

INCH-POUND

MIL-DTL-83140B
19 February 2014
SUPERSEDING
MIL-DTL-83140A
9 July 2004

DETAIL SPECIFICATION

WIRE ROPE: STAINLESS STEEL, PREFORMED, ROTATION RESISTANT, FOR AIRCRAFT RESCUE HOIST, UTILITY HOIST AND 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 rotation-resistant (see [6.4.6](#)), preformed (see [6.4.5](#)), stainless steel wire rope (see [6.4.10](#)) intended for aircraft rescue hoist, utility or retrieval hoist or winching applications.

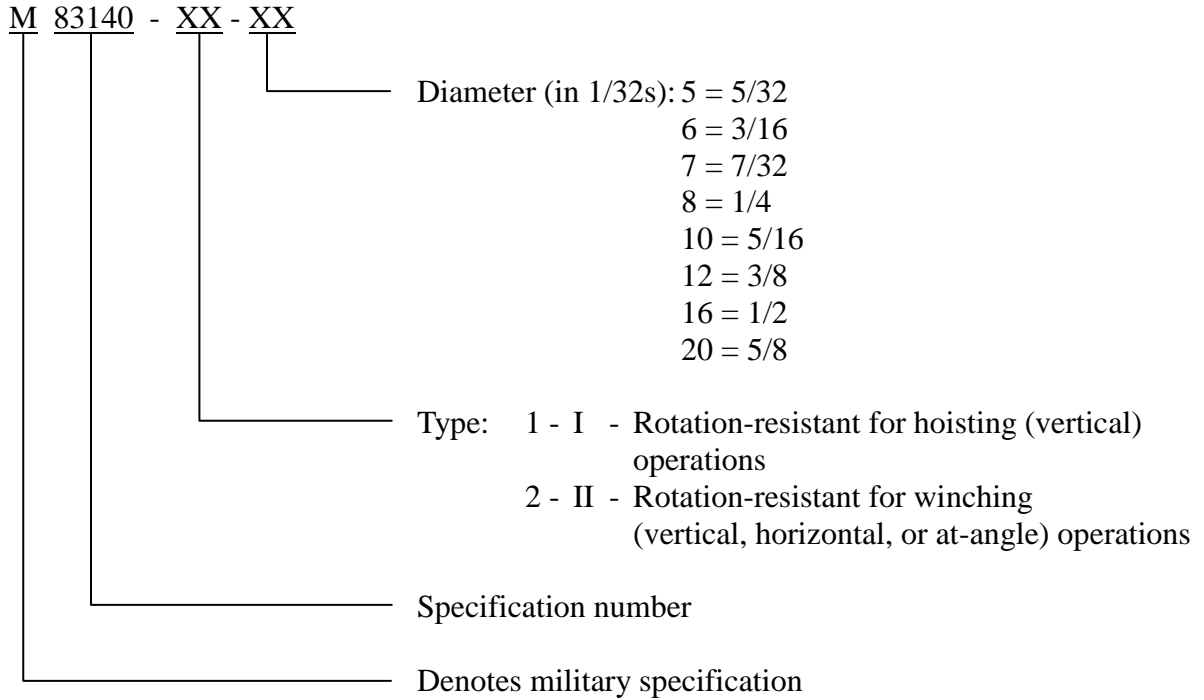
1.2 Classification. The preformed stainless steel wire rope will be of the following types, as specified (see [6.2](#)):

- | | |
|---|--|
| Type I - 19×7 | - Rotation-resistant for hoisting (vertical) operations |
| Type II - $10 \times 7 (7 \times 19 \text{ IWRC})$ ¹ | - Rotation-resistant for winching (vertical, horizontal, or at-angle) operations |

¹ "IWRC" indicates independent wire rope core.

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



Example: M83140-1-12 is 3/8 diameter, type I wire rope

See [table I](#) for applicable type/diameter combinations.

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 document.

