

INCH-POUND

MIL-DTL-32266

2 June 2008

DETAIL SPECIFICATION

WIRE ROPE, 1.5 INCH DIAMETER, GALVANIZED,
COMPACTED STRAND, FOR AIRCRAFT ELEVATOR

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 1.5 inch diameter, galvanized, compacted strand construction wire rope (see 6.4.8 and 6.4.9) used for Navy shipboard aircraft elevators. The wire rope must provide high tensile stiffness to minimize the changes in platform elevation associated with roll-on and roll-off of aircraft and a uniform density that provides consistent tension values in service. It must also provide good bending fatigue performance to accommodate repeated cycling over the various sheaves in the elevator system. The rope must be resistant to corrosion associated with continual exposure to and operation in a salt water environment.

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 specifications and standards 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.

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 emailed to STDZNMGT@dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST database at http://assist.daps.dla.mil/ .

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FEDERAL SPECIFICATIONS

RR-W-410 - Wire Rope and Strand.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-11796 - Corrosion Preventive Compound, Petrolatum, Hot Application.

MIL-PRF-18458 - Grease, Wire Rope - Exposed Gear.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-129 - Military Marking for Shipment and Storage.

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

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 <http://assist.daps.dla.mil/> or from the Standardization Documents 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 A 90/A 90M - Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

ASTM A 1007 - Standard Specification for Carbon Steel Wire for Wire Rope.

ASTM A 1023/A 1023M - Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes.

ASTM E 8/E8M - Standard Test Methods for Tension Testing of Metallic Materials.

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(Copies of these documents are available from <http://www.astm.org/> or ASTM International, 100 Barr Harbor Drive, Conshocken, 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 Qualification. Wire rope furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3). Products must be qualified by a test facility located in the continental United States or Canada (see 4.1). The qualifying activity will be advised of any plant relocation, changes in key personnel, or major process change(s) for re-qualification testing determinations.

3.2 Material.

3.2.1 Wire rope and strand (see 6.4.7). Wire rope and strand shall be high quality, high carbon steel made by either open-hearth, basic oxygen, or electric furnace process. The steel shall be free from defects that are a detriment to its appearance or serviceability.

3.3 Finish.

3.3.1 Zinc coating. With the exception of the core strand, all wires in the wire rope shall be drawn galvanized. The wires of the core strand may be either drawn galvanized or galvanized at finished size. Zinc coating shall conform to the following:

Drawn galvanized wire		Galvanized at finish size	
Wire diameter (inch)	Minimum weight of zinc coating (oz./sq. ft.)	Wire diameter (inch)	Minimum weight of zinc coating (oz./sq. ft.)
0.028 to 0.060	0.20	0.028 to .047	0.20
Over 0.060 to 0.090	0.30	0.048 to 0.054	0.40
Over 0.090 to 0.140	0.40	0.055 to 0.063	0.50
		0.064 to 0.079	0.60
		0.080 to 0.092	0.70
		0.093 - larger	0.80

3.4 Lubricant. Each wire of the wire rope shall be coated with a friction-preventive, non-corrosive lubricant conforming to MIL-C-11796, or chemically compatible with MIL-PRF-18458. As a minimum, the lubricant shall operate at temperatures from -65 °F to +250 °F (-54 °C to +121 °C). The lubricant shall be applied to the wires during stranding and to the rope during closing.

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3.5 Construction.

3.5.1 Wire rope. The wire rope shall be 1.5 inch minimum diameter, 1.575 inch maximum diameter, 8 x 31, right lang lay (see 6.4.2), parallel-lay independent wire rope core (IWRC), compacted-strand construction.

3.5.1.2 Wire rope assembly. The eight inner strands and the eight outer strands shall be closed around the core strand in a single or continuous operation. The outer eight strands shall be nested in the valleys formed by the eight inner strands.

3.5.1.3 Wire rope lay length. The lay length of the finished wire rope shall be between 9.5 and 10.5 inches.

3.5.2 Core strand. The wire rope shall have a central core strand that may be compacted at the manufacturer's discretion.

3.5.2.1 Core strand configuration. The core strand shall be right-hand lay, 1 x 7 or 1 x 19 Seale construction.

3.5.2.2 Core strand lay length. The lay length of the outer wires of the core strand shall be between 2.5 and 3.0 inches.

3.5.2.3 Core strand compaction. If the core strand is compacted, the compaction may be accomplished either by die forming, roller or by swaging.

3.5.3 Inner strands. The wire rope shall have eight compacted inner strands.

3.5.3.1 Inner strand configuration. Each of the inner strands shall be a 1 x 7 construction having a left-hand lay.

3.5.3.2 Inner strand lay length. The lay length of the six outer wires of the inner strands shall be between 1.8 and 2.2 inches. All eight of the inner strands shall have the same lay length within +/- 0.125 inch.

