

INCH-POUND

MIL-W-83420E

6 June 1994

SUPERSEDING

MIL-W-83420D

25 April 1983

MILITARY SPECIFICATION

WIRE ROPE, FLEXIBLE, FOR AIRCRAFT CONTROL

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 carbon steel and corrosion resistant steel aircraft control flexible wire rope. The wire rope, Type I shall be capable of operation within a -54°C to $+121^{\circ}\text{C}$ (-65°F to $+250^{\circ}\text{F}$) temperature range in wind, dust, fuel and oil spills, in wash-down and other environmental stresses and aircraft experiences. Type II wire rope shall be capable of operation within a -54°C to $+94^{\circ}\text{C}$ (-65°F to $+200^{\circ}\text{F}$) temperature range in wind, dust, fuel and oil spills, in wash-down and other environmental stresses and aircraft experiences.

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

1.2.1 Type. The type of wire rope shall be as follows:

Type I - Nonjacketed wire rope

Type II - Jacketed wire rope

1.2.2 Composition. The composition of the wire rope shall be as follows:

Composition A - Carbon steel, zinc or tin over zinc coated

Composition B - Corrosion resistant steel

2. APPLICABLE DOCUMENTS

2.1 Government documents.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: San Antonio AFMC/TILDD, 485 Quentin Roosevelt Rd, Kelly AFB, TX 78241-6425 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 4010

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

QQ-S-781	Strapping, Steel, and Seals
PPP-S-760	Strapping, Nonmetallic, (and Connectors)

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MIL-B-121	Barrier Material, Greaseproofed, Waterproofed, Flexible
MIL-T-781	Terminal, Wire Rope, Swaging
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-P-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243	Anti-icing and Deicing - Defrosting Fluid
MIL-H-19457	Hydraulic Fluid, Fire Resistant, Non Neurotoxic
MIL-C-87936	Cleaning Compounds, Aircraft Exterior Surfaces, Water Dilutable
MIL-H-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft
MIL-W-83420/1	Wire Rope, Type I, Composition A
MIL-W-83420/2	Wire Rope, Type I, Composition B
MIL-W-83420/3	Wire Rope, Type II, Composition A
MIL-W-83420/4	Wire Rope, Type II, Composition B

STANDARDS

MILITARY

MIL-STD-129	Marking for Shipment and Storage
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(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Bldg 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government Publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 90	Weight of Coating on Zinc Coated (Galvanized)
ASTM B 246	Iron or Steel Articles, Method of Test for
ASTM D 570	Tinned Hard-Drawn and Medium-Hard-Drawn Copper
ASTM D 635	Wire for Electrical Purposes, Specification for
ASTM D 638	Water Absorption of Plastics, Test for
ASTM D 648	Rate of Burning and/or Extent and Time of Burning
ASTM D 746	of, Self Supporting Plastic, in Horizontal
ASTM D 747	Position, Test Method for
ASTM D 789	Tensile Properties of Plastics, Test Method for
ASTM D 792	Deflection Temperatures of Plastics Under
ASTM D 910	Flexural Load, Test Method for
ASTM E 8	Brittleness Temperature of Plastics and
	Elastomers by Impact, Test Method for
	Stiffness of Plastics by Means of a Cantilever
	Beam, Test Method for
	Nylon Injection Molding and Extrusion
	Materials, Specification for
	Specific Gravity and Density of Plastics by
	Displacement, Test Methods for
	Gasolines, Aviation, Grades 80/87, 100/130, 115/145
	Tension Testing of Metallic Materials, Methods of

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

Uniform Freight Classification Committee

UNIFORM FREIGHT CLASSIFICATION RULES

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, Illinois 60606.)

(Non-Government standards and other publications are normally available from the organization that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of Precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, or specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern. (If a specific requirement specified herein is not required for an item, it shall be so indicated on the specification sheet; for example, "Shock - N/A").

3.2 Qualification. Wire rope (see 6.5.14) furnished under this specification shall be products that are qualified for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.4). Products must be qualified by a test facility located in the continental United States or Canada (see 4.1).

3.2.1 Wire rope for table II. The wire rope that is to be nylon jacketed shall first be qualified as type I, composition A or B wire rope in accordance with the provisions of this specification.

3.3 Materials and protective coating

3.3.1 Steel for composition A. Carbon steel shall be used for composition A wire rope and shall be of one type. The carbon steel shall be capable of meeting the requirements of this specification.

3.3.2 Steel for composition B. Corrosion resistant steel shall be used for composition B, types I and II wire rope, and shall be of one type. The steel shall conform to the following composition limits:

<u>ELEMENT</u>	<u>PERCENT</u>
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

3.3.3 Protective coating. Composition A wires shall be thoroughly and uniformly coated by the methods specified in 3.3.3.1 or 3.3.3.2.

3.3.3.1 Zinc coating for composition A. Zinc coating of composition A wires shall be by the hot dipped or electroplated process and shall conform to the following:

<u>Wire Diameter</u>	Min Weight of Zinc Coating <u>Oz/Sq Ft</u>
0.005 to 0.010 inch	0.03
Over 0.010 to 0.015 inch	0.05
Over 0.015 to 0.028 inch	0.10
Over 0.028 to 0.060 inch	0.20

3.3.3.2 Tin coating for composition A. Tin coating over zinc of composition A wires shall be by the hot-dipped or electroplated process and shall conform to the following:

<u>Wire Diameter</u>	Min Weight of Tin Coating <u>Oz/Sq Ft</u>
0.005 to 0.010 inch	0.003
Over 0.010 to 0.015 inch	0.005
Over 0.015 to 0.028 inch	0.010
Over 0.028 to 0.060 inch	0.015

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3.3.3.3 Nylon jacketed coating for type II. The nylon jacketing (see 6.5.2) material shall meet the requirements of this specification as specified in 3.3.3.3.1 and shall be extruded over the rope. Only virgin nylon material shall be used in coating on the type II wire rope.

3.3.3.3.1 Nylon jacketing physical and mechanical properties. The nylon used on the wire rope shall be capable of meeting the requirements listed below when tested in accordance with the following test methods:

<u>Property</u>	<u>Requirement (Test Method)</u>
Ultimate tensile strength	5000 psi min (4.6.1)
Elongation	250 percent min (4.6.1)
Specific gravity	.95 to 1.09 (4.6.2)
Stiffness	35,000 psi min (4.6.5)
Water absorption	1.5 percent max (4.6.3)
Brittleness	-54°C (-65°F) max (4.6.4)
Heat deflection	100/35°C at 66/264 psi min (4.6.6)
Melting range	160°C to 190°C (320°F to 364°F) (4.6.7)
Burn resistance	4 inch/min (4.6.8)

3.3.4 Lubricant. The wire rope shall be coated with a friction-preventative noncorrosive lubricant. The lubricant shall be applied so that each wire is coated. The lubricant shall have good lubrication properties at temperatures from -54°C (-65°F) to +121°C (+250°F). The lubricant shall also be resistant to oxidation.

3.4 Construction

3.4.1 Wire. The wire (see 6.5.13) used in steel wire rope cable shall be cylindrical, smooth and of uniformly high quality. It shall be free from splits, cold shuts, and other defects.

3.4.1.1 Wire properties. Tensile strengths of wire and wire sizes shall be such that wire rope will be capable of meeting the requirements of this specification.

3.4.1.2 Preforming (see 6.5.8) of wires and strands. The individual wires and strands composing the wire rope shall be shaped into the exact helical position they will have in the finished wire rope, so that if the wire rope is cut or severed there is no tendency for the measured diameter of the wire rope at the unseized cut ends to increase by more than the amount specified in table I.

