

INCH-POUND

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SUPERSEDING
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DETAIL SPECIFICATION

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

This specification is approved for use by all departments and agencies of the Department of Defense.

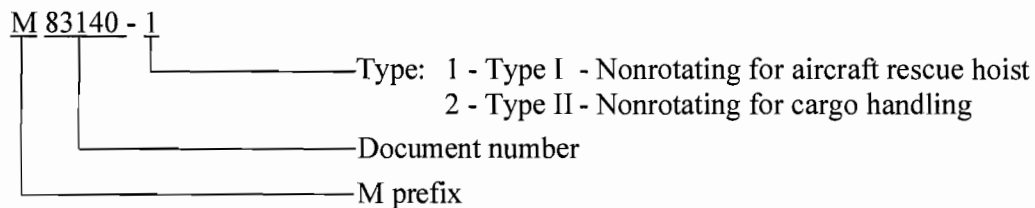
1. SCOPE

1.1 Scope. This specification covers the requirements for nonrotating (see 6.4.4), preformed stainless steel wire rope (see 6.4.1) 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 will be of the following types, as specified (see 6.2):

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

1.3 Part or identifying number (PIN). The PIN to be used for wire rope acquired to this specification is created as follows:



Comments, suggestions, or questions on this document should be addressed to Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or e-mailed to STDZNMGT@dla.mil. Since contact information can change, you may want to verify the currency of this e-mail address information using the ASSIST Online database at www.dodssp.daps.mil.

AMSC N/A

FSC 4010

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification 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 the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specification forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that cited in the solicitation or contract (see 6.2).

DEPARTMENT OF DEFENSE

MIL-DTL-781 - Terminal: Wire Rope Swaging.

(A copy of this document is available online at <http://assist.daps.dla.mil/quicksearch/> or www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issue of this document is that cited in the solicitation or contract (see 6.2).

ASTM INTERNATIONAL

ASTM E 8 - Standard Test Methods for Tension Testing of Metallic Materials (DoD adopted).

(A copy of this document is available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

2.4 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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. The wire (see 6.4.7) 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	0.150 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 that 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 (see 6.4.5) into the exact helical position they will have in the finished cable so that if the cable is cut or severed, there will be no tendency for the normal diameter (see 6.4.2) of the cable at the unseized ends to increase by more than the amount specified in table II (see 6.2).

TABLE II. Construction and physical properties.

Nominal diameter of cable (inch)	Construction	Tolerance on diameter (plus only) (inch)	Allowable increase in diameter at unseized end (maximum) (inch)	Breaking strength of cable (minimum) (pounds)	Weight per 100 feet (approximate) (pounds)
5/32	19 by 7	0.008	0.017	2,160	4.50
3/16	19 by 7	0.009	0.019	3,330	6.50
7/32	19 by 7	0.010	0.020	4,500	8.60
1/4	19 by 7	0.012	0.021	5,760	11.00
5/16	19 by 7	0.016	0.024	8,100	17.30
3/8	19 by 7	0.020	0.027	10,800	24.30
1/2	19 by 7	0.025	0.034	20,520	45.80
5/8	19 by 7	0.030	0.040	31,500	71.50
7/32	10 by 7 (7 by 19 IWRC)	0.010	0.020	4,500	8.60

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 (see 6.4.6) shall be not closer than 20 feet. Any brazed or welded wire that protrudes in excess of one 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 (see 6.4.3). 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.

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 acquisition order (see 6.2).

3.7 Temperature conditions. The cable shall be capable of performing satisfactorily and shall be able to meet all the requirements of this specification throughout a temperature range of -65 °F to 160 °F (-54 °C to 71 °C).

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 II. 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.

TABLE III. Breaking strength after endurance test.

Nominal diameter (inches)	Tension ¹ (pounds)	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

¹Tension is equal to half of weight (w), which includes idler sheave and hanger as shown in figure 1.

3.10 Identification of product. Each cable, regardless of size, construction, or length, shall be identified by a color code established by the procuring activity. Each manufacturer will be assigned a color that shall be applied at the end of the cable that attaches to the reel. The color shall cover a minimum of 24 inches at the end of the cable.

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. VERIFICATION

4.1 Classification of tests. All 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.

4.2 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. 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 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 Identification of reels. Each manufacturing reel shall be identified by the manufacturer. When the manufacturing reel is cut to 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. The failure of any specimen shall be cause for rejection of the lot represented by the sample.

4.3.3 Certified test report. If specified (see 6.2), 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. All tests specified herein shall be conducted at ambient room temperature.

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-DTL-781 shall be swaged to the ends of the specimens. The length of the cable test section between terminals shall be approximately two feet. The terminals shall be clamped in the jaws of the 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-DTL-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 five seconds. At the end of the above test the cable fitting shall be completely unwound and every wire inspected. The failure of any wire shall be cause for rejection of the lot represented.

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. 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 in figure 1. The test pulleys shall be made of steel and shall conform to the dimensions shown on figure 2. 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.

