

MIL-W-83140
11 April 1969

MILITARY SPECIFICATION

WIRE ROPE: STEEL, (STAINLESS STEEL) PREFORMED, NONROTATING, FOR AIRCRAFT RESCUE HOIST AND CARGO HANDLING (WINCHING)

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

1. SCOPE

1.1 This specification covers the requirements for nonrotating, preformed stainless steel wire rope for aircraft rescue hoist and cargo handling winching applications. The word "cable" is used interchangeably with "wire rope" throughout this specification.

1.2 Classification. The wire rope shall be furnished in the following types, as specified (see 6.2):

Type I	19 by 7	Nonrotating for aircraft rescue hoist
Type II	10 by 7 (7 by 19 IWRC)	Nonrotating for cargo handling (winching)

2. APPLICABLE DOCUMENTS

2.1 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.

SPECIFICATIONS

Federal

QQ-S-781	Steel Strapping, Flat
QQ-S-790	Steel Strapping, Round (Bare and Zinc-Coated)
PPP-B-1055	Barrier Material, Waterproofed, Flexible

Military

MIL-B-121	Barrier Material, Grease Proofed, Waterproofed, Flexible
MIL-T-781	Terminal; Wire Rope Swaging

STANDARDS

Military

MIL-STD-129	Marking for Shipment and Storage
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FSC 4010

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

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM)

ASTM-E-8 Methods of Tension Testing of Metallic Materials

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

3. REQUIREMENTS

3.1 Materials. The wire used in the fabrication of the wire rope shall be manufactured of electric-arc furnace steel. The check analysis shall conform to the chemical composition limits specified in table I.

TABLE I. Chemical Composition

ELEMENT	PERCENT
Carbon	0.15 max
Manganese	2.00 max
Silicon	1.00 max
Phosphorous	0.045 max
Sulfur	0.030 max
Chromium	17.0-20.0
Nickel	8.0-12.0

3.1.1 Wire properties. The wire used shall be suitable for manufacture into aircraft high speed rescue winch wire rope which will meet the performance requirements of this specification. Tensile strength and wire sizes shall be determined by the cable manufacturer.

3.1.2 Preforming of wire and strands. The individual wires and strands composing the cable shall be preformed into the exact helical position they will have in the

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finished cable so that if the cable is cut or severed, there will be no tendency for the normal diameter of the cable at the unseized ends to increase by more than the amount specified in table II.

3.2 Joining. Splices in individual wires shall be brazed or welded. No wire splices in any size wire shall be made by twisting. Splices in individual wires in any layer of a strand shall be not closer than 20 feet. Any brazed or welded wire that protrudes in excess of 1 percent times the normal cable diameter shall be cause for rejection.

3.2.1 Broken wires. Broken wires or protruding wires shall be considered defects and shall be cause for rejection of any lengths of cable in which they appear.

3.3 Construction, dimensions, and physical properties. The types of construction for the respective diameter, the dimensional tolerances, and the physical properties shall be as specified in table II.

3.4 Types of construction. The cable covered by this specification shall be of 19 by 7 and 10 by 7 (7 by 19 IWRC) construction according to the diameter of the cable as specified in table II.

3.4.1 Type I (19 by 7 construction). Cable of this construction shall consist of one core of 7 strands of 7 wires each for a total of 49 wires and an outer layer of 12 strands of 7 wires each for a total of 84 wires. The inner core shall be lang lay, left lay. The outer layer shall be regular lay, right lay. The total number of wires in the cable shall be 133.

3.4.1.1 Length of lay. The length of lay of the inner core shall be not less than five times nor more than six times the diameter of the inner core. The length of lay of the outer layer shall be not less than six times nor more than seven times the diameter of the finished cable.

3.4.2 Type II (10 by 7 (7 by 19 IWRC)) construction. Cable of this construction shall consist of:

(a) Core: 7 by 19 cable consisting of 7 strands of 19 wires each for a total of 133 wires laid right lay, regular lay.

(b) Outer lay: 10 by 7 construction consisting of 10 strands of 7 wires each for a total of 70 wires laid around the core left lay, regular lay.

3.4.2.1 Length of lay. The length of lay of the 7 by 19 core shall be not less than six times nor more than eight times the diameter of the core. The length of lay of the 10 by 7 outer layer shall be not less than six times nor more than eight times the diameter of the finished cable.

