOCUMENTS

2.1 Government documents. Unless otherwise specified, the following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

Federal Specifications:

UU-T-81 - Tags, Shipping and Stock  
PPP-B-601 - Boxes, Wood, Cleated-Plywood  
PPP-B-636 - Boxes, Shipping, Fiberboard

Federal Standard:

FED-STD-191 - Textile Test Methods

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4020

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(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402).

(Single copies of this specification, and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.)

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards and Commercial Item Descriptions from established distribution points in their agencies.)

Military Specification:

- MIL-C-3131 - Cordage; Packaging Of
- MIL-L-35078 - Loads, Unit: Preparation of Semiperishable Subsistence Items; Clothing, Personal Equipment and Equipage; General Specification For

Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
- MIL-STD-129 - Marking for Shipment and Storage
- MIL-STD-147 - Palletized Unit Loads
- MIL-STD-731 - Quality of Wood Members for Containers and Pallets

(Copies of Military specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified the issue in effect on date of invitation for bid or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 3951 - Standard Practice for Commercial Packaging

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Technical society and technical association documents are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document shall take precedence. Nothing in this document, however, shall supersede 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 purchases. The requirements specified in 3.11 and 3.12 apply only to cord purchased directly by the Government. All other requirements apply to cord purchased by a contractor as a component for an end item and to cord purchased directly by the Government.

3.3 Standard sample. The cord shall match the standard sample for shade and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.4).

3.4 Material. The yarn used in the fabrication of the cord shall be bright, high tenacity multifilament polyester yarn. The yarn denier shall be as specified in table I.

3.5 Construction and physical requirements. The cord shall be braided without a core and conform to the requirements specified herein and in table I when tested as specified in 4.4.5. The cord shall be braided on braiding machines having the number of carriers specified in table I for the applicable type, and the machines shall be regulated to give a two over and two under conventional braid. The cord after braiding shall be heat set in continuous lengths and shall not show more than a 3 percent residual shrinkage when tested as specified in 4.4.5.

TABLE I. Physical requirement.

	Type I	Type II
Number of carriers	24	24
Ends per carrier	2	3
Total ends	48	72
Basic yarn denier	1100	1100
Yarn ply	single	single
Picks per inch	15-16	10-12
Length per pound, feet (minimum)	180	120
Breaking strength, pounds (minimum)	600	1000
Elongation percent (at 75% of the specified breaking strength)		
minimum	7	7
maximum	11	11

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3.6 Color. Unless otherwise specified (see 6.2), the color of the cord shall be natural. When Camouflage Green 483 is specified, the color shall be obtained by yarn dyeing and the cord shall match an approved standard shade of Camouflage Green 483 (see 6.4).

3.6.1 Shade matching. The dyed cord shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and have a correlated color temperature of  $7500 \pm 200K$ , with illumination of  $100 \pm 20$  foot candles, and shall be a good match to the standard sample under incandescent lamplight at  $2300 \pm 200K$ .

3.6.2 Colorfastness. The dyed cord shall show fastness to light and laundering equal to or better than the standard sample or shall show good fastness to light and laundering when tested as specified in 4.4.5.

3.7 Finish. The cord shall be finished with an acrylic resin such as to result in an additional weight not to exceed 2 percent.

3.7.1 Tackiness. The cord shall not be excessively tacky. The force required to separate the lines shall be not greater than 23 pounds when tested as specified in 4.4.5.

3.8 Age. The yarn used to fabricate the cord shall be no more than two years old on date of delivery to the first receiving point. The cord shall be no more than one year of age from the date of manufacture to the date of delivery to the first receiving point.

3.9 Resistance to heat and light. The polyester cord shall lose no more than 25 percent of its original breaking strength after exposure to heat and light when tested as specified in 4.4.5.

3.10 Extractable matter (chloroform-soluble material). No material shall be added for the purpose of weighing the cord. The chloroform-soluble material of the cord shall not exceed 4.0 percent when tested as specified in 4.4.5.