3.4.1.3 Splicing and joining. All splices or joints in wires less than 0.008 inch may be longitudinally twisted, but all wire sizes of 0.008 inch or more shall be brazed or welded. Any joints in individual wires in any layer of a strand (see 6.5.10) shall not be closer than 20 feet except as specified in 3.4.1.3.1 (see 4.5.2).

3.4.1.3.1 Twist-off. When a twist-off (see 6.5.12) occurs during fabrication of the 7-wire layer of a 19-wire strand (see 3.4.1.3), splices and joints in individual wires may be as close as 18 inches.

3.4.2 Wire rope lengths. The wire rope shall be furnished on reels in lengths specified by the procuring activity. There shall be no more than two pieces of wire rope on the reel. The shortest piece shall be a minimum of 20 percent of the reel length. The distance to the break point on the reel shall be marked on the reel and Package (see 5.3.1.h).

3.4.3 Types of construction. Flexible steel wire rope shall be 3 by 7, 7 by 7, or 7 by 19 construction and shall be regular lay (see 6.5.9) for the respective diameters, the dimensional tolerances, and the physical properties as specified in tables I and II.

3.4.3.1 Construction 3 X 7. Wire rope of this construction shall consist of 3 strands of 7 wires each laid together without a core. Each strand shall consist of a layer of 6 wires laid around a center wire (see 6.5.1) in a left-hand direction. The 3 strands shall be laid together in a right-hand direction. The length of lay (see 6.5.3 and 6.5.4) of the 6 outer wires in each strand shall not exceed 70 percent of the lay of the finished rope. The length of lay of the finished wire rope shall be not more than 7 nor less than 5 times the nominal wire rope diameter (see 6.5.15).

3.4.3.2 Construction 7 X 7. Wire rope of this construction shall consist of 6 outer strands of 7 wires each laid around a strand core (see 6.5.11) of 7 wires. The 6 outer strands shall consist of a layer of 6 wires laid around a center wire in a left-hand direction. The strand core shall consist of a layer of 6 wires laid around a center wire in a right-hand direction. The 6 outer strands shall be laid around the core in a right-hand direction. The length of lay of the outside 6 wires in each of the 6 outside strands and the outside 6 wires of the strand core shall not exceed 60 percent of the lay of the finished wire rope. The length of the lay of the finished wire rope shall be not more than 8 nor less than 6 times the nominal rope diameter.

3.4.3.3 Construction 7 X 19. Wire rope of this construction shall consist of 6 outer strands of 19 wires each laid around a strand core of 19 wires. The 6 outer strands shall each consist of a layer of 6 wires laid around a center wire in a left-hand direction and a layer of 12 wires laid over the 7-wire strand in a left-hand direction. The strand core shall consist of a layer of 6 wires laid around a center wire in a right-hand direction and a layer of 12 wires laid around the 7-wire strand in the right-hand direction. The 6 outer strands shall be laid around the core in a right-hand direction. The length of lay of the inside layer of 6 wires in each of the 6 outer strands and the one strand core shall not exceed 60 percent of the outside layer of 12 wires in each strand. The length of lay of the outside layer of 12 wires in each of the 6 outside strands and the strand core shall not exceed 50 percent of the lay of the finished wire rope. The length of lay of the finished wire rope shall be not more than 8 nor less than 6 times the nominal rope diameter.

3.5 Performance.

3.5.1 Wire flexibility.

3.5.1.1 Ductility of steel. Composition A or B wire shall not fracture when wrapped in accordance with 4.5.1.1 prior to wire rope fabrication.

3.5.1.2 Adherence of coating. The tin or zinc coating shall not crack or flake when wrapped in accordance with 4.5.1.2 prior to wire rope fabrication.

3.5.2 Breaking strength. The type I, compositions A and B wire ropes shall have the minimum breaking strength as shown in table I.

3.5.3 Endurance, type I wire rope. Each wire rope size of each construction shall be capable of withstanding the respective tension loads and reversals shown in table III.

3.5.4 Endurance, type II wire rope. Each wire rope size of each construction shall be capable of withstanding the respective tension loads and reversals shown in table IV.

3.5.5 Stretch limits. The stretch in each wire rope size of each construction shall not exceed 1.5 percent when is loaded to 60 percent of the minimum breaking strength as shown in table I.

3.5.6 Test load. Each wire rope size of each construction shall carry 80 percent of its respective minimum breaking strength load, as shown in table I, without any failures of the individual wires in the rope.

3.5.7 Jacket characteristics, type II. The nylon jacketed wire rope shall have characteristics in accordance with the requirements of table II.

3.5.8 Low temperature flexibility, type II. Each size of each type II jacketed rope shall be bent or flexed at a temperature of -54°C (-65°F) without any deleterious effects such as cracking of the nylon or separation from the wire rope.

3.5.9 Resistance to fluids. Type II wire rope shall show no deleterious effects when immersed in the fluids listed in 4.5.10.

3.6 Identification of Product. The wire rope shall be identified in accordance with the following:

3.6.1 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, and a sequential transfer number.

3.6.2 Identification by color tracer filament. Each manufacturer shall identify every wire rope made to this specification by the use of color tracer filaments manufactured into the rope. The specification preparing activity shall assign a combination of two colors to each manufacturer desiring qualification. The inclusion of color tracing filaments does not signify that the wire rope is in full conformance, but only serves to identify the manufacturer. Color tracer filaments not mandatory in 3 x 7 construction.

3.6.2.1 Extruder for type II wire rope. When the fabricator for type II wire rope is solely the extruder and not the wire rope manufacturer, the fabricator must meet the qualification requirements of type II jacketed wire rope and shall satisfy the following requirements:

a. Wire rope from manufacturers qualified to QPL-83420 and certified to this specification shall be used. The wire rope shall have the rope manufacturer's color-coding.

b. The jacketing shall have identifying markings of assigned color tracer filament laid between the jacket and the wire rope. The colored tracers shall be those assigned by the preparing activity to the extruder. The identifying marking shall not cause any external deformation in the jacket.

3.7 Workmanship and finish. All details of workmanship and finish shall be in accordance with the best practice for high quality aircraft 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 (see 4.5.2).

3.7.1 Physical appearance, type II. The nylon jacket shall be uniform in outside diameter (O.D.) and in wall thickness as specified in table II and shall be uniform in appearance. The nylon jacket shall be translucent and shall be homogeneous and uniform in consistency. A specimen shall be checked under 10 x magnification to determine if there is any foreign material in the nylon. Periodic foreign particles shall be allowed, provided they do not exceed 20 percent of the nominal nylon thickness in diameter and do not exceed the concentration of two in any lineal foot of jacketed wire rope. The jacketed wire rope shall have no cracks or seams, or extrusion die marks on the surface which affect wire rope performance. Any deleterious effects, such as cracking or separating from the wire rope shall be cause for rejection.

3.7.1.1 Concentricity. The differences in wall thickness as determined in 4.5.2.1 shall not exceed 20 percent.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other suitable facilities for the performance of the inspection requirements specified herein, unless disapproved by the government. Due to the critical nature of this product and the urgent and ongoing requirement for quality control, it is required that test facilities be located within the continental United States or Canada for ready accessibility to Government personnel. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance with requirements. It is not a substitute for the examination of material and does not constitute an acceptance of material, nor does it commit the Government to accept defective material.

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

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

4.3 Qualification inspection.

4.3.1 Qualification inspection samples. When conducting qualification tests specified herein, one sample lot for each size and construction of wire rope listed in tables I and II, 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 for each lot of wire rope.

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4.3.1.1 Lot. A qualification inspection lot 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.

4.3.2 Qualification testing. Qualification tests shall be performed for each size and construction of wire rope for which qualification is desired as specified in table V.