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TABLE II. Construction and Physical Properties

Nominal Diameter of Cable	Construction	Tolerance on Diameter (Plus Only)	Allowable Increase in Diameter at Unseized End (Max)	Breaking Strength of Cable (Min)	Weight Per 100 Ft (Approx)
5/32	19 by 7	.008	.017	2,160	4.50
3/16	19 by 7	.009	.019	3,330	6.50
7/32	19 by 7	.010	.020	4,500	8.60
1/4	19 by 7	.012	.021	5,760	11.00
5/16	19 by 7	.016	.024	8,100	17.30
3/8	19 by 7	.020	.027	10,800	24.30
1/2	19 by 7	.025	.034	20,520	45.80
5/8	19 by 7	.030	.040	31,500	71.50
7/32	10 by 7 (7 by 19 IWRC)	.010	.020	4,500	8.60

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3.5 Lubrication. Unless otherwise specified, the wires of the inner and outer strands shall be thoroughly and uniformly coated with a suitable friction preventive compound.

3.6 Wire rope length. The wire rope shall be furnished in the length specified in the contract or purchase order (see 6.2).

3.7 Temperature conditions. The cable shall perform satisfactorily and meet all requirements of this specification throughout a temperature range of -65° to $+160^{\circ}$ F.

3.8 Proof load. Cables shall withstand the proof-load testing specified in 4.4.2.1 without failure of any wire.

3.9 Endurance. Endurance tests shall be performed on all sizes of cables listed in table III. The cables shall withstand the loads and reversals specified in table III without failure.

3.9.1 Breaking strength after endurance test. The breaking strength of the cable after the endurance test shall be not less than the minimum values specified in table III.

3.10 Identification of product. Each cable regardless of size, construction, or length shall be identified by the manufacturer's name or trademark. The marking shall consist of a color code or any other permanent method.

3.11 Workmanship. All details of workmanship shall be in accordance with the best practice for quality aircraft cable consistent with the requirements of this specification. The cable shall be securely laid and free from kinks, loose wires, loose strands, or other defects. The cable must resist kinking, snarling, and corrosion.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test reports. The manufacturer shall maintain a record showing quantitative results for all tests required by this specification. This record shall be available to the purchaser and shall be signed by an authorized representative of the manufacturer or the testing laboratory as applicable.

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TABLE III. Breaking Strength after Endurance Test

Nominal Diameter (Inches)	Tension (Pounds) $\frac{1}{2}$	Pulley Diameter (Inches)	Number of Reversals	Breaking Strength (Pounds)
5/32 19 by 7	30	1.484	150,000	1,300
3/16 19 by 7	45	1.781	150,000	2,000
7/32 19 by 7	60	2.078	150,000	2,700
1/4 19 by 7	70	2.375	150,000	3,450
7/32 10 by 7 (7 by 19 IWRC)	60	2.493	150,000	2,700

$\frac{1}{2}$ Tension is equal to half of weight (w) which includes idler sheave and hanger as shown on figure 1.

4.2 Classification of tests. All the tests required herein for the testing of cables are classified as quality conformance tests and shall be conducted in accordance with the sampling techniques and methods of testing specified.

4.3 Sampling instructions. When conducting the tests specified herein, with the exception of examination of product, one sample not less than 40 feet in length for the sizes listed in table II shall be taken after any discard has been removed from the head or starting end of the first manufacturing reel for each lot of cable. In addition to this sample, one sample shall be taken from each shipping reel of 10,000 feet or less, except that for shipping reels of 5,000 feet or less, one sample shall be taken from each 5,000 feet of cable from each lot.

4.3.1 Lot. A lot shall consist of cable of the same diameter and construction produced continuously by one machine or one series of progressive processing machines.

4.3.1.1 Identification of reels. Each manufacturing reel shall be identified by the manufacturer. When the manufacturing reel is cut into specified lengths for shipping reels, each shipping reel shall be marked with the identifying number of the manufacturing reel starting from the head end and numbering each shipping reel consecutively.

4.3.2 Rejection and retest. The failure of any specimen shall be cause for rejection of the lot represented by the sample. The manufacturer may sample each length of cable comprising the rejected lot and subject specimens from these samples to retest. Lengths of the cable shown to conform to all of the requirements of this specification on retest may be submitted for acceptance upon presentation of test data.

4.3.3 Certified test report. Upon request, the manufacturer shall furnish a certified test report showing that the manufacturer's product satisfactorily conforms to this specification. The test report shall include, as a minimum, actual results of the tests specified herein.