3.11 Put-up and length. Unless otherwise specified (see 6.2), the cord shall be put on nonreturnable reels/spools in lengths specified in table II. The use of plastic spools is prohibited. Each reel/spool shall not contain any knots or splices and shall be so wound that each turn and layer is free from entanglement. A plus tolerance of 10 percent shall be allowed on the total length of any reel/spool. The ends of the cord shall be heat sealed to prevent fraying. When cord is put up in 1200 or 1500 foot lengths, 80 percent of the total number of reels/spools in the lot shall be in one continuous length. The remaining 20 percent in the lot may contain pieced lengths (lapped on ends). These reels/spools shall contain no more than two pieces, with no piece less than 100 feet in length. When cord is put up on 2100 foot reels/spools, 80 percent of these reels/spools shall contain no more than two pieces, with no piece less than 100 feet in length. The remaining 20 percent in the lot shall contain no more than three pieces less than 100 feet. When pieced lengths are contained on a reel/spool, the number and lengths of the pieces shall be marked on the identification ticket or label as specified in 3.12.

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TABLE II. Length

Type	Length on reel/spool (feet), minimum
I	2100 or 1200
II	1500

3.12 Identification. Each spool (reel) of cord shall have a ticket (identification tag) or label attached to it for identification purposes. The ticket shall conform to the requirements for type B, size 4 or 5 of UU-T-81. The ticket shall be made of not less than 15-point paper stock and shall have a minimum tearing resistance of both directions (total) of 850 grams when tested as specified in UU-T-81. When labels are used, the label shall be attached in such a manner as to remain in place and be legible until all cord has been removed. The ticket or label shall be legibly printed, stamped, or typed with water insoluble ink. The ticket or label shall contain the following:

- Stock number
- Item description including type (I or II)
- Specification number
- Length
- Number and length of pieces (when applicable)
- Color
- Contract number and date
- Date of manufacture (month and year)
- Length of pieces of cord per spool (when applicable)
- Contractor's name
- Bar code

3.13 Workmanship. The fabricated cord shall conform to the quality and grade of product established by this specification.

#### 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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor

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of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 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:

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

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 through 4.4.4.2 and shall be tested as specified in 4.4.5.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.4.1 Component and material inspection. In accordance with 4.1, 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 and material certification

<u>Characteristic</u>	<u>Requirement paragraph</u>
Material	3.4
Denier	3.4
Tenacity	3.4
Age of yarn and cord	3.8

4.4.2 End item critical defect examination. Every end item, prior to the visual examination in 4.4.3, shall be examined for the critical defects listed in table IV. Any end item found to contain one or more critical defects shall be rejected.

4.4.3 End item visual examination. The cord 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 spools or reels. The

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sample unit shall be one spool or reel. Ten percent of the total footage, but not less than 100 feet, shall be examined on each spool or reel in the sample. The inspection level shall be II and the acceptable quality level (AQL), 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 inspection 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 or hole	X		
	Abrasion, chafed area, or distortion in the orientation of yarn	X		
	Kink or unevenly braided, resulting open place, break in continuity of braid, or soft spot	X		
	Float, broken or missing end, or pick	X		
Knots in yarn	Any knot	X		
Type	Other than specified	X		
	Manufacturer's identification missing		X	
Color	Other than specified		X	
	Not within established tolerances			X
Put-up	Other than specified		X	
	Plastic spool used		X	
Cleanness	Spot or stain clearly visible <u>1/</u>		X	
	Objectionable odor			X
Identification	Omitted		X	
	Information incorrect, illegible			X
	Ticket or label not as specified			X
	Handwritten entries			X
Coarse or heavy end (per 20 linear yards)	Over one end, 2 yards or more in length		X	
	Over two ends		X	
	Two ends, over 1 yard long		X	
	One end, up to 2 yards long			X
	Two ends, up to 1 yard long			X
Tight ends (per 10 linear yards)	Over one end, 2 yards or more in length		X	
	Two or more ends, less than 2 yards long			X

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



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4.4.4 Length and winding examination. The cord shall be examined for the defects listed in 4.4.4.1 and 4.4.4.2. The lot size shall be expressed in units of spools or reels. The sample unit shall be one spool or reel. The inspection level shall be S-3 and the AQL, expressed in terms of defects per hundred units, shall be 4.0. For lots consisting of 500 or fewer units, the sample size shall be 10 and the acceptance number shall be 1.