2.2.1 Specification. 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.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-DTL-781

- Terminal, Wire Rope Swaging, General Specification for

(Copies of these documents are available online at <http://quicksearch.dla.mil>)

2.2.2 Other Government documents. The following other Government documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

STANDARDIZATION DOCUMENTS

SD-6 - Provisions Governing Qualification

(Copies of this document are available online at <https://assist.dla.mil/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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

ASTM INTERNATIONAL

ASTM A492 - Standard Specification for Stainless Steel Rope Wire

ASTM E8/E8M - Standard Test Methods for Tension Testing of Metallic Materials

(Copies of these documents are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

SAE INTERNATIONAL

SAE HS-1086 - Metals and Alloys in the Unified Numbering System

(Copies of these documents are available online at <http://www.sae.org/> or from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

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 Qualification. Wire ropes furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) before contract award (see [4.2](#) and [6.3](#)).

3.2 Materials. The wire (see [6.4.9](#)) used in the fabrication of the wire rope shall be composed of corrosion resistant steel S30200 or S30400 in accordance with ASTM A492 or SAE HS-1086 and shall be cylindrical, smooth, and of uniformly high quality.

3.2.1 Wire properties. The wire used shall be suitable for manufacture into wire rope that will meet the performance requirements of this specification. Tensile strength and wire sizes will be determined by the wire rope manufacturer and shall be of sufficient strength and size to meet the performance requirements of this specification.

3.2.1.1 Ductility of steel. The wire shall not fracture when wrapped in accordance with [4.4.2](#) prior to wire rope fabrication.

3.2.2 Preforming of wire and strands. The individual wires and strands composing the wire rope shall be preformed (see [6.4.5](#)) into the exact helical position they will have in the finished wire rope, so that if the wire rope is cut or severed, there will be no tendency for the normal diameter (see [6.4.1](#)) of the wire rope at the unseized ends to increase by more than the amount specified in [table I](#).

TABLE I. Construction and physical properties.

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

3.3 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 [6.4.8](#)) shall not be closer than 20 feet. Any brazed or welded wire that protrudes in excess of one percent of the normal wire rope diameter shall be cause for rejection.

3.3.1 Broken wires. Broken wires or protruding wires shall be considered defects and shall be cause for rejection of any length of wire rope.

3.4 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 I](#).

3.5 Types of construction. The wire rope covered by this specification shall be of 19 x 7 (see [3.5.1](#)) or 10 x 7 (7 x 19 IWRC) (see [3.5.2](#)) construction according to the diameter of the wire rope as specified in [table I](#).

3.5.1 Type I, 19 x 7 construction (see [figure 1](#)). Wire rope 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 left lang lay (see [6.4.2.1](#)). The outer layer shall be right regular lay (see [6.4.2.2](#)). The total number of wires in the wire rope shall be 133.

3.5.1.1 Length of lay. The length of lay (see [6.4.2.3](#)) 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 wire rope.

3.5.2 Type II, 10 x 7 (7 x 19 IWRC) construction (see [figure 2](#)). Wire rope of this construction shall consist of:

a. Core: 7 x 19 wire rope consisting of 7 strands of 19 wires each for a total of 133 wires laid right regular lay (see [6.4.2.2](#)).

b. Outer layer: 10 x 7 construction consisting of 10 strands of 7 wires each for a total of 70 wires laid around the core left regular lay (see [6.4.2.2](#)).

3.5.2.1 Length of lay. The length of lay (see [6.4.2.3](#)) of the 7 x 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 x 7 outer layer shall be not less than six times, nor more than eight times, the diameter of the finished wire rope.

3.6 Lubrication. Unless otherwise specified, each wire of the wire rope shall be coated with a friction-preventive, non-corrosive lubricant. If suitable, bio-based lubricants are preferred. At a minimum, the lubricant shall operate at temperatures from -65 °F to 160 °F (-54 °C to 71 °C).