4.3.3 Qualification for type II. Qualification for type II wire rope will be finalized after the following:

- a. Receipt from the nylon manufacturer of a test report that includes, as a minimum, the results of the tests specified in 4.6.
- b. Successful completion of the remaining qualification tests for type II wire rope.

4.3.3.1 Duplication nylon certification. If two or more type II wire rope sizes are submitted for qualification, and the nylon coating is of the same type and grade, copies of the original test certification on the particular type and grade of nylon will satisfy the requirement as specified in 4.3.3 and 4.4.5.

4.3.4 Qualification test report. The manufacturer shall furnish a certified test report showing the wire rope satisfactorily conforms to this specification.

4.3.5 Retention of qualifications. To retain qualification, the manufacturer shall forward certification at 2-year intervals to the qualifying activity stating that the company still has the capabilities and facilities necessary to produce the item and that the product has not been changed in any way. The qualifying activity shall establish the initial reporting date.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of individual tests and sampling tests.

4.4.1 Individual tests. Each size wire rope of each construction furnished under each government order or contract shall be subject to the following tests as described under 4.5 (see table V).

- Ductility of steel (4.5.1.1)
- Adherence of coating (4.5.1.2)
- Examination of product (4.5.2)
- Concentricity tests for type II wire rope (4.5.2.1)
- Conformance test to preforming of cable (4.5.2.2)
- Color-coding identification (4.5.11)

4.4.2 Sampling Plan.

4.4.2.1 Sample. When conducting the sampling tests specified herein, one sample not less than 50 feet in length for each size and construction listed in tables I and 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 wire rope.

4.4.2.2 Lot. A 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.

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

4.4.3 Sampling tests. The quality conformance sampling tests shall be performed in accordance with the following paragraphs:

Breaking strength (4.5.3)
Endurance testing for type I (4.5.4, 4.5.4.2)
Endurance testing for type II (4.5.5, 4.5.5.2)
Stretch test for type I (4.5.6)
Test load for type I (4.5.7, 4.5.7.1)

4.4.5 Certification. For each government order or contract, the wire rope manufacturer shall certify that the product satisfactorily passed the quality conformance inspections (see 4.4.1, 4.4.3) of this specification. The certification shall include, as a minimum, actual results of the tests specified herein (see 6.3).

4.4.6 Nylon certification. For each government order or contract a certification from the nylon manufacturer shall verify that the nylon meets the requirements of this specification (3.3.3.3 and 3.3.3.3.1) (See 6.3).

4.5 Test methods.

4.5.1 Wire flexibility.

4.5.1.1 Ductility of steel. The wire shall be wrapped in a way which 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 fifteen turns per minute. The cylindrical mandrel diameter shall be equal to the nominal wire diameter being tested for composition B, and two times the nominal diameter being tested for composition A.

4.5.1.2 Adherence of coating. The tin or zinc coated wire shall be capable of being wrapped at a rate not to exceed fifteen turns per minute in close helix of at least two turns around a cylindrical mandrel equal to two times the nominal diameter of the wire under tests without cracking or flaking the tin or zinc coating to such an extent that any tin or zinc can be removed by rubbing with the bare finger.

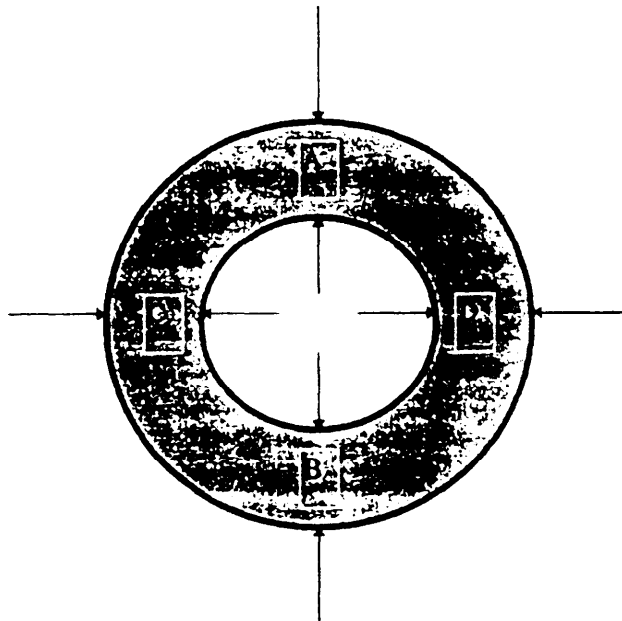
NOTE: Loosening or detachment during the adhesion test of superficial, small particles of tin or zinc formed by mechanical polishing of the surface of the coated wire shall not be considered cause for rejection.

4.5.2 Examination of Product. All wire rope shall be examined for workmanship and finish to determine compliance with 3.7. For this purpose, the wire rope shall travel no faster than 100 feet per minute, and shall be stopped for closer inspection when necessary. This inspection shall take place at the time the wire rope is wound on shipping reels. Any discard from the head or starting end of the manufacturing reel shall be removed prior to winding of the shipping reels. Protruding wires are considered a defect and not more than one broken wire will be accepted in 1000 feet of wire rope.

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4.5.2.1 Concentricity test for type II wire rope. All type II wire rope shall be examined for concentricity as specified in 3.7.1.1. The wall thickness shall be measured 180 degrees apart in two 90 degree planes. The percent variation in wall thickness shall be calculated as follows:

$$\text{Percent variation} = \frac{\text{Difference between the two measurements C and D}}{\text{Smaller of the two measurements}} \times 100 \leq 20\%$$



This calculation shall be repeated for dimensions A and B.

4.5.2.2 Conformance test to Preforming of wire rope. To test wire rope for conformity to values shown in table I for increase in diameter, wire rope shall be cut with a cutter having constricting jaws. A plain shear with straight blades distorts the product and may void the test. After cutting, the wire rope shall be measured by passing the wire rope through a hole drilled to a diameter increased as shown in table I under "Allowable increase in diameter at cut end" or by using a shadowgraph with suitable magnification.

4.3.3 Breaking strength type I composition A and B. A specimen for each size and construction of wire rope shall be selected from the sample from each lot. The specimen shall be no less than 24 inches in length, and where necessary, swagged terminals conforming to MIL-T-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 no less than 10 inches. The breaking strength shall be determined by use of a tensile testing machine in accordance with applicable requirements of ASTM E 8. The breaking strength shall conform to the requirement of table I. In case of failure due to an unsatisfactory end termination, the test may be disregarded and a new test conducted.

4.5.4 Endurance testing for type I. The test set-up for the endurance tests, for all type I wire rope shall conform to figure 1. The total travel of the wire rope in one direction shall be 13-1/2 inches. The test sheaves shall be made of steel and shall conform to the dimensions of figure 2 and table VI. The application of lubricant to the endurance test sample, in addition to the lubricant applied during the manufacture of wire rope, shall not be permitted either before or during the endurance test.

4.5.4.1 Endurance testing at -54°C (-65°F) for type I composition A. An endurance test at -54°C (-65°F) shall be conducted for each type I, composition A wire rope diameter and construction as specified in 4.5.4. The number of reversals and tension loads shall be as indicated in table III. After the endurance test at -54°C (-65°F), a test specimen that is that portion of the wire rope that passes over the test sheave during the endurance test shall be subjected to a breaking strength determination as specified in 4.5.3, except the breaking strength shall be equal to or greater than that specified in table III.

4.5.4.2 Endurance test at room temperature for type I, composition A and B. An endurance test at room temperature shall be conducted for each type I composition A and B wire rope diameter and construction as specified in 4.5.4. The number of reversals and tension loads shall be as indicated in table III. After the endurance test at room temperature, a test specimen that is that portion of the wire rope that passes over the test sheave during the endurance test shall be subjected to a breaking strength determination as specified in 4.5.3, except the breaking strength shall be equal to or greater than that specified in table III.