4.4.4.1 Defects with regard to length. Defects shall be considered to exist if any of the following are determined during inspection:

- a. The length of cord on spool (reel) is less than specified or more than 10 percent in excess of the length specified.
- b. Length of cord on spool (reel) is more than 6 feet less than length marked on ticket or label.

4.4.4.2 Defects with regard to winding. Defects shall be considered to exist if any of the following conditions are determined during inspection:

- a. Improperly or not firmly wound, resulting in kinking, knotting, entangling, or slippage during unwinding or otherwise affecting free unhampered unwinding of cord.
- b. Put-up not as specified.
- c. Any end not heat sealed.
- d. Knot or otherwise joining of ends to make a continuous length.
- e. Any spool (reel) of cord found to contain more pieced lengths than specified.
- f. Any piece of cord less than 100 feet in length.
- g. The lengths of the pieces not marked on the identification ticket or label.

4.4.5 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 the table, 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 spools or reels. The sample unit shall be one spool or reel. The inspection level shall be S-3 and AQL, expressed in terms of defects per hundred units, shall be 1.0. Tests to determine compliance with specification requirements, may be made under prevailing atmospheric conditions. In cases of dispute, tests shall be made upon material that has reached equilibrium under standard conditions as defined in FED-STD-191.



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TABLE V. End item tests

Characteristics	Requirement reference	Test method	No. of determinations per individual sample unit	Results reported as
<u>Construction:</u>				
Picks per inch	Table I	6001 <u>1/</u>	1	To nearest whole No.
Number of carriers	Table I	Visual	3	Avg. of 3 determinations to nearest whole no.
Number of ends per carrier	Table I	Visual	3	Avg. of 3 determinations to nearest whole no.
Length per pound	Table I	6004 <u>1/</u>	-	-
Breaking strength	Table I	6016	-	-
Elongation	Table I	6016 <u>2/</u>	-	-
Shrinkage	3.5	6010	-	-
<u>Colorfastness:</u>				
To light	3.6.2	5660 <u>3/</u>	1	Pass or fail
To laundering	3.6.2	5614 <u>4/</u>	1	Pass or fail
Tackiness	3.7.1	4.5.3	8	Avg. of 8 determinations to the nearest 1 pound.
Resistance to light	3.9	4.5.1	-	-
Resistance to heat	3.9	4.5.2	-	-
Extractable matter (chloroform-soluble material)	3.10	2611	-	-

1/ This test shall be performed while the cord is under a static load of 5 pounds.

2/ Except that elongation shall be determined at 75 percent of the breaking strength specified in table I.

3/ The exposure shall be 20 standard fading hours.

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4/ Test on dyed cord: The test specimen shall be 4 to 5 grams of cord.

4.4.6 Packaging inspection. Inspection shall be made in accordance with the quality assurance provisions of MIL-C-3131 except that the inspection level shall be S-2 and the AQL, expressed in terms of defects per hundred units, shall be 2.5.

4.4.7 Palletization examination. The fully packaged and palletized end items shall be examined for the defects listed below. The lot size shall be expressed in units of palletized unit loads. The sample unit shall be one palletized unit load, fully packaged. The inspection level shall be S-1 and the AQL, expressed in terms of defects per hundred units, shall be 6.5.