3.7 Temperature conditions. The wire rope, including lubricant, 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 Load test. Wire ropes shall withstand the load test specified in [4.4.5](#) or [4.4.5.1](#) without failure of any wire.

3.9 Break test. Wire ropes shall meet or exceed the minimum breaking strength specified in [table I](#) when tested in accordance with [4.4.4](#). The sample from the load test (see [3.8](#)) may be used for the break test if procedure [4.4.5.1](#) is used and no wire failure is detected.

3.10 Endurance. All wire ropes 1/4 inch and under shall withstand endurance tests at ambient temperature in accordance with [table II](#). The wire ropes shall withstand the loads and reversals specified in [table II](#) without failure (see [4.4.6](#), [figure 3](#), and [figure 4](#)).

TABLE II. Endurance testing and breaking strength.

Nominal diameter (inches)	Construction	Tension (pounds)	W ¹ weight (pounds)	Pulley diameter (inches)	Number of reversals	Breaking strength (min.) (pounds)
5/32	19 × 7	30	60	1.484	150,000	1,300
3/16	19 × 7	45	90	1.781	150,000	2,000
7/32	19 × 7	60	120	2.078	150,000	2,700
1/4	19 × 7	70	140	2.375	150,000	3,450
7/32	10 × 7 (7 × 19 IWRC)	60	120	2.493	150,000	2,700

¹ Includes weight of idler sheave and hanger as shown in [figure 3](#).

3.10.1 Breaking strength after endurance test. The breaking strength (see [6.4.3](#)) of the wire rope after the endurance test described in [3.10](#) shall be not less than the minimum values specified in [table II](#) (see [4.4.4](#)).

3.11 Identification of product. The wire rope shall be identified in accordance with the following:

3.11.1 Identification by number. Each manufacturer shall assign a significant identification number on each manufacturing reel of wire rope. When the wire rope on the manufacturing reel is cut to specified lengths for transfer to the shipping reel, each shipping reel shall be marked with the identification number of the manufacturing reel.

3.11.2 Identification by color tracer filament. Each manufacturer shall identify every wire rope by the use of color filaments manufactured into the rope. The specification preparing activity will assign a combination of colors to each manufacturer desiring qualification. The inclusion of color tracing filaments alone does not designate that the wire rope is in full conformance with this specification or has met qualification requirements, but serves only to identify the manufacturer.

3.12 Workmanship. All details of workmanship shall be in accordance with the best practices for quality rotation-resistant, preformed, stainless steel wire rope consistent with the requirements of this specification. The wire rope shall be securely laid and free from kinks,

loose wires, loose strands, or other defects. The wire rope shall resist kinking, snarling, and corrosion.

3.13 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

4. VERIFICATION

4.1 Classification of inspection. The inspection and testing of the wire rope shall be classified as follows:

- a. Qualification inspection (see [4.2](#)).
- b. Conformance inspection (see [4.3](#)).

4.1.1 Testing. Qualification and conformance tests shall be as shown in [table III](#).

TABLE III. Qualification and conformance inspections.

Inspection/test	Qualification	Conformance	Requirement paragraph	Test paragraph
Ductility of steel (wire)	X	X	3.2.1.1	4.4.2
Examination	X	X	3.11.2, 3.12	4.4.3
Break test	X	X	3.9	4.4.4
Load test	X	X	3.8	4.4.5 or 4.4.5.1
Endurance, with break test	X	X	3.10	4.4.6

4.2 Qualification inspection.

4.2.1 Qualification inspection samples. When conducting qualification tests specified herein, one sample for each size and construction of wire rope listed in [table I](#) for which qualification is desired shall be taken after any discard has been removed from the head or starting end of the first manufacturing reel.

4.2.1.1 Sample size. A qualification sample shall consist of 50 feet of wire rope of the same construction and diameter produced continuously by one machine or by one series of progressive processing machines.