4.5.5 Endurance testing for type II. The test set-up for the endurance tests of type II nylon jacketed wire rope shall conform to figure 1. Sheave sizes shall be as specified in table VII and figure 2 which conform to the O.D. size of the nylon coating, and test loads which conform to the wire rope size. There shall be no cracking or deterioration of the nylon coating after completion of the tests.

4.5.5.1 Endurance test at -54°C (-65°F) for type II composition A and B. An endurance test at -54°C (-65°F) shall be conducted for each type II composition A and B wire rope diameter and construction as specified in 4.5.5. The number of reversals and tension loads shall be as indicated in table IV. After the endurance test at -54°C (-65°F), a test specimen that is that portion of the nylon jacketed wire rope that passes over the test sheave during the endurance test shall be subjected to a breaking strength determination as specified in 4.5.3, except the breaking strength shall be equal to or greater than that specified in table IV.

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4.5.5.2 Endurance test at room temperature for type II composition A and B. An endurance test at room temperature shall be conducted for each type II composition A and B wire rope diameter and construction as specified in 4.5.5. The number of reversals and tension loads shall be as indicated in table IV. After the endurance test at room temperature a test specimen that is that portion of the nylon jacketed wire rope that passes over the test sheave during the endurance test shall be subjected to a breaking strength determination as specified in 4.5.3, except the breaking strength shall be equal to or greater than that specified in table IV.

4.5.6 Stretch test for type I, composition A and B. For each size and construction of wire rope, one specimen from each sample of wire rope selected as specified in 4.4.2.3 shall be tested to determine the percent stretch. The total length of the wire rope specimen to be tested shall not be less than 24 inches. Where necessary, swagged terminals and accompanying hardware may be used to facilitate installation of the specimen in the jaws of the test machine. The amount of stretch shall be determined on a tension testing machine in accordance with ASTM E 8. The specimen shall be loaded to one percent minimum breaking strength shown in table I to straighten the wire rope and, while the specimen is under tension, a gauge length not less than 10 inches shall be marked on the wire rope between the end fittings of the testing specimen. The specimen shall then be loaded to 60 percent of minimum breaking strength and measured for elongation under load. From these data, the percent stretch can be calculated using the formula below:

$$\text{Percent stretch} = \frac{\text{Elongation of gauge length under load} \times 100}{\text{Original gauge length}} \leq 1.5\%$$

4.5.7 Test load for type I, composition A and B. For each size and construction of wire rope, the following test shall be made using the same wire rope specimen used in the stretch test, or similarly prepared specimen. Load the specimen to one percent of breaking strength then increase the loading to 80 percent of the minimum required breaking strength of the wire rope specified in table I. The load shall be applied for five seconds. At the end of the test, the wire rope fitting shall be removed and the entire wire rope shall be completely unwound and every wire inspected. A suitable electronic device capable of detecting the breaking of individual wires during testing may be used instead of unwinding the wire rope. The failure of any wire shall be cause for rejection (see 4.5.7.1 and 6.5.7).

4.5.7.1 Use of electronic device for first wire break test. The load shall be increased to 80 percent on the test specimen (see 6.5.7). If no ping (see 6.5.7) is heard, the specimen has passed the test. If one or more pings are heard, the wire rope specimen shall be unraveled and the broken wires shall confirm failure of the specimen. If no broken wires are found, the specimen has passed the test.

4.5.8 Protective coating.

4.5.8.1 Tin or zinc coating, composition A.

4.5.8.1.1 Preparation of specimens. For qualification, three specimens not less than 12 inches long shall be cut from the wire before the wire rope is fabricated. These specimens shall be cut from each size of wire to be used in making each lot of wire rope. Optionally, three 12 inch samples of the wire rope may be cut off and used for specimens.

4.5.8.1.2 Tin-coated wire. The weight of coating on samples of tin-coated wire shall be determined in accordance with ASTM B 246.

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

4.5.9 Low temperature flexibility for type II, composition A and B. The jacketed wire rope for qualification testing shall be subjected to -54°C (-65°F) for a period of 24 hours in a straight position. After this time and while still at the specified temperature, the sample shall be evenly and uniformly bent over a test sheave with the same dimensions as the endurance sheave for the particular size wire rope. Bending shall be accomplished in a period of not less than eight seconds and not more than 12 seconds, and the wire rope shall be bent at least 180 degrees in the groove of the sheave. After flexing, straighten the wire rope out and allow to warm to room temperature in four to six hours, then examine the flexed area under a magnification of 20 x power. There shall be no evidence of cracks or separation of the nylon jacketing from the wire rope.

4.5.10 Resistance to fluids on type II, composition A and B. For qualification testing, totally immerse a separate 3-inch unsealed length of nylonjacketed wire rope in each of the fluids listed below for four hours. Remove, wipe dry, and record appearance of each one of the specimens. Deleterious effects such as softening, cracking, or separation shall be cause for rejection. A separate test specimen shall be used for each fluid test.

a. MIL-H-5606	Hydraulic fluid
b. MIL-P-5624	Jet fuel JP-5
c. MIL-L-7808	Lubrication oil
d. MIL-A-8243	Anti-icing fluid
e. MIL-H-19457	Hydraulic fluid (Skydrol 500A, or equivalent)
f. MIL-C-87936	Cleaning compound
g. MIL-H-83282	Hydraulic fluid
h. ASTM D 910	Aviation gasolines

4.5.11 Color-coding identification. Each wire rope shall be inspected for proper identification as specified in 3.6.2.

4.6 Nylon testing for type II. The nylon manufacturer shall perform all the tests specified herein to determine compliance with the requirements of 3.3.3.3 herein. The test specimen shall be molded into a shape needed to perform the tests. The jacket extrusion lot number shall be identified in the molding test report.

4.6.1 Tensile strength, Percent elongation. Specimens shall be molded into type 4 test bars and tests shall be conducted in accordance with ASTM D 638.

4.6.2 Specific gravity. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 792.

4.6.3 Water absorption. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 570.

4.6.4 Brittleness. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 746.

4.6.5 Stiffness. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 747.

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4.6.6 Heat deflection. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 648.

4.6.7 Melting range. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 789.

4.6.8 Burn resistance. Specimens shall be molded and tests shall be conducted in accordance with ASTM D 635.

4.7 Preparation for delivery. The preservation, packaging, packing and marking shall be examined for conformance to section 5.

5. PACKAGING

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

5.1.1 Level A. Wire rope of one type, size, and composition shall be wound on reels constructed to the dimensions specified in table VIII, as applicable. Reels shall be fabricated in a manner similar to those shown on figure 3. Before starting to wind the wire rope on the reel, barrier material conforming to type I, grade A, class 1 or 2 of MIL-B-121 shall be applied to the drum of the reel and the inside of its heads against which the rope will rest. After the rope is wound on the reel and secured, a layer of the above-referenced barrier material shall be applied over the wire rope the full width of the drum and overlap itself not less than 8 inches. The barrier material shall be secured by the use of straps and wooden buffer strips as shown on figure 3D. When the distance between heads is no more than 7 inches, one strap may be used; when more than 7 inches, two straps shall be used. Metallic strapping shall conform to QQ-S-781. Non-metallic strapping shall conform to PPP-S-760. Wire rope reels weighing in excess of 100 pounds shall be packaged as noted above. At the contractor's option, wire rope reels weighing 100 pounds or less may be packaged by winding on metal or fiberboard reels and covered with a layer of barrier paper secured by tape and packed in accordance with the instructions in 5.2.1. If no further packing is used, complete barrier material protection shall be applied.

NOTE: For type II (jacketed) wire rope, the inner barrier paper may be omitted from all packages described above.