4.4 Tests. The cable manufacturer shall be responsible for accomplishing the quality conformance tests specified herein.

4.4.1 Examination of product. All cable shall be examined for workmanship and finish. For this purpose the cable shall travel no faster than 100 feet per minute and shall be stopped for more critical inspection when necessary. This inspection shall be performed when the cable is wound on shipping reels. Any discard from the head end of the manufacturing reel shall be removed prior to winding on the shipping reels or prior to making assemblies.

4.4.2 Breaking strength. Two specimens shall be prepared from each sample of cable selected. When necessary, terminals conforming to MIL-T-781 shall be swaged to the ends of the specimens. The length of the cable test section between terminals shall be approximately 2 feet. The terminals shall be clamped in the jaws of the

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testing machine or suspended between fixtures attached to the heads. The breaking strength shall be determined by the use of a tensile testing machine in accordance with the applicable requirements of test method ASTM-E-8.

4.4.2.1 Proof-load testing. Two specimens from each sample of cable selected as specified in 4.3 shall be tested. The total length of the cable specimen to be tested shall be not less than 20 inches. When necessary, terminals conforming to MIL-T-781 shall be swaged to the end of the cable specimens. The terminals shall be clamped or fastened in the jaws of the test machine and then gradually loaded to the minimum required breaking strength of the cable as specified in table II. The load shall be applied for a minimum of 5 seconds. At the end of the above test the cable fitting shall be removed and the entire cable shall be completely unwound and every wire inspected. The failure of any wire shall be cause for rejection of the entire lot.

4.4.2.1.1 Proof-load testing (optional). Proof-load testing, as specified in 4.4.2.1 may be monitored with a microphone while the specimens are being loaded to the minimum breaking strength requirements. Any audible "pings" that occur during the loading cycle indicate broken wires and shall be cause for rejection of the lot represented.

4.4.3 Endurance. Two endurance test specimens shall be prepared from each lot of cable of the diameters shown in table III. One specimen shall be tested at +70°F, and one specimen shall be tested at -65°F. The number of reversals per minute and the tension in the cable for the endurance test shall be as indicated in table III for each size of cable. The total travel of the cable in one direction shall be 13-1/2 inches as specified on figure 1. The test pulleys shall be made of steel and shall conform to the dimensions shown on figure 2.

4.4.3.1 The application of lubrication to the endurance test samples in addition to the lubricant applied during the manufacture of the cable shall not be permitted either before or during the endurance test.

4.4.3.2 Breaking strength after endurance test. The breaking strength after the endurance test shall be determined by the method specified for determining the breaking strength of cable except that the specimen for this test shall be so selected as to determine the breaking strength of a portion of the cable that has been subject to bending by contact with the pulley.

4.5 Examination of the preparation for delivery. The preservation, packaging, packing, and marking shall be examined for conformance to section 5.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.2).