4.2.2 Qualification testing. Qualification tests shall be performed for each size and construction of wire rope for which qualification is desired as specified in [table III](#).

4.2.3 Maintenance of qualification. At specified intervals as determined by the qualifying activity, the manufacturer shall demonstrate that the company still has the capabilities and facilities necessary to produce the QPL items in accordance with this specification and in accordance with the provisions governing qualification specified in SD-6.

4.3 Conformance testing.

4.3.1 Sampling instructions. When conducting the conformance tests specified in table III, one continuous sample of sufficient length shall be taken after any discard has been removed from the head or starting end of the first manufacturing reel for each lot of wire rope.

4.3.2 Lot. A wire rope lot shall consist of not more than 20,000 feet of wire rope of the same construction and diameter produced continuously by one machine or by one series of progressive processing machines.

4.3.2.1 Identification of reels. Each manufacturing or shipping reel shall be uniquely identified by the manufacturer. The identification shall provide traceability to the original manufacturer's production lot, including as a minimum, the date of manufacture and the material lots used.

4.3.2.2 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 Preparation of test specimens. Individual lengths of wire rope shall be prepared as described in the test procedures listed. When required, the wire rope shall be cut to the length specified and shall be swaged with steel terminations (ball terminations shall not be used) in accordance with MIL-DTL-781.

4.4.2 Ductility of steel. A specimen from the wire sample shall be wrapped in a way that does not cause indenting. The wire shall be wrapped around a cylindrical mandrel for two complete turns in a close helix at a rate not exceeding 15 turns per minute. The cylindrical mandrel diameter shall be equal to the nominal wire diameter being tested (see [3.2.1.1](#)).

4.4.3 Examination of product. All wire rope shall be examined for workmanship and finish (see [3.11.2](#) and [3.12](#)).

4.4.4 Breaking strength. A specimen shall be prepared from each sample of wire rope selected. Swaged terminations conforming to MIL-DTL-781 (do not use ball end fittings) and accompanying hardware may be used to facilitate installation of the specimen in the jaws of the testing machine. The length of wire rope sample under load shall be not less than 10 inches. Sample length shall be measured from the edge of jaw-style grips, the tangency point of wrap-style grips, the end of the swaged shank of MIL-DTL-781 terminals or some similar position. The breaking strength shall be determined by use of a tensile testing machine in accordance with the applicable requirements of ASTM E8/E8M. The breaking strength shall conform to the requirements of [table I](#). In the case of failure due to an unsatisfactory end termination, the test will be disregarded and a new test will be conducted (see [3.9](#)).

4.4.5 Load testing. A specimen from each sample of wire rope selected shall be tested. The length of wire rope sample under load shall be not less than 10 inches. Sample length shall be measured from the edge of jaw-style grips, the tangency point of wrap-style grips, the end of the swaged shank of MIL-DTL-781 terminals or some similar position. The specimen shall be gradually loaded to the minimum breaking strength of the wire rope as specified in [table I](#). The load shall be applied for a minimum of five seconds. At the end of the test, the entire wire rope shall be completely unwound and every wire inspected. The failure of any wire shall be cause for rejection of the lot represented (see [3.8](#)). A suitable electronic device capable of detecting the breaking of individual wires during testing may be used instead of unwinding the wire rope (see [4.4.5.1](#)).

4.4.5.1 Load testing (optional). The specimen shall be loaded to the minimum breaking strength requirement of the wire rope. If no ping (see [6.4.4](#)) is heard, the specimen has passed the test. If one or more pings are heard, the wire rope specimen shall be considered to have broken wires or shall be unraveled and any broken wires shall confirm failure of the specimen. If no broken wires are found, the specimen shall be considered as having passed the test (see [3.8](#)). Specimens with broken wires shall be cause for rejection of the lot represented.