<u>Examine</u>	<u>Defect</u>
Finished dimensions	Length, width, or height exceeds specified maximum requirement
Palletization	Pallet pattern not as specified Interlocking of loads not as specified Load not bonded with required straps as specified
Weight	Exceeds maximum load limits
Marking	Omitted; incorrect; illegible; of improper size, location, sequence, or method of application

#### 4.5 Methods of inspection.

4.5.1 Determination of resistance to light. Five test specimens shall be taken from each sample unit. The test specimens shall be exposed in the accelerated weathering unit as specified in Method 5804 of FED-STD-191. The specimens shall be placed side by side on the rack in such a manner that only the center 10 inches to 18 inches of each specimen is exposed without being shielded by the rack. Unbacked specimens shall be exposed either mounted in stainless steel frames or as a large piece suspended from the outside rim of the exposure rack. Corex D filters and sunshine carbons shall be used. The exposure time shall be 50 hours. The spray heads shall be shut off during the entire exposure period and the relative humidity in the test chamber during the exposure shall be  $55 \pm 5$  percent. The drain pan shall contain from 1/2 to 1 inch of water during the exposure process. At the end of the exposure period, the specimens shall be conditioned at  $70 \pm 2$  degrees F and  $65 \pm 2$  percent relative humidity for 24 hours. The specimens shall then be tested for breaking strength (B.S.) in accordance with Method 6016 of FED-STD-191, and the percent of breaking strength lost shall be calculated as follows:

$$\text{Percent of B.S. lost} = \frac{\text{Original B.S.} - \text{B.S. after exposure}}{\text{Original B.S.}} \times 100$$

4.5.2 Determination of resistance to heat. Five test specimens shall be taken from each sample unit. The test specimens shall be suspended in a circulating air oven at a temperature of  $356 \pm 5$  degrees F for 1 hour. After removal from the oven,

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the specimens shall be conditioned at  $70 \pm 2$  degrees F and  $65 \pm 2$  percent relative humidity for 24 hours. The specimens shall then be tested for breaking strength in accordance with Method 6016 of FED-STD-191, and the percent breaking strength lost shall be calculated as specified in 4.5.1.

4.5.3 Determination of tackiness (adhesion). Eight specimens of 40-inch length shall be taken from each sample unit. The test specimens shall be laid together and folded around a 2 1/4 inches O.D. (outside diameter) by 1/4 inch metal ring, at the line bundle mid-point (see figure 1). Tightly secure the line bundle together at the ring with multiple turns of a rubber band. Individual lines should be tensioned equally around the ring. The double line bundle shall be wrapped around a second metal ring such that there is an 8-inch overlap. Lines shall be straight and the ends even. Secure the doubled line bundle with multiple turns of rubber bands tightly at three locations (see figure 1). Wrap the bundled lines in cloth and place in an oven at 180 degrees F for 6 hours and allow to cool. Remove the cloth and, without disturbing the line bundle, slice and remove all of the rubber bands around the bundle. Afix one ring to a stationary object and attach a spring scale or other strength recording equipment to the other ring. Pull the rings apart until the lines separate, recording the amount of resistance (in pounds) to separate the lines.

## 5. PACKAGING

5.1 Preservation. Preservation shall be level A or Commercial, as specified (see 6.2).

5.1.1 Level A. Spools (reels) of cord, put-up as specified, shall be preserved in accordance with the applicable requirements of MIL-C-3131.

5.1.2 Commercial. Spools (reels) of cord shall be preserved in accordance with ASTM D 3951.

5.2 Packing. Packing shall be level A, B, or Commercial, as specified (see 6.2).

5.2.1 Levels A and B Packing. Spools (reels) of cord shall be packed in accordance with the applicable requirements of MIL-C-3131 except that for level A the shipping container shall conform to style RSC, grade V2s of PPP-B-636 or to overseas type, style A or I, grade A or B type 2 load of PPP-B-601, as specified (see 6.2). For level A packing, fiberboard shipping containers shall be arranged in unit loads in accordance with MIL-L-35078 for the type and class of load specified (see 6.2). Strapping shall be limited to nonmetallic strapping, except for type II, class F loads.

5.2.2 Commercial packing. Spools (reels) of cord, preserved as specified in 5.1, shall be packed in accordance with ASTM D 3951.