5.1.2 Level C. Each wire rope wound on a reel as specified in table VIII shall be preserved and packaged to afford adequate protection against corrosion, deterioration, and physical damage during shipment from supply source to the first receiving activity. This level may conform to the supplier's commercial practice when it meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C as specified.

5.2.1 Level A. Wire ropes preserved and packaged in accordance with 5.1 shall be lagged with a layer of lumber in such manner that the barrier material is not exposed to forces which may cause mechanical damage as shown on figure 3C. At the contractor's option, reels weighing 150 pounds or less and having a distance between head of 7 inches or less may be covered with flexible plywood laggings as shown on figure 3A. All lagging, except wire bound wood lagging, shall be secured by two metallic straps conforming to QQ-S-781. Wire rope reels weighing 100 pounds or less, packaged on metal or fiberboard reels in accordance with 5.1.1, shall be packed in a sealed or taped waterproof (plastic) bag and a suitable box or carton as shown on Figure 3B.

5.2.2 Level C. Packages that require overpacking for acceptance by the carrier shall be placed in exterior shipping containers in a manner that will insure safe transportation at the lower rate to the point of delivery. Containers shall comply with Uniform Freight Classification Rules or regulations of other carriers as applicable to the mode of transportation.

5.3 Marking for shipment.

5.3.1 Marking of reels and shipping containers. Each shipping reel and shipping container shall be marked in accordance with the requirements of MIL-STD-129. The following information shall be included:

- a. Stock No. or identification as specified in the contract 1/
 - b. Size (include diameter of wire rope, outside diameter of nylon jacket for type II and rope construction)
 - c. Name of wire rope manufacturer
 - d. Name of contractor
 - e. Contract order number
 - f. Type of wire rope composition, protective coating for composition A, and specification number (MIL-W-83420)
 - 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.
- 1/ The contractor shall enter the NSN (National Stock Number) specified in the contract or as furnished by the procuring activity. Space shall be left for the NSN when not available.

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 wire rope covered by this specification is intended for use in aircraft flight control systems applications where high resistance is needed against corrosion, abrasion, and fatigue wear.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of the specification.
- b. Selection of type and composition of wire rope (see 1.2).
- c. Size and construction of wire rope (see specification sheet).
- d. For type II, also specify jacket outside diameter.
- e. For composition A specify type of protective coating.
- f. Length of wire rope per reel to be furnished.
- g. Selection of applicable levels of packaging and packing required, (see 5.1 and 5.2).

6.3 Data requirements. The following Data Item Descriptions (DID's) must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this specification is applied on a contract, in order to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirements for a DD Form 1423.

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<u>Paragraph No.</u>	<u>Data Requirements</u>	<u>Applicable DID No.</u>
4.5.1.1, 4.5.1.2, 4.5.2 4.5.2.1, 4.5.2.2, 4.5.3 4.5.4.2, 4.5.5.2, 4.5.6 4.5.7, 4.5.7.1, 4.5.11	Acceptance test reports	DI-T-3721A
4.4.5, 4.4.6	Certificate of compliance	DI-E-2121

The above DIDs were those cleared as of the date of this specification. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DIDs are cited on the DD Form 1423.

(Copies of DIDs required by contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.4 **Qualification.** With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Product List QPL-83420 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 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. The activity responsible for the Qualified Products List is San Antonio AFMC/TILDM, Kelly AFB, TX 78241-6425 and information pertaining to qualification of products may be obtained from that activity.

6.5 Definitions.

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

6.5.2 Jacketing. Jacketing is the sheet or shielding coating around the wire rope and is extruded over the wire rope to completely enclose the wire rope with a protective coating.

6.5.3 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.

6.5.4 Length of lay (pitch). 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 length of lay (pitch) of the strand or wire rope.

6.5.5 Lubricant leak-out. Lubricant leak-out (see 3.3.4) and evaporation of the lubricant applied to the wire rope during fabrication and preparation of shipment can be expected. In order to ensure optimum performance with wire rope manufactured to this specification, the user should relubricate the wire rope upon installation and periodically throughout its service life. The method of lubrication, frequency, and identity of the approved military standard lubricant should be included in the appropriate aircraft maintenance manuals.

6.5.6 Master reel. The master reel (see 6.5.6) is the large manufacturing reel that is used to hold the wire rope as it is continuously manufactured. The shipping reels are cut from the master reel as needed.

6.5.7 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.

6.5.8 Preforming. Wires and strands shaped, during fabrication of the wire rope, to conform to the form or curvature which they take in the finished wire rope.

6.5.9 Regular lay. Wire rope in which the direction of the lay of the wires in the strand is in an opposite direction to the lay of the strand in the wire rope.

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

6.5.11 Strand core. A strand core consists of a single straight strand made of wires similar to the other strands comprising the cable in arrangement and number of wires.

6.5.12 Twist-off. Twist-off is a twisting severance of the strand or wire due to a malfunctioning of the stranding equipment.

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

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

6.5.15 Wire rope diameter. The diameter of wire rope is the diameter of the circumscribing circle, or the distance across opposite strands.

6.6 Subject term (key word) listing.

Airplane
Coated
Guide
Plated
Pliable
Steel cable
Uncoated

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

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Table I. Construction, physical properties of type I, carbon steel and corrosion resistant steel wire.

Nominal Diameter of Wire Rope	Tolerance on Diameter (Plus Only)	Allowable Increase of Diameter at cut end	Construction	Minimum Breaking Strength Composition A	Minimum Breaking Strength Composition B	Approximate Weight per 100 ft
In.	In.	In.		lbs	lbs	lbs
1/32	.006	.006	3 x 7	110	110	0.16
3/64	.008	.008	7 x 7	270	270	0.42
1/16	.010	.009	7 x 7	480	480	0.75
1/16	.010	.009	7 x 19	480	480	0.75
3/32	.012	.010	7 x 7	920	920	1.60
3/32	.012	.010	7 x 19	1,000	920	1.74
1/8	.014	.011	7 x 19	2,000	1,760	2.90
5/32	.016	.017	7 x 19	2,800	2,400	4.50
3/16	.018	.019	7 x 19	4,200	3,700	6.50
7/32	.018	.020	7 x 19	5,600	5,000	8.60
1/4	.018	.021	7 x 19	7,000	6,400	11.00
9/32	.020	.023	7 x 19	8,000	7,800	13.90
5/16	.022	.024	7 x 19	9,800	9,000	17.30
3/8	.026	.027	7 x 19	14,400	12,000	24.30

Table II. Construction and dimensional properties of type II wire rope jacket tolerance.

Nominal Diameter of Wire Rope	Construction	Outside Diameter of Jacket	Tolerance on Jacket O.D. (Plus Only)	Jacket Wall Thickness (Reference)	Approximate Weight per 100 ft
In.		In.	In.	In.	lbs
1/32	3 x 7	3/64	.008	.008	0.22
3/64	7 x 7	1/16	.010	.008	0.49
3/64	7 x 7	5/64	.012	.016	0.76
1/16	7 x 7	3/32	.012	.016	0.93
1/16	7 x 7	1/8	.014	.031	1.18
1/16	7 x 19	3/32	.012	.016	0.93
1/16	7 x 19	1/8	.014	.031	1.18
3/32	7 x 7	1/8	.014	.016	1.85
3/32	7 x 7	5/32	.016	.031	2.18
3/32	7 x 19	1/8	.014	.016	1.99
3/32	7 x 19	5/32	.016	.031	2.32
1/8	7 x 19	3/16	.018	.031	3.62
5/32	7 x 19	7/32	.018	.031	6.10
5/32	7 x 19	9/32	.022	.063	7.51
3/16	7 x 19	1/4	.018	.031	7.75
3/16	7 x 19	5/16	.022	.063	9.20
7/32	7 x 19	9/32	.020	.031	9.76
7/32	7 x 19	11/32	.024	.063	11.55
1/4	7 x 19	5/16	.020	.031	12.30
1/4	7 x 19	3/8	.024	.063	14.42
9/32	7 x 19	13/32	.024	.063	16.18
5/16	7 x 19	1/2	.024	.063	19.80
3/8	7 x 19	1/2	.027	.063	27.20

Table III. Breaking strength of type I after endurance testing.