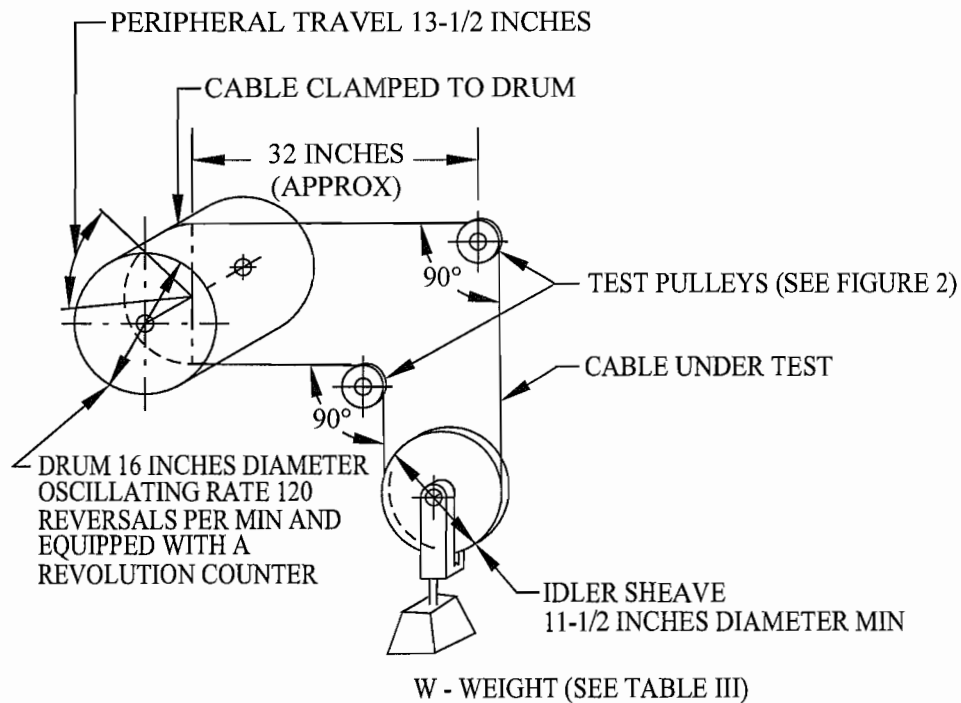
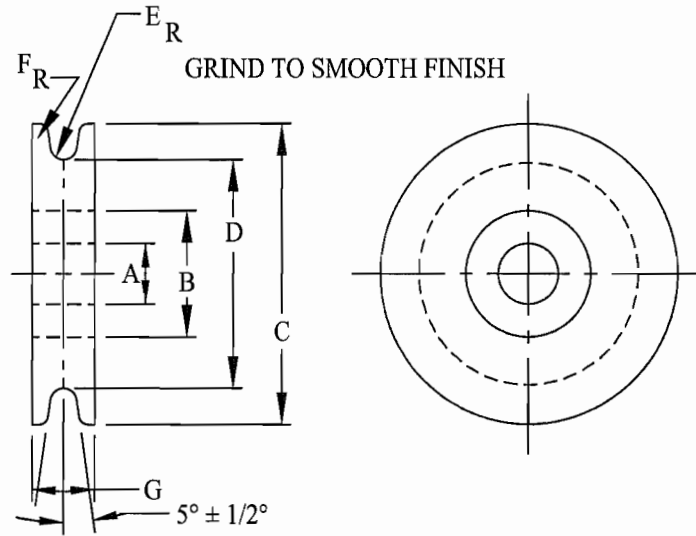


FIGURE 1. Cable endurance testing machine (diagrammatic).

4.4.3.1 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 selected to determine the breaking strength of a portion of the cable that has been subject to bending by contact with the pulley.

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 materiel 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 command. Packaging data retrieval is available from the managing military department's or defense agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.



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 (inch)		Pulley ¹ ratio	Pulley dimensions				
			C ±1/64 (inches)	D ±.005 -.000 (inches)	ER +.002 -.000 (inches)	FR (inch)	G ±1/64 (inch)
5/32	19 by 7	9.5	2	1.484	0.086	1/16	3/8
3/16	19 by 7	9.5	2-3/8	1.781	0.103	1/16	1/2
7/32	19 by 7	9.5	2-3/4	2.078	0.118	1/16	1/2
1/4	19 by 7	9.5	3-1/8	2.375	0.133	1/16	1/2
7/32	10 by 7 (7 by 19 IWRC)	11.4 ²	3-1/8	2.493	0.118	1/16	1/2

¹Ratio of pulley diameter "D" to nominal cable diameter.

²Outer wires in outer strands in 10 by 7 are 20 percent larger than outer wires in outer strands in 19 by 7.

FIGURE 2. Endurance test pulley.

6. NOTES

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

6.1 Intended use. This specification covers wire rope used on helicopter rescue hoist and cargo winching equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type (see 1.2).
- c. The specific issue of individual documents referenced (see 2.2.1 and 2.3).
- d. Nominal diameter of cable (see table II).
- e. Length of cable (see 3.6).
- f. Test report, if required (see 4.3.3).
- g. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

cable
lang
lay
pitch
strand

6.4 Definitions.

6.4.1 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.

6.4.2 Diameter. The diameter of cable is the diameter of the circumscribed circle.

6.4.3 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 the left-hand lay, they are in the opposite direction.

6.4.3.1 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.

6.4.3.2 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.

6.4.3.3 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 the axis is designated as the pitch (or length of lay) of the strand or cable, respectively.

6.4.4 Nonrotating. A nonrotating cable is a cable that resists spinning under load.

6.4.5 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.

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

6.4.6.1 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.

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

6.4.7.1 Wire center. The center of all strands is an individual wire and is designated as a wire center.

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

Custodians:
Army - AV
Navy - AS
Air Force - 11

Preparing Activity:
DLA - GS5

(Project 4010-0136)

Review Activity:
Air Force - 99

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 www.dodssp.daps.mil.