5.3 Palletization. When specified (see 6.2), cord, packed in fiberboard shipping containers as specified in 5.2.1 or 5.2.2, shall be palletized on a 4-way entry pallet in accordance with load type Ia of MIL-STD-147. Pallet type shall be type I (4-way entry), type IV, or type V in accordance with MIL-STD-147. Pallets shall be fabricated from wood groups I, II, III, or IV of MIL-STD-731. Each prepared load

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shall be bonded with primary and secondary straps in accordance with bonding means C and D or film bonding means F or G. Pallet pattern shall be in accordance with the appendix of MIL-STD-147. Interlocking of loads shall be effected by reversing the pattern of each course.

5.4 Marking. In addition to any special marking required by the contract or purchase order, interior unit packs, exterior shipping containers, spools (reels), and palletized unit loads shall be marked in accordance with MIL-STD-129 or ASTM D 3951, as applicable.

## 6. Notes

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

6.1 Intended use. The cord is intended for use in the MC-4 Ram Air Parachute System.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification.
- b. Type (see 1.2).
- c. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
- d. When first article is required (see 3.1, 4.3, and 6.3).
- e. When shade Camouflage Green 483 is required (see 3.6).
- f. Put-up if other than specified (see 3.11).
- g. Levels of preservation and packing (see 5.1 and 5.2).
- h. Type of shipping container desired for level A packing (see 5.2.1).
- i. Type and class of unit load required for level A packing (see 5.2.1).
- j. When palletization is required (see 5.3).

6.3 First article. When a first article is required, it shall 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 Standard sample. For access to samples, address the contracting activity assign the invitation for bids.

6.5 Subject term (key word) listing.

MC-4  
Parachute Cord  
Ram Air

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Custodians:

Army - GL  
Navy - AS  
Air Force - 99

Preparing Activity:

Army - GL  
(Project 4020-0311)

Review Activities:

Army - ME, TS  
Navy - SH  
Air Force - 82  
DLA - IS

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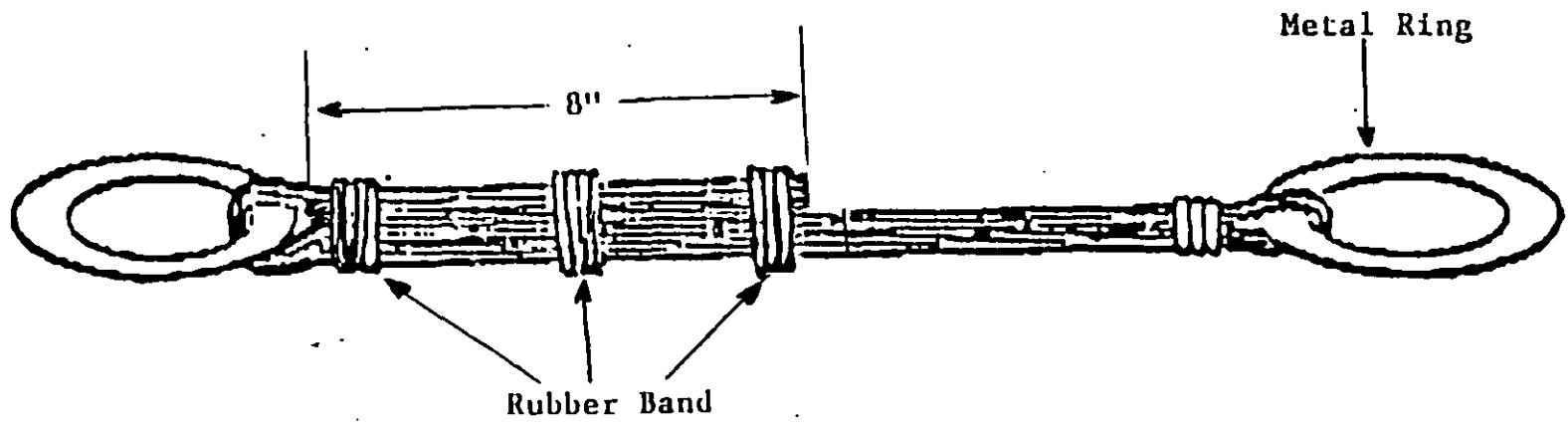


Figure 1

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**NOTE:** This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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