COMPOSITION		A			B		
Nominal Diameter of Bare Wire Rope	Construction	Tension Load (Min) 1/ 4/	Number of Reversals**	Minimum Breaking Strength 2/	Tension Load (Min) 1/ 4/	Number of Reversals**	Minimum Breaking Strength 3/
In.		lbs		lbs	lbs		lbs
1/32	3 x 7	1.0	70,000	55	1.0	70,000	66
3/64	7 x 7	3.0	70,000	135	3.0	70,000	162
1/16	7 x 7	5.0	70,000	240	5.0	70,000	288
1/16	7 x 19	5.0	70,000	240	5.0	70,000	288
3/32	7 x 7	9.0	70,000	460	9.0	70,000	552
3/32	7 x 19	9.0	70,000	500	9.0	70,000	552
1/8	7 x 19	18.0	70,000	1,000	18.0	70,000	1,056
5/32	7 x 19	24.0	130,000	1,400	24.0	130,000	1,440
3/16	7 x 19	37.0	130,000	2,100	37.0	130,000	2,220
7/32	7 x 19	50.0	130,000	2,800	50.0	130,000	3,000
1/4	7 x 19	64.0	130,000	3,500	64.0	130,000	3,840
9/32	7 x 19	78.0	130,000	4,000	78.0	130,000	4,680
5/16	7 x 19	90.0	130,000	4,900	90.0	130,000	5,400
3/8	7 x 19	120.0	130,000	7,200	120.0	130,000	7,200

** - 1 cycle = 2 reversals

1/ - Tension is equal to one half the weight (w) which includes idler sheave and hanger.

2/ - Equal to 50 percent of the original minimum breaking strength.

3/ - Equal to 60 percent of the original minimum breaking strength.

4/ - The magnitude of the tension loads are test parameters only and are by no means intended as design criteria.

Table IV. Breaking strength of type II after endurance testing.

COMPOSITION		A			B		
Nominal Diameter of Bare Wire Rope	Construction	Tension Load (Min) 1/ 3/	Number of Reversals**	Minimum Breaking Strength 2/	Tension Load (Min) 1/ 3/	Number of Reversals**	Minimum Breaking Strength 2/
In.		lbs		lbs	lbs		lbs
1/32	3 x 7	1.0	200,000	66	1.0	200,000	66
3/64	7 x 7	3.0	200,000	162	3.0	200,000	162
1/16	7 x 7	5.0	200,000	288	5.0	200,000	288
1/16	7 x 19	5.0	200,000	288	5.0	200,000	288
3/32	7 x 7	9.0	200,000	552	9.0	200,000	552
3/32	7 x 19	9.0	200,000	600	9.0	200,000	552
1/8	7 x 19	18.0	200,000	1,200	18.0	200,000	1,056
5/32	7 x 19	24.0	500,000	1,680	24.0	500,000	1,440
3/16	7 x 19	37.0	500,000	2,520	37.0	500,000	2,220
7/32	7 x 19	50.0	500,000	3,360	50.0	500,000	3,000
1/4	7 x 19	64.0	500,000	4,200	64.0	500,000	3,840
9/32	7 x 19	78.0	500,000	4,800	78.0	500,000	4,680
5/16	7 x 19	90.0	500,000	5,880	90.0	500,000	5,400
3/8	7 x 19	120.0	500,000	8,640	120.0	500,000	7,200

** - 1 cycle = 2 reversals

1/ - Tension is equal to one half the weight (w) which includes idler sheave and hanger.

2/ - Equal to 60 percent of the original minimum breaking strength.

3/ - The magnitude of the tension loads are test parameters only and are by no means intended as design criteria.

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*Table V. Qualification tests and quality conformance tests and inspections.

TESTS	REQUIREMENT PARA	QUALIFICATION PARA	QUALITY CONFORMANCE PARA
Ductility of steel	3.4.1.1	4.5.1.1	4.5.1.1
Adherence of coating	3.4.1.2	4.5.1.2	4.5.1.2
Identification of product	3.5 - 3.5.2.1	4.5.11	4.5.11
Examination of product	3.6 - 3.6.1.1	4.5.2, 4.5.2.1, 4.5.2.2	4.5.2, 4.5.2.1, 4.5.2.2
Breaking strength	3.4.2	4.5.3	4.5.3
Endurance for type I	3.4.3	4.5.4, 4.5.4.1, 4.5.4.2	4.5.4, 4.5.4.2,
Endurance for type II	3.4.4	4.5.5, 4.5.5.1, 4.5.5.2	4.5.5, 4.5.5.2
Stretch limits	3.4.5	4.5.6	4.5.6
Test load	3.4.6	4.5.7 - 4.5.7.1	4.5.7 - 4.5.7.1
Tin and zinc coating	3.2.3.1, 3.2.3.2	4.5.8.1 - 4.5.8.1.3	-
Low temperature flexibility	3.4.8	4.5.9	-
Resistance to fluids	3.4.9	4.5.10	-

Table VI. Dimensions of steel sheave** used in type I endurance test.

Nominal Diameter of Wire Rope (d)	Construc- tion	Sheave Ratio to 1		C 1/ 2/	G 1/	D	Er
		Composition A & B Rm Temp Test	Composition A -65°F (-54°C) Test	+1/64 -1/64	+1/64 -1/64	+ .005 - .000	+ .002 - .000
In.				In.	In.	In.	In.
1/32	3 x 7	18.0	23.0	0.703	3/8	0.562	.025
1/32	3 x 7			0.814	3/8	0.750	.025
3/64	7 x 7	12.0	16.0	0.703	3/8	0.562	.025
3/64	7 x 7			0.891	3/8	0.750	.025
1/16	7 x 7	12.0	16.0	0.938	3/8	0.750	.036
1/16	7 x 7			1.188	3/8	1.000	.036
1/16	7 x 19	7.0	9.5	0.625	3/8	0.438	.036
1/16	7 x 19			0.782	3/8	0.594	.036
3/32	7 x 7	13.0	14.0	1.406	3/8	1.220	.052
3/32	7 x 7			1.594	3/8	1.313	.052
3/32	7 x 19	7.0	9.5	0.938	3/8	0.656	.052
3/32	7 x 19			1.172	3/8	0.891	.052
1/8	7 x 19	7.0	9.5	1.250	3/8	0.875	.069
1/8	7 x 19			1.562	3/8	1.188	.069
5/32	7 x 19	9.5	9.5	1.953	3/8	1.484	.086
3/16	7 x 19	9.5	9.5	2.343	1/2	1.781	.102
7/32	7 x 19	9.5	9.5	2.734	1/2	2.078	.118
1/4	7 x 19	9.5	9.5	3.125	1/2	2.375	.134
9/32	7 x 19	9.5	9.5	3.515	1/2	2.671	.150
5/16	7 x 19	9.5	9.5	3.907	9/16	2.969	.167
3/8	7 x 19	9.5	9.5	4.687	9/16	3.562	.200

1/ - Reference numbers, not a mandatory dimension. Left to manufacturers discretion.

2/ - $C = D + 3d$

** - The dimensions of the test sheaves are test parameters only and are by no means intended as design criteria.

Table VII. Dimensions of steel sheaves** used in type II endurance test.