4.4.6 Endurance testing. One endurance test specimen shall be prepared from each lot of wire rope of the diameters shown in [table II](#). The number of reversals per minute shall be 120 (see [figure 3](#)) and the tension loads shall be as indicated in [table II](#) for each size of wire rope. The total travel of the wire rope in one direction shall be 13.5 inches as specified in [figure 3](#). The test pulleys shall be made of steel and shall conform to the dimensions shown on [figure 4](#). The application of lubricant to the endurance test samples in addition to the lubricant applied during the manufacture of the wire rope shall not be permitted either before or during the endurance test (see [3.10](#)).

4.4.6.1 Endurance test – break strength. Following the endurance test of [4.4.6](#), two specimens corresponding to the length cycled over the small sheaves shall be tested in accordance with [4.4.4](#). Minimum breaking strength shall meet the criteria of [table II](#). Both specimens must meet or exceed minimum breaking strength for the sample to pass the endurance test.

4.5 Certification. For each contract or order, the wire rope manufacturer shall certify that the product satisfactorily passed the conformance inspections (see 4.3.1 and 4.3.3) of this specification. The certification shall include, as a minimum, actual results of the tests specified herein and shall be retained on file at the manufacturer's facility for a minimum of 7 years.

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 commands. 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.

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 the requirements for rotation-resistant, preformed, stainless steel wire rope intended for aircraft rescue hoist, utility or retrieval hoist or winching applications.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and composition, if specified (see 1.2).
- c. Nominal diameter of wire rope (see 1.3 and table I).
- d. Length of wire rope.
- e. Test report, if required (see 4.3.3).
- f. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products that are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-83140 whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Logistics Agency Aviation VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or STDZNMGT@dla.mil.

6.4 Definitions.

6.4.1 Diameter. The diameter of a wire rope is the overall maximum diameter of a circle as circumscribed around the wire rope.

6.4.2 Lay or twist. The helical form taken by the wires in the strand and by the strands in the wire rope is characterized as the lay or twist of the strand or wire rope, 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, the wires or strands are in the opposite direction.

6.4.2.1 Lang lay. A wire rope in which both the wires in the strand and the strands in the wire rope are laid in the same direction is designated as lang lay.

6.4.2.2 Regular lay. A wire rope in which the wires in the strand are laid in one direction and the strands in the wire rope are laid in the opposite direction is designated as regular lay.

6.4.2.3 Length of lay (also termed "lay length" or "pitch"). The distance, parallel to the axis of the strand or wire rope, 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 wire rope.

6.4.3 Minimum breaking strength. The minimum tensile load that a wire rope must support without breaking.

6.4.4 Ping. Ping is an audible sound given off as a result of an individual wire breaking in the wire rope. The sound is amplified and fed into a speaker system to a level distinctly detectable by the human ear.

6.4.5 Preformed type. Wire rope consisting of wires and strands shaped prior to fabrication of the wire rope to conform to the form or curvature that they take in the finished wire rope. Preformed wire ropes are wire ropes in which the wires and strands in the wire rope will not, after removal of any seizing (serving) or when cut, spring out of the wire rope formation.

6.4.6 Rotation-resistant (also termed "nonrotating" or "low torque"). A rotation-resistant wire rope is a wire rope that resists turning or producing torque when placed under load.

6.4.7 Seizing. Single wires or strands used for making a close-wound helical serving, or wrapped binding, to retain the wires and strands of a wire rope in their assembled position. When cutting wire rope, seizing is applied to both sides of the cut location before the cut is made.

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

6.4.8.1 Strand center. A strand center consists of a single straight strand made of preformed wires, similar to the other strands comprising the wire rope in arrangement and number of wires.

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

6.4.9.1 Center wire. The center of all strands is an individual wire and is designated as a center wire.

6.4.10 Wire rope. A group of strands helically twisted or laid about a central core is designated as a wire rope. The strands and the core act as a unit.