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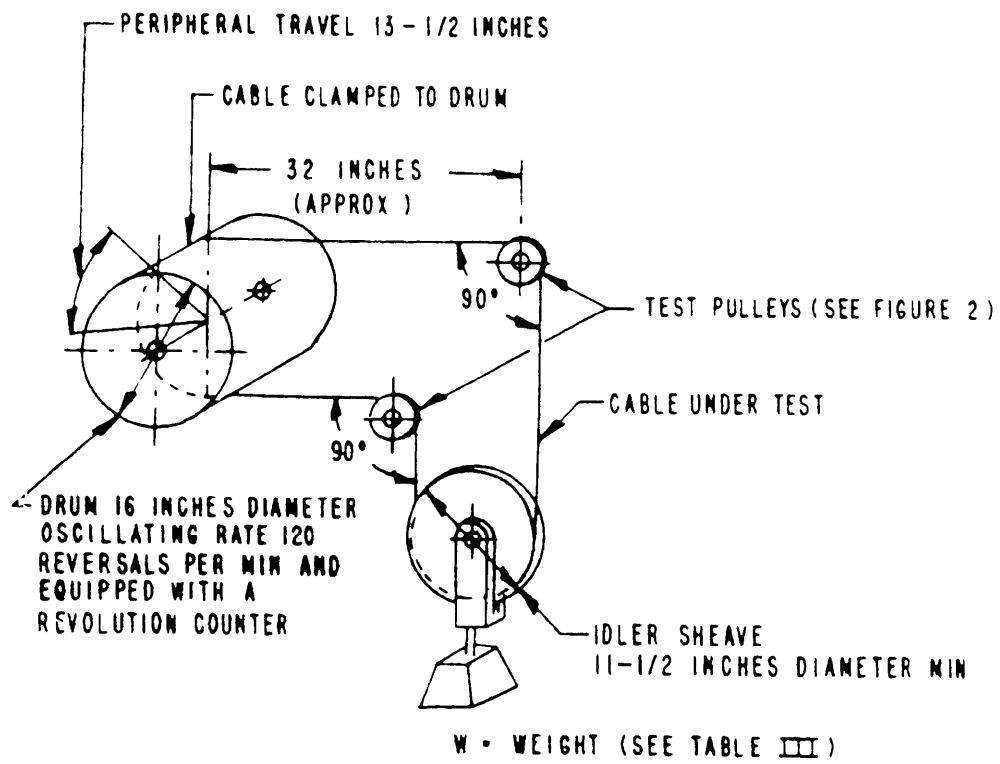
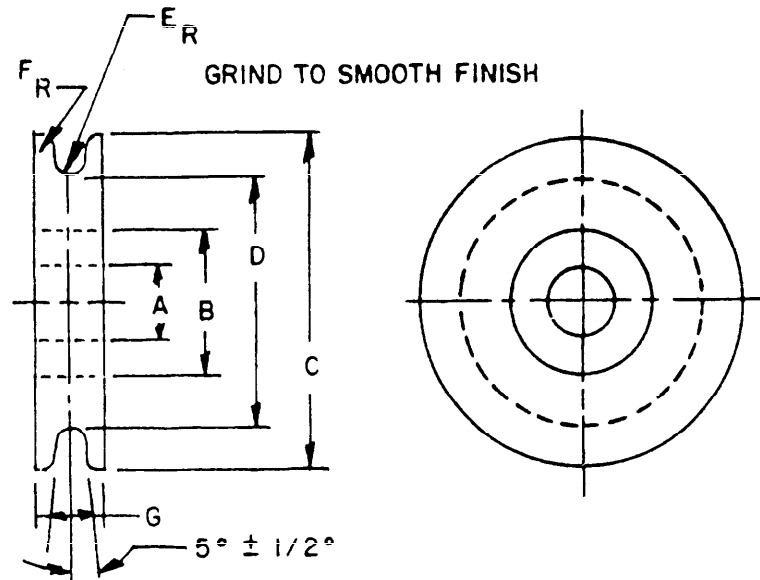


FIGURE 1. Cable Endurance Testing Machine (Diagrammatic)

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NOTE: FIT PULLEYS WITH SUITABLE BALL OR ROLLER BEARINGS.
 "B" SHOULD BE BORED AND GROUND TO LIGHT PRESS FIT FOR BEARINGS.
 "A" BORE OF BEARING AS RECEIVED.
 MATERIAL: TOOL STEEL.
 HEAT TREAT: HARDEN TO ROCKWELL C60 MINIMUM.

DIMENSIONS OF STEEL PULLEYS USED IN ENDURANCE TESTS

CABLE DIAMETER	PULLEY RATIO ^{1/}	PULLEY DIMENSIONS					
		C ± 1/64	D ^{+ .005} - .000	E _R ^{+ .002} - .000	F _R	G ± 1/64	
INCH		INCHES	INCHES	INCH	INCH	INCH	
5/32	19 BY 7	9.5	2	1.484	.086	1/16	3/8
3/16	19 BY 7	9.5	2-3/8	1.781	.103	1/16	1/2
7/32	19 BY 7	9.5	2-3/4	2.078	.118	1/16	1/2
1/4	19 BY 7	9.5	3-1/8	2.375	.133	1/16	1/2
7/32	10 BY 7	11.4 ^{2/}	3-1/8	2.493	.118	1/16	1/2

^{1/} RATIO OF PULLEY DIAMETER "D" TO NOMINAL CABLE DIAMETER.

^{2/} OUTER WIRES IN OUTER STRANDS IN 10 BY 7 ARE 20% LARGER THAN OUTER WIRES IN OUTER STRANDS IN 19 BY 7

FIGURE 2. Endurance Test Pulley

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5.1.1 Level A. The cable shall be wound, one size on a reel, on reels constructed to the dimensions specified in table IV. Before starting to wind the cable on the reel, a layer of waterproof barrier material conforming to PPP-B-1055 and then a layer of greaseproof paper conforming to MIL-B-121, grade A, shall be applied to the barrel of the reel and the inside of the flange against which the cable will subsequently rest. After the cable is wound on the lined reel, a layer of greaseproof paper conforming to MIL-B-121, grade A and then a layer of waterproof paper conforming to PPP-B-1055 shall be applied and fastened by three or more wooden lagging strips and two metal straps. The metal strapping shall conform to QQ-S-781 or QQ-S-790.