Nominal Diameter of Wire Rope (d)	Construc- tion	Sheave Ratio to 1 (O.D.)	Outside Diameter Jacket (O.D.)	C 1/ 2/	G 1/	D	Er
				+1/64 -1/64	+1/64 -1/64	+.005 -.000	+.002 -.000
In.				In.	In.	In.	In.
1/32	3 x 7	16.0	3/64	0.938	3/8	0.750	.036
3/64	7 x 7	12.0	1/16	0.938	3/8	0.750	.036
3/64	7 x 7	12.0	5/64	1.172	3/8	0.938	.044
1/16	7 x 7	12.0	3/32	1.405	3/8	1.125	.052
1/16	7 x 7	12.0	1/8	1.875	3/8	1.500	.069
1/16	7 x 19	7.0	3/32	0.938	3/8	0.656	.052
1/16	7 x 19	7.0	1/8	1.250	3/8	0.875	.069
3/32	7 x 7	12.0	1/8	1.875	3/8	1.500	.069
3/32	7 x 7	12.0	5/32	2.344	3/8	1.875	.086
3/32	7 x 19	7.0	1/8	1.250	3/8	0.875	.069
3/32	7 x 19	7.0	5/32	1.563	3/8	1.094	.086
1/8	7 x 19	7.0	3/16	1.875	3/8	1.313	.102
5/32	7 x 19	9.5	7/32	2.734	3/8	2.078	.118
5/32	7 x 19	9.5	9/32	3.515	3/8	2.671	.150
3/16	7 x 19	9.5	1/4	3.125	1/2	2.375	.134
3/16	7 x 19	9.5	5/16	3.907	1/2	2.969	.167
7/32	7 x 19	9.5	9/32	3.515	1/2	2.671	.150
7/32	7 x 19	9.5	11/32	4.296	1/2	3.265	.184
1/4	7 x 19	9.5	5/16	3.907	1/2	2.969	.167
1/4	7 x 19	9.5	3/8	4.687	1/2	3.562	.200
9/32	7 x 19	9.5	13/32	5.078	1/2	3.859	.215
5/16	7 x 19	9.5	7/16	5.469	9/16	4.156	.231
3/8	7 x 19	9.5	1/2	6.250	9/16	4.750	.263

1/ - Reference numbers, not a mandatory dimension. Left to manufacturers discretion.

2/ - $C = D + 3d$

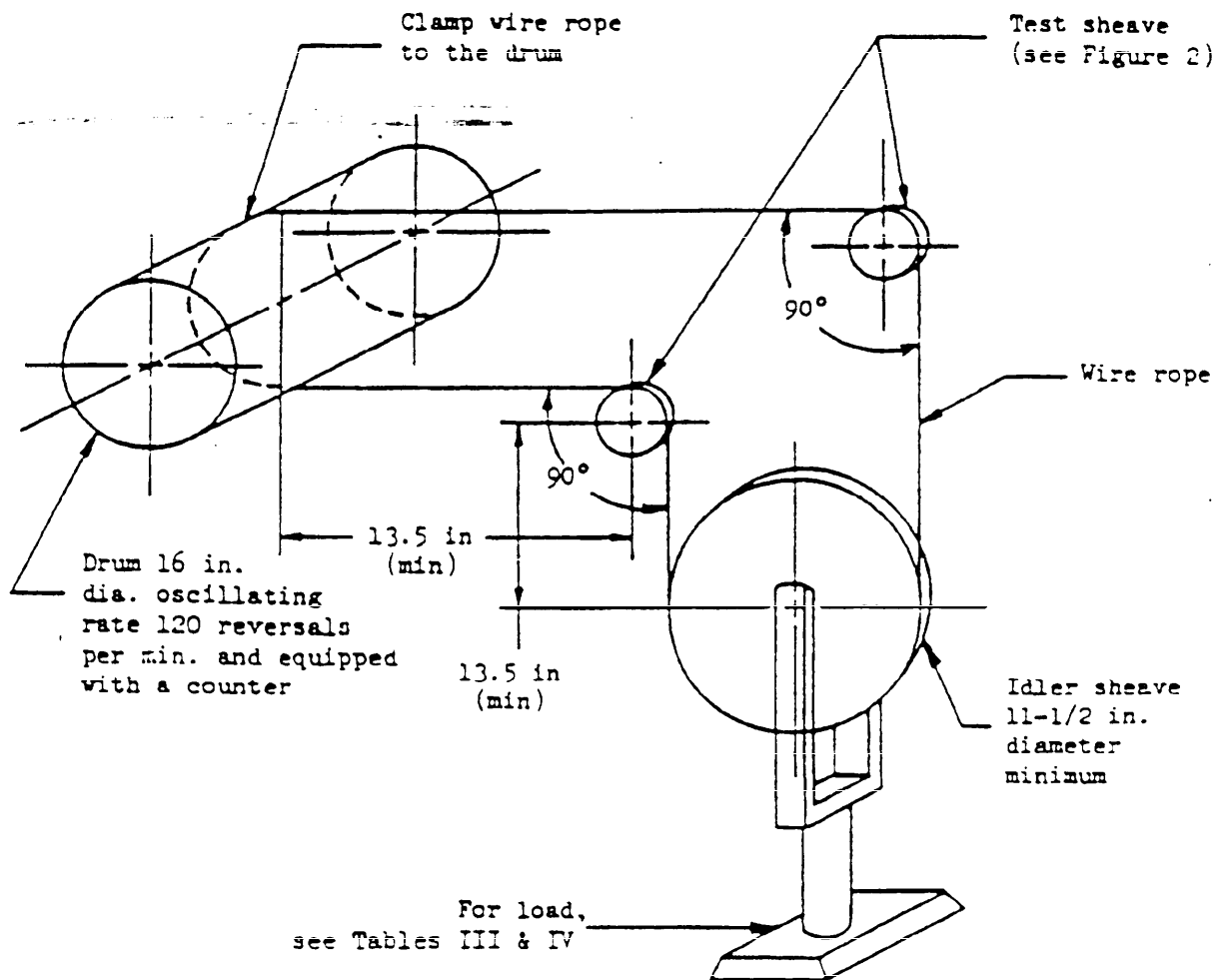
** - The dimensions of the test sheaves are test parameters only and are by no means intended as design criteria.

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Table VIII. Dimensions of reels per wire rope size.

Overall 1/ Diameter of Wire Rope	1,000 Ft		3,000 Ft	
	Minimum Diameter of Drum	Diameter of Arbor Hole	Minimum Diameter of Drum	Diameter of Arbor Hole
	In	In	In	In
1/32	4	1-1/8	6	1-1/8
3/64	4	1-1/8	6	1-1/8
1/16	6	1-1/8	8	1-1/8
3/32	6	1-1/8	10	1-1/8
1/8	8	1-1/8	10	2-1/8
5/32	8	1-1/8	10	2-1/8
3/16	8	2-1/8	10	2-1/8
7/32	8	2-1/8	10	2-1/8
1/4	10	2-1/8	12	2-1/8
9/32	10	2-1/8	12	2-1/8
5/16	12	2-1/8	12	2-1/8
3/8	12	2-1/8	12	2-1/8
	5,000 Ft		10,000 Ft	
1/32	8	1-1/8	10	1-1/8
3/64	8	1-1/8	10	1-1/8
1/16	10	1-1/8	12	2-1/8
3/32	10	1-1/8	12	2-1/8
1/8	10	1-1/8	12	2-1/8
5/32	12	2-1/8	12	2-1/8
3/16	12	2-1/8	12	2-1/8
7/32	12	2-1/8	12	3-1/8
1/4	12	2-1/8	18	3-1/8
9/32	12	2-1/8	18	3-1/8
5/16	12	2-1/8	18	3-1/8
3/8	16	2-1/8	18	3-1/8