6.5 Subject term (key word) listing.

Cable	Compact
Helical	Lang
Lay	Low torque
Minimum break	Nonrotating
Pitch	Proof load
Recovery	Search
Seizing	Splice
Strand	Unseized

6.6 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.

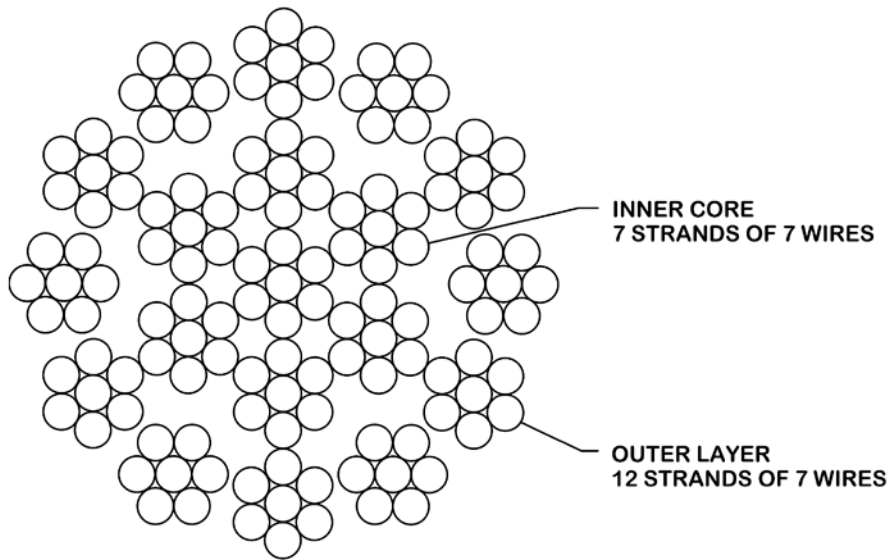


FIGURE 1. Wire rope construction, 19 x 7, type I.