5.1.2 Level C. Preservation and packaging shall be in accordance with the manufacturer's commercial practice in a manner to insure carrier acceptance and safe delivery to destination.

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

5.2.1 Level A. Each packaged reel or container shall be packed in such a manner that the waterproof barrier material is not exposed to forces which may cause mechanical damage.

5.2.2 Levels B and C. No additional packing is necessary.

5.3 Marking of shipments. Each shipping reel or container shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The wire rope covered by this specification is intended primarily for use on helicopter rescue hoist and cargo winching equipment.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification
- (b) Type, size, length, and quantity to be furnished
- (c) Applicable levels of preservation, packaging, and packing.

6.3 Definitions

6.3.1 Wire. Each individual cylindrical steel rod or thread is designated as a wire.

6.3.2 Strand. Each group of wires helically twisted or laid together is designated as a strand.

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TABLE IV. Reels for Cable

Dia of cable	1,000 feet			3,000 feet			Dia of arbor hole
	Dia of head	Traverse or distance between heads	Dia of drum	Dia of arbor hole	Dia of head	Traverse or distance between heads	
Inch	Inches	Inches	Inches	Inches	Inches	Inches	Inches
5/32	16	7	12	1-1/8	16	10	8
3/16	18	7	12	2-1/8	18	10	8
7/32	18	7	12	2-1/8	22	10	10
1/4	18	10	10	2-1/8	24	10	10
5/16	18	10	10	2-1/8	24	16	10
3/8	22	10	10	2-1/8	32	16	16
1/2	24	14	10	2-1/2	50	12	26
5/8	32	18	18	3	50	16	30
5,000 feet							
Inch	Inches	Inches	Inches	Inches	Inches	Inches	Inches
5/32	24	10	10	2-1/8	24	16	10
3/16	24	10	10	2-1/8	24	16	10
7/32	24	10	10	2-1/8	32	20	16
1/4	32	18	16	2-1/8	36	22	18
5/16	32	18	16	2-1/8	36	22	18
3/8	32	20	16	3-1/8	50	16	26
1/2	50	16	26	5	50	28	26
5/8	50	26	30	5	60	30	30

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- 6.3.3 Cable or wire rope. A group of strands helically twisted or laid about a central core is designated as a cable. The strands and the core act as a unit.
- 6.3.4 Preformed type. Cable consisting of wires and strands shaped prior to fabrication of the cable to conform to the form or curvature which they take in the finished cable is designated as preformed type.
- 6.3.5 Diameter. The diameter of cable is the diameter of the circumscribed circle.
- 6.3.6 Lay or twist. The helical form taken by the wires in the strand and by the strands in the cable is characterized as the lay or twist of the strand or cable, respectively. In a right-hand lay the wires or strands are in the same direction as the thread on a right-hand screw; for a left-hand lay, they are in the opposite direction.
- 6.3.7 Pitch (or length of lay). The distance, parallel to the axis of the strand or cable, in which a wire or strand makes one complete turn about that axis is designated as the pitch (or length of lay) of the strand or cable, respectively.
- 6.3.8 Lang lay. A cable in which both the wires in the strand and the strands in the cable are laid in the same direction is designated as lang lay.
- 6.3.9 Regular lay. A cable in which the wires in the strand are laid in one direction and the strands in the cable are laid in the opposite direction is designated as regular lay.
- 6.3.10 Wire center. The center of all strands is an individual wire and is designated as a wire center.
- 6.3.11 Strand center. A strand center consists of a single straight strand made of preformed wires, similar to the other strands comprising the cable in arrangement and number of wires.
- 6.3.12 Nonrotating. A nonrotating cable is a cable which resists spinning under load.

Custodian:

Air Force - 11
Army - AV

Preparing activity:

Air Force - 11

Project No. 4010-0076

Review activities:

Air Force - 82
Army - AV

User activities:

Navy - SH, AS

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 22-R255
<p>INSTRUCTIONS - This sheet is to be filled out by personnel (either Government or contractor) involved in the use of this specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.</p>		
SPECIFICATION		
ORGANIZATION		
CITY AND STATE	CONTRACT NUMBER	
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input checked="" type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO (If "yes", in what way?)		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED BY (Printed or typed name and activity - Optional)		DATE

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