3.5.3.3 Inner strand compaction. Each inner strand shall be compacted either by die forming, roller or by swaging.

3.5.4 Outer strands. The wire rope shall have eight compacted outer strands.

3.5.4.1 Outer strand configuration. Each of the outer strands shall be a 1 x 31 Warrington Seale construction having a right-hand lay.

3.5.4.2 Outer strand lay length. The lay length of the wires in the outer strands shall be between 4.0 and 4.5 inches. All eight of the outer strands shall have the same lay length within +/- 0.125 inch.

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3.5.4.3 Outer strand compaction. The outer strands shall each be compacted either by die forming, roller or by swaging.

3.6 Wire tightness. During closing of the wire rope, the outer strands shall be fore-turned sufficiently to ensure that all wires in the outer strands are tight (see 4.4.8.3).

3.7 Preforming (see 6.4.5). The eight outer strands shall be preformed during closing of the wire rope.

3.8 Prestretching. The finished wire rope shall be prestretched in accordance with ASTM A 1023/A 1023M.

3.9 Wire diameters. Wire used for manufacture of the wire rope shall not vary beyond the limits defined as follows:

<u>Wire design diameter (inch)</u>	<u>Wire design tolerance +/- Inch</u>
0.028 - 0.059	0.0020
0.060 - 0.092	0.0025
0.093 - 0.141	0.0030
0.142 - 0.200	0.0035

3.10 Wire strength. The minimum tensile strength of the main wires (excluding the wires in the core strand and the center wires (see 6.4.1) in all other strands) shall be in accordance with ASTM A 1007. Tensile strength grade/level shall be subject to the requirements of ASTM A 1023/A 1023M to the extent that the minimum breaking strength, wire rope density, tensile stiffness bending fatigue performance and wire ductility are achieved. Wires in the core strand and center wires in all other strands may be lower in strength than the main wires.

3.11 Breaking strength. The wire rope shall have a minimum breaking strength (see 6.4.4) of 250,000 pounds and a maximum breaking strength of 305,000 pounds.

3.12 Tensile stiffness. The wire rope tensile stiffness (the product of the cross-sectional area and the modulus of elasticity, AE) shall be a minimum of 18,000,000 pounds as measured by the slope of the strain versus tension curve at a tension of 30,000 pounds.

3.13 Wire joints. If wire joints must be made in individual wires before or during fabrication of the strands, the wires shall be electrically butt welded. The minimum distance between two wire joints in the same strand shall be 36 inches.

3.14 Bending fatigue performance. The wire rope shall withstand 120,000 bending cycles (straight-bent-straight) over a maximum tread diameter of 59.5, conformally grooved sheave at a tension of 30,000 pounds with less than a ten percent reduction of actual breaking strength.

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3.15 Wire ductility. The wires in the wire rope shall meet the following torsion requirements:

<u>Wire type</u>	<u>Torsion (revolutions) for a gauge length of 100 wire diameters</u>
Main wires (excluding core strand)	27.0 – 100d
Strand center wires	No requirements

Note: To convert to torsion in a 8-inch gauge length, divide the torsion listed above by 12.5d (d = wire diameter)

3.16 Density. The weight of the finished wire rope shall be between 4.60 and 4.85 pounds per linear foot.

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

3.17.1 Identification by number. Each manufacturer shall assign a significant identification number on each manufacturing reel of wire rope.

3.17.2 Identification by color tracer filament. Each manufacturer shall identify every wire rope by use of a color filament manufactured into the rope. The specification preparing activity will approve/assign of a specific color for each manufacturer desiring qualification.

3.17.3 Identification of reels and shipping containers. Each shipping reel (see 6.4.6) and shipping container shall be marked in accordance with the requirements of MIL-STD-129. The following information shall be included:

- a. NSN specified in the contract.
- b. Size.
- c. Name of wire rope manufacturer.
- d. Name of contractor.
- e. Contractor order number.
- f. Type of wire rope, composition, finish and specification number (MIL-DTL-32266).
- g. Date of manufacture (month/year).
- h. For reels with 2 lengths of wire rope, record distance from outside end to separation point and total length of wire rope on the reel.
- i. Manufacturing reel/lot number.

3.18 Workmanship. All details of workmanship shall be in accordance with ASTM A 1023/A 1023M, RR-W-410, and the best practice for high quality, elevator wire rope consistent with the requirements of this specification. The finished cable shall be uniform in construction and securely laid, free from kinks, loose wires, loose strands, or other defects.