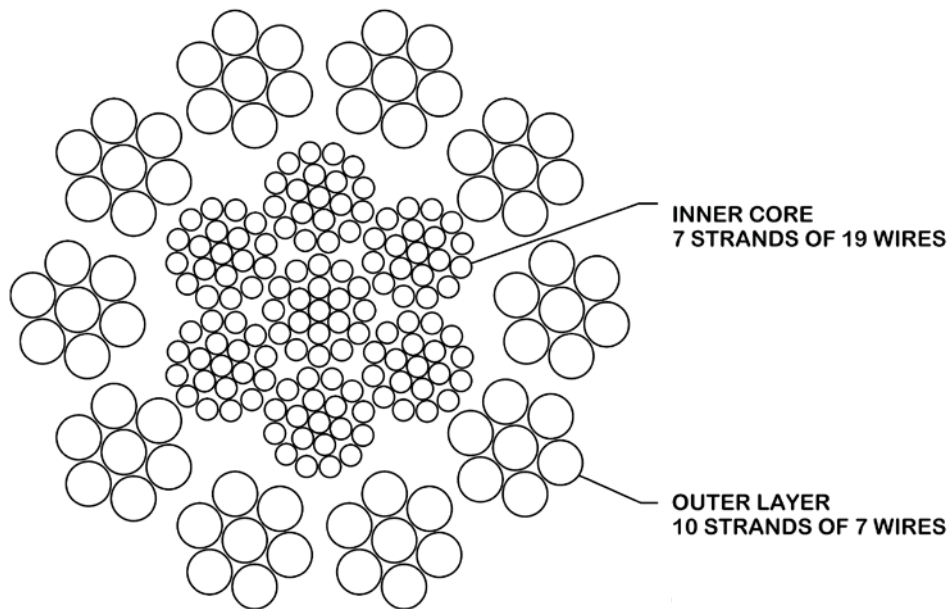
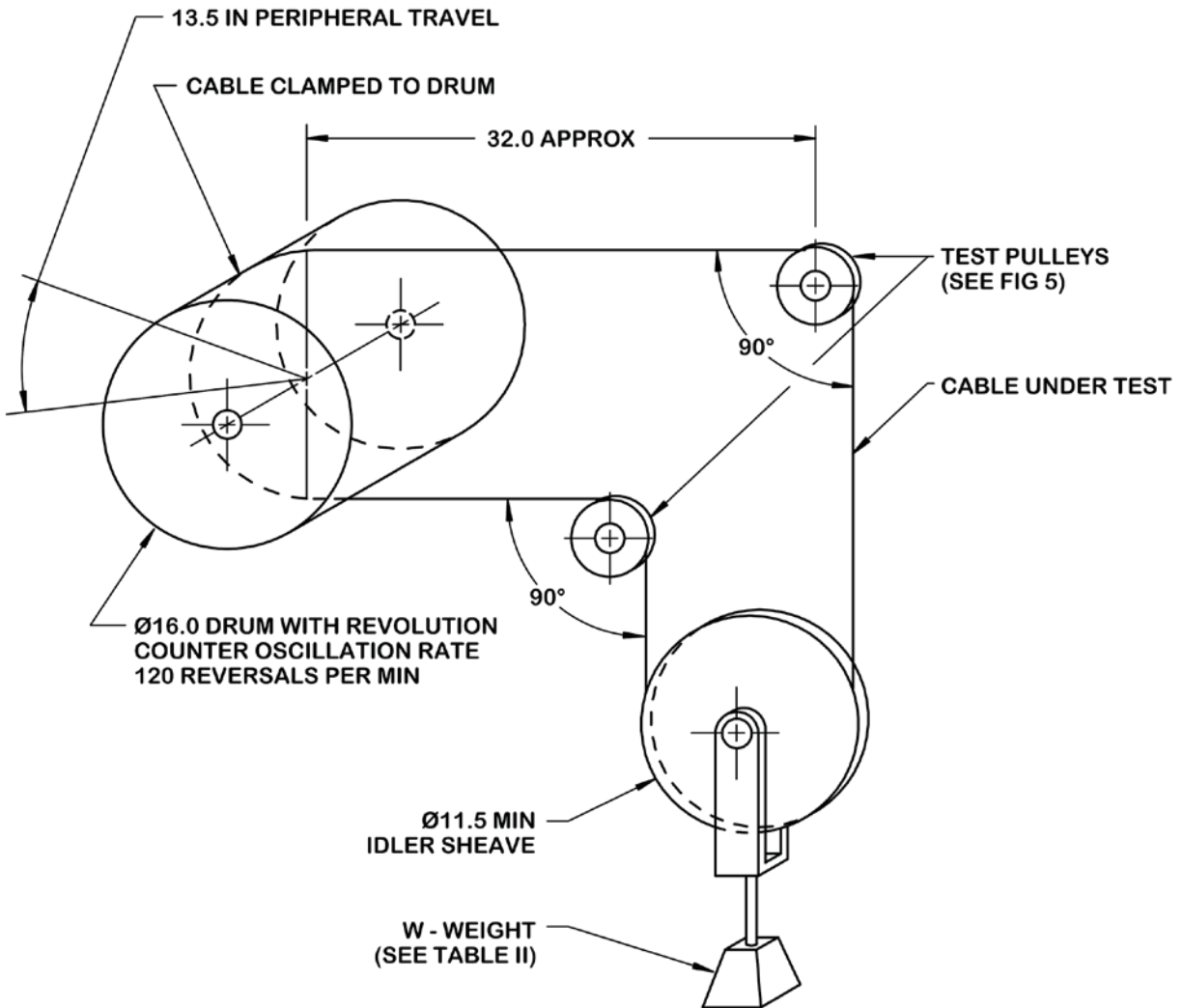