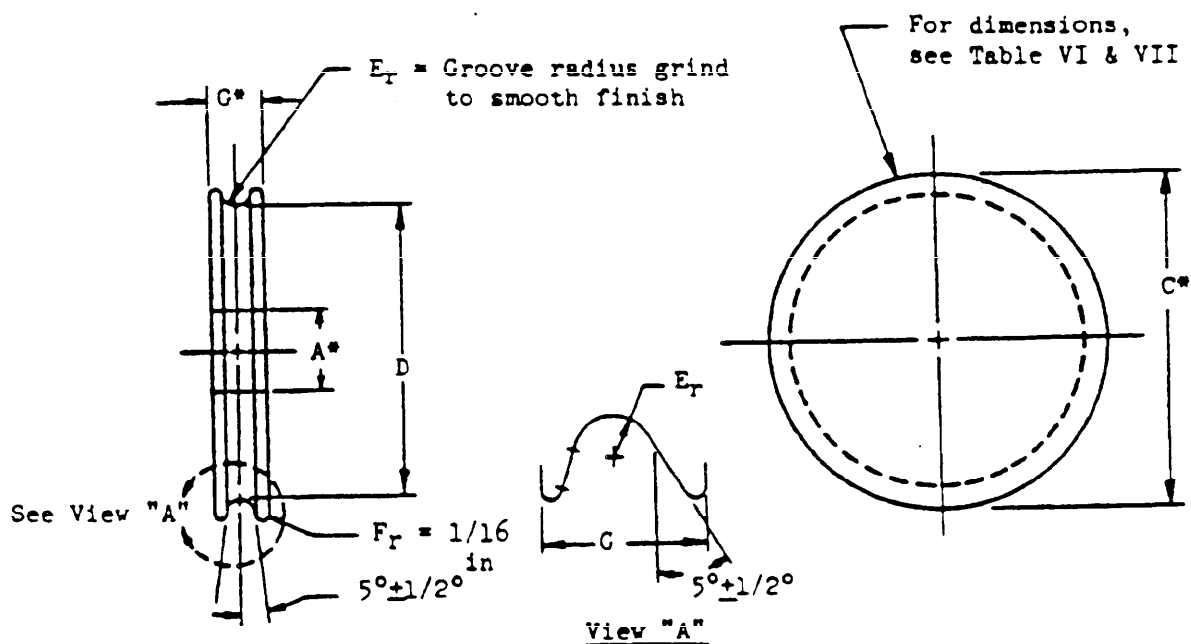
1/ For type II the wire rope size is the diameter of the wire rope with the nylon jacket.



NOTE: The dimensions of the test sheaves are test parameters only and are by no means intended as design criteria.

Figure 1. Diagram of endurance testing machine and conditions of the test.

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*NOTE: These dimensions are only reference numbers; these may be varied by the manufacturer

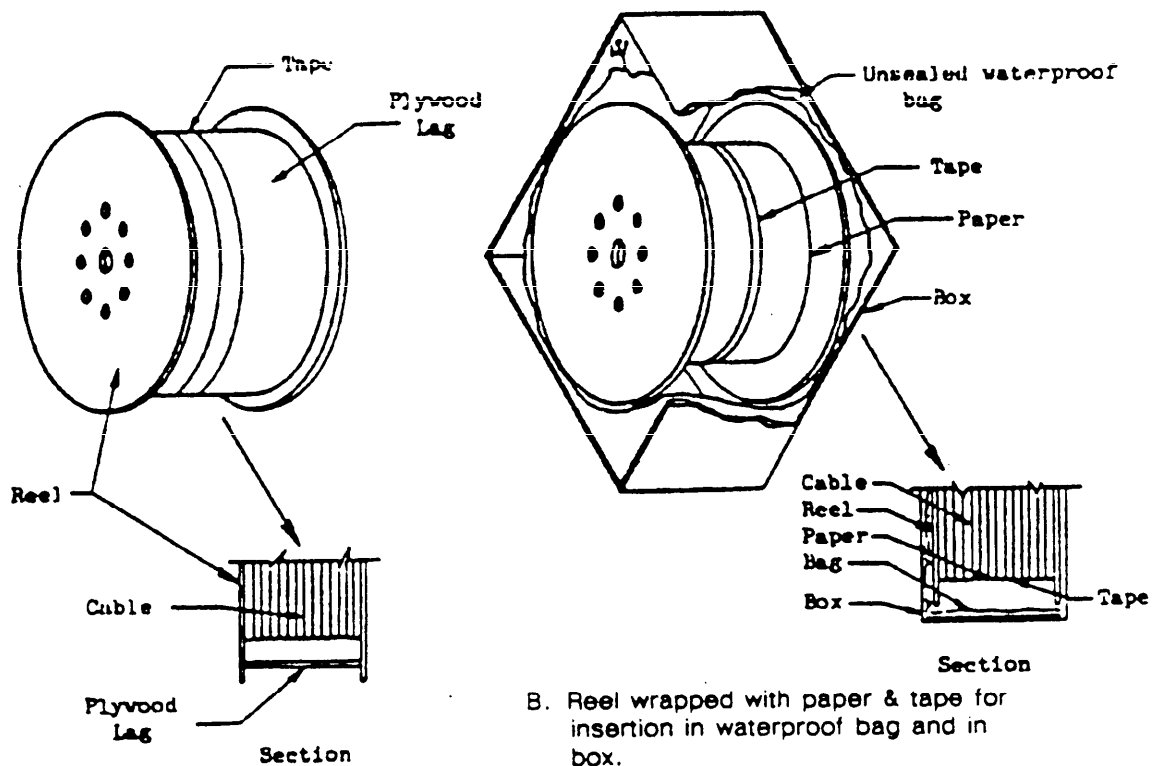
Material: Tool Steel

Heat Treat: Harden to Rockwell C60 minimum.

NOTE: "A" support sheaves on suitable ball or roller bearing or shaft extensions supported on suitable ball or roller bearings.

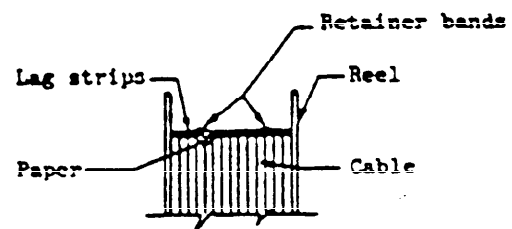
The dimensions of the test sheaves are test parameters only and are by no means intended as design criteria.

Figure 2. Test sheaves used in standard endurance test.

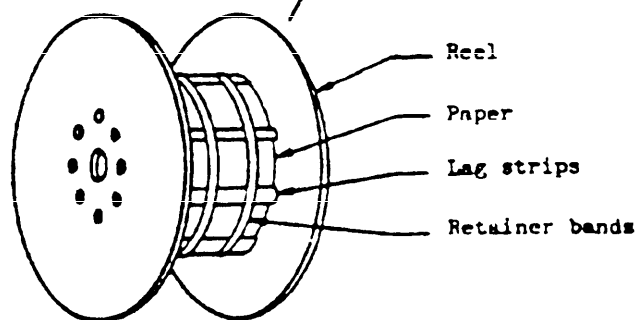


- A. Reel enclosed with flexible plywood lagging.
NOTE: The plywood lagging may optionally cover the outer edge of the reel.

- B. Reel wrapped with paper & tape for insertion in waterproof bag and in box.



- C. Reel enclosed with outside wirebound wood lagging.



- D. Reel wrapped with paper secured with spaced lagging strips held with retainer bands.

*Figure 3. Illustrations of acceptable packaging methods.

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(Project 4010-0200)

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