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4. VERIFICATION

4.1 Classification of inspections. The inspection and testing requirements specified herein are classified as follows:

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

4.2 Qualification inspection.

4.2.1 Qualification inspection samples. When conducting qualification tests specified herein, samples of wire rope and individual wires shall be taken after any discard has been removed from the head or starting end of the manufactured wire rope.

4.2.1.1 Sample. A qualification inspection sample shall consist of a minimum 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 and a minimum of 10 feet for each individual wire size.

4.2.2 Qualification testing. Qualification tests shall be performed for the wire rope and each size of individual wire as specified in table I.

TABLE I. Qualification and conformance tests and inspections.

Tests	Requirement paragraph	Qualification paragraph	Conformance paragraph
Wire strength	3.10	4.4.1	4.4.1
Wire coating	3.3	4.4.2	4.4.2
Wire ductility	3.15	4.4.3	4.4.3
Breaking strength	3.11	4.4.4	4.4.4
Tensile stiffness	3.12	4.4.5	4.4.5
Bending fatigue performance	3.14	4.4.6	-
Density	3.16	4.4.7	4.4.7
Examination of product	3.4, 3.5, 3.6, 3.13, 3.17, 3.18	4.4.8	4.4.8

4.2.3 Maintenance of qualification. At specified intervals determined by the qualifying activity, the manufacturer must be able to 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 inspection. Conformance inspection shall consist of individual tests and sampling tests.

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4.3.1 Individual tests. Each size wire rope of each type, composition, and construction furnished under each contract or order shall be subject to the following tests as described under 4.4 (see table I).

- a. Wire strength (4.4.1).
- b. Wire coating (4.4.2).
- c. Wire ductility (4.4.3).
- d. Breaking strength (4.4.4).
- e. Tensile stiffness (4.4.5).
- f. Density (4.4.7).
- g. Examination of product (4.4.8).

4.3.2 Sampling plan.

4.3.2.1 Sample.

4.3.2.1.1 Wire rope. When conducting the sampling tests specified herein, 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.

4.3.2.1.2 Wire. When conducting the sampling tests specified herein, one random sample of wire, of sufficient length to meet testing requirements, shall be taken from the wire lot.

4.3.2.2 Lot.

4.3.2.2.1 Wire rope. A lot shall consist of not more than 20,000 feet of wire rope produced continuously by one machine or by one series of progressive processing machines.

4.3.2.2.2 Wire. A lot shall consist of wire of one size produced from the same heat of steel in one continuous process.

4.3.2.3 Specimen. A specimen is a section of wire rope or wire cut from a sample for the performance of a testing method. All specimens shall be taken from the lot furnished under that specific order.

4.3.3 Sampling tests. The conformance sampling tests shall be performed in accordance with the paragraphs listed in table I.

4.3.4 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, the actual results of the tests specified herein and shall be retained on file at the manufacturer's facility for a minimum of 7 years after the tests.

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4.4 Test methods.

4.4.1 Wire strength. A specimen of wire, 24 inches in length, shall be selected from the sample for each lot. Using suitable hardware, the specimen shall be installed in the jaws of the testing machine. The free length of wire sample under load shall be no less than 10 inches and the crosshead speed shall be no more than one inch per minute. The breaking strength shall be determined by use of a tensile testing machine in accordance with applicable requirements of ASTM E 8/E8M. The tensile strength shall conform to requirements of 3.10. In case of failure due to an unsatisfactory end termination, the test will be disregarded and a new test conducted.

4.4.2 Finish.4.4.2.1 Wire coating.

4.4.2.2 Zinc-coated wire. The weight of coating on samples of zinc-coated wire shall be determined in accordance with ASTM A 90/A 90M.

4.4.3 Wire ductility.

4.4.3.1 Wire torsion tests. A specimen of wire shall be selected from the sample from each lot. Using suitable hardware, the specimen shall be installed in the jaws of the testing machine. The free length of wire sample under load shall be no less than 8 inches +/- 1/16. One jaw of the test machine shall be movable parallel to the axis of the wire specimen and shall apply a tension on the wire specimen equal to one percent of the breaking load for that lot of wire. The wire specimen shall be twisted by rotating one or both jaws at a uniform rate of not more than 60 revolutions per minute. The wire shall achieve the number of rotations as specified in 3.15.

4.4.4 Breaking strength. A sample of wire rope, with a free length of 4 feet, +/- 1 inch, shall be prepared by installing spelter sockets at each end of the test specimen. The specimen shall be pulled to failure at a strain rate of approximately 10 percent per minute to determine compliance with 3.11. If the measured breaking strength is below 250,000 pounds and the failure occurs within 5 inches of a socket, the test will be disregarded and a new test conducted.