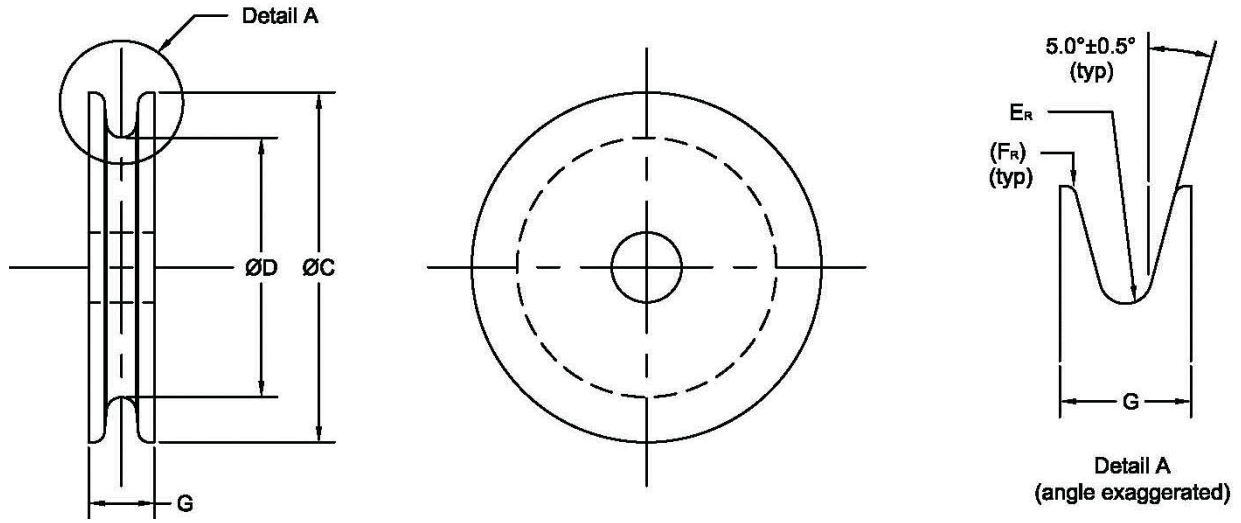
FIGURE 2. Wire rope construction, 10 x 7 (7 x 19 IWRC), type II.



NOTE:

1. All dimensions are in inches.
2. Reciprocating hydraulic, pneumatic, or electrical actuators, or other fittings, may be used in lieu of the oscillating drum shown.

FIGURE 3. Wire rope endurance testing machine (diagrammatic).



NOTES:

1. Fit pulleys with suitable ball or roller bearings.
2. Material: Tool steel.
3. Heat treat: Harden to Rockwell C60 minimum.
4. Grind all groove surfaces to a smooth finish.

Wire rope diameter (nom.) (inch)	Construction	Pulley ¹ ratio	Steel pulley dimensions				
			$\varnothing D$ +0.005 - 0.000 (inches)	$\varnothing C$ (inches) min.	E_R +0.002 - 0.000 (inches)	F_R (inch)	G (Ref)
5/32	19 × 7	9.5	1.484	1.747	0.086	0.062	0.375
3/16	19 × 7	9.5	1.781	2.094	0.102	0.062	0.500
7/32	19 × 7	9.5	2.078	2.437	0.118	0.062	0.500
7/32	10 × 7 (7 × 19 IWRC)	11.4 ²	2.493	2.852	0.118	0.062	0.500
1/4	19 × 7	9.5	2.375	2.782	0.134	0.062	0.500

¹ Ratio of pulley diameter "D" to nominal wire rope diameter.

² Outer wires in outer layer of 10 × 7 are 20 percent larger than outer wires in outer layer of 19 × 7.

FIGURE 4. Endurance test pulleys.

Custodians:

Army - AV

Navy - AS

Air Force - 99

DLA - GS

Preparing Activity:

DLA - GS5

(Project 4010-2013-002)

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 database at <https://assist.dla.mil/>.