4.4.5 Wire rope tensile stiffness. A specimen of wire rope of sufficient length shall be selected from the sample for each lot. Using suitable hardware, the specimen shall be installed in the jaws of the testing machine and subjected to a tensile test. Wire rope strain versus tension will be measured during the tensile test. The strain (change in length divided by the original length) measurements shall be made using an extensometer that is attached to the mid section of the wire rope specimen with a gauge length of at least 50 inches. The wire rope specimen shall be subjected to 10 load cycles to a peak tension not to exceed 100,000 pounds. On cycle 10, the wire rope strain versus tension shall be recorded on an x-y recorder. A straight line shall be drawn on the strain versus tension curve at a tangent to the curve at a tension of 30,000 pounds. The slope of this line (change in tension divided by the corresponding change in strain) provides a measure of wire rope tensile stiffness (AE) that shall meet the requirements of 3.12.

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4.4.6 Bending fatigue performance. A wire rope specimen of sufficient length shall be prepared by installing zinc or resin poured sockets. The specimen shall be wrapped 180 degrees around a steel sheave having a maximum tread diameter of 59.5 inches and a groove diameter of 1.625 inches. At least one of the ends of the specimen shall be attached to rail guided trolleys that support the socket weight and prevent socket rotation. While the rope tension is maintained at 30,000 pounds, the specimen shall be cycled back and forth over the sheave with a stroke amplitude of at least 12 feet. The test shall be continued for 60,000 machine cycles (120,000 strokes) to provide 120,000 straight-bent-straight rope bending cycles. At the conclusion of the test, the entire specimen shall be pulled to failure in straight tension to determine remaining breaking strength. The remaining breaking strength shall be at least 90 percent of the actual breaking strength as specified in 3.11.

4.4.7 Density. A wire rope specimen of 10 feet in length, minimum, shall be weighed and averaged to determine compliance with 3.16.

4.4.8 Examination of product.

4.4.8.1 Lubricant. A sample of wire rope shall be sectioned and visually examined to determine compliance with 3.4. Each wire must exhibit evidence of the presence of a lubricant.

4.4.8.2 Construction. A sample of wire rope shall be sectioned and visually examined to determine compliance with 3.5.

4.4.8.3 Wire tightness. A sample of wire rope shall be sectioned and examined to determine compliance with 3.6. The outer wires of the strands must not be movable by probing with a knife point or other suitable tool.

4.4.8.4 Wire joints. A sample of wire rope shall be sectioned and examined to determine compliance with 3.13.

4.4.8.5 Workmanship. A sample of wire rope shall be sectioned and examined to determine compliance with 3.18.

4.4.8.6 Identification. A sample of wire rope shall be sectioned and examined to determine compliance with 3.17.2.

5. PACKAGING

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

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6. NOTES

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

6.1 Intended use. The product covered by this specification is 1.5 inch diameter, galvanized, compacted strand construction wire rope used for Navy shipboard aircraft elevators.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type and composition of wire rope (see 1.2).
- c. Size and construction of wire rope (see 3.5).
- d. Length of wire rope per reel to be furnished.
- e. Packaging requirements (see 5.1).
- f. NSN

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 QPL-32266 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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Richmond, ATTN: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616 or STDZNMGT@dla.mil.

6.4 Definitions.

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

6.4.2 Lay (twist). The helical form taken by the wires in the strand and by the strand in the wire rope is characterized as the lay (twist) of the strands or wire rope, respectively. In a right-hand lay, the wires of strands are the same direction as the thread on a right-hand screw, and for a left-hand lay, the strands or wires lay in an opposite direction.

6.4.3 Master reel. The master reel is the large manufacturing reel that is used to hold the wire rope as it is continuously manufactured.

6.4.4 Minimum breaking strength. The minimum tension load that a wire rope must support.

6.4.5 Preforming. Wire and strand shaped, during fabrication of the wire rope, to conform to the form or curvature which they take in the finished wire rope.

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6.4.6 Shipping reel. The shipping reels are cut from the master reel (see 6.4.3) as needed.

6.4.7 Strand. Each group of wires helically twisted is designated as a strand.

6.4.8 Wire. Each individual cylindrical element is designated as a wire.

6.4.9 Wire rope. A group of 3 or more strands helically twisted is designated as a wire rope.

6.5 Subject term (key word) listing.

Aircraft carrier

Steel cable

Custodian:
Navy - SH

Preparing Activity:
DLA - GS5

(Project 4010-2007-003)

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 <http://assist.daps.dla.mil/>.