

MIL - W - 7072B(ASG)

4 SEPTEMBER 1962

Superseding
MIL-W-7072A(ASG)
25 September 1956

MILITARY SPECIFICATION

WIRE, ELECTRIC, 600-VOLT, ALUMINUM, AIRCRAFT, GENERAL SPECIFICATION FOR

This specification has been approved by the Department of the Air Force and by the Bureau of Naval Weapons.

1. SCOPE

1.1 Scope.-- This specification covers 600-volt insulated single aluminum conductors capable of continuous operation at a maximum conductor temperature of 105° C (221° F). This wire is suitable for use in aircraft using any combination of electrical loading and ambient temperatures providing that the maximum conductor temperature is not exceeded.

1.2 Classification.-- The wire shall be as specified in the applicable MS standard (see 6.2).

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

J-C-98	Cable and Wire, Insulated; Methods of Sampling and Testing
NN-P-515	Plywood, Container Grade
UU-P-271	Paper, Wrapping, Waterproofed Kraft
UU-T-450	Tissue, Facial
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner

FSC 6145

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Military

MIL-A-140	Adhesive, Water-Resistant, Waterproof Barrier-Material
MIL-C-572	Cords, Yarns and Monofilaments Organic Synthetic Fiber
MIL-Y-1140	Yarn, Cord, Sleeving, Cloth, and Tape--Glass
MIL-T-5438	Tester, Abrasion, Electrical Cable
MIL-F-5566	Fluid, Anti-Icing (Isopropyl Alcohol)
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance
MIL-J-5624	Jet Fuel, Grades JP-4 and JP-5
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

STANDARDSMilitary

MIL-STD-104	Limits for Electrical Insulation Color
MIL-STD-105	Sampling Procedures and Tables for Inspection By Attributes
MIL-STD-109	Inspection Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage

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

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

National Bureau of Standards

Circular No. 31, Copper Wire Tables
3rd Edition

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

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3. REQUIREMENTS

3.1 Qualification.- The wire furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein and has been listed on or approved for listing on the applicable Qualified Products List.

3.2 Materials.- All polyvinyl chloride and polyamide materials shall be certified virgin materials. Virgin material shall be defined as 100 percent new material which has only been through the processes essential to its manufacture or its application to the wire, or both, and has been through these essential processes one time only. Any material which has previously been processed in any other manner shall be considered nonvirgin material.

3.2.1 Conductor.- The conductor strands used shall be electrical conductor (E.C.) grade, (electrical conductivity, minimum 60.5 average 61.0 percent of international annealed copper standard wire, in accordance with National Bureau of Standards Circular No. 31) hard-drawn aluminum wire from the best obtainable aluminum wire bars. Strands shall be free from lumps, kinks, splits, abrasions, scraped or corroded surfaces, and skin impurities. The average tensile strength of individual strands, selected at random from the finished wire, shall be not less than 20,000 pounds per square inch (psi), and not greater than 32,000 psi.

3.2.2 Insulation.-

3.2.2.1 Primary insulation.- The primary insulation shall be extruded polyvinyl chloride.

3.2.2.2 Glass braid.- A tightly woven glass braid conforming to the physical properties listed for ECG 150-1/0 glass yarn specified in Specification MIL-Y-1140 shall be used to cover the primary insulation. The braid shall be treated with suitable finishers to facilitate stripping and minimize wicking.

3.2.2.3 Outer surface.- The outer surface shall be braided nylon impregnated with nylon finisher. The nylon fibers used shall conform to type P, Form Y in accordance with Specification MIL-C-572.

3.3 Design and construction.- The wire shall consist of an aluminum stranded conductor covered by insulation and shall be in accordance with the applicable MS standard.

3.3.1 Conductor.-

3.3.1.1 Stranding.- Wire size 8 shall be as specified in table I. The direction of lay of the outer layer of strands shall be left hand, and the length of lay of the outer layer of strands shall be not less than 8 nor more than 16 times the outside diameter of the finished conductor. The length of lay of the inner strands, beneath the outer layer, shall be optional, except that the length of lay of the inner strands shall be less than the length of lay of the outer layer of strands.

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TABLE I
Conductor details

Wire size	Nominal conductor area (cir. mils)	Stranding	Allowable number of missing strands	Diameter of stranded conductor (inches)	Maximum resistance at 20° C (68° F) (ohms/1,000 ft.)
8	16,564	41 by 24	0	0.155 ±0.005	1.093
6	28,280	7 by 10 by 24	0	0.206 ±0.005	0.641
4	42,420	7 by 15 by 24	0	0.255 ±0.007	0.427
2	67,872	7 by 24 by 24	2	0.320 ±0.010	0.268
1	84,840	7 by 30 by 24	2	0.358 ±0.010	0.214
0	107,464	19 by 14 by 24	3	0.408 ±0.010	0.169
00	138,168	19 by 18 by 24	3	0.466 ±0.012	0.133
000	168,872	19 by 22 by 24	4	0.523 ±0.012	0.109
0000	214,928	19 by 28 by 24	5	0.575 ±0.012	0.085

3.3.1.2 Wire sizes 6 through 0000 shall be as specified in table I and rope lay as follows:

- (a) Members of rope lay stranded conductors: the length of lay of the wires composing the stranded members shall be not greater than 16 times the outside diameter of the member. Stranding of the individual members may be either concentric or bunch. The direction of lay of the individual strands of each member shall be left hand.
- (b) Rope lay stranded conductors shall be laid up concentrically; a central core surrounded by one or more helically wound members. The direction of lay for successive layers shall be in the same direction (unidirectional lay) and shall be left hand. The length of lay of the outer layer of rope lay stranded members forming the conductor shall be not less than 10 nor more than 14 times the outside diameter of the completed conductor. The length of lay of the inner layer of the stranded members shall be less than the length of lay of the outer layer of stranded members.

3.3.1.3 Splices.— Where splices are necessary, an individual strand may be mechanically joined by butt welding or twisting. Splices shall not be closer together than 10 feet in a bunch of the 8-gage conductor or in a member of a rope lay conductor. Splices of any member of a rope lay conductor or of a whole conductor shall not be permitted.

3.3.1.4 Conductor diameter.— The diameter of the stranded conductor shall be as specified in table I.

3.3.2 Insulation.—

3.3.2.1 Concentricity.— The primary insulation shall be extruded concentrically around the conductor. It shall fit snugly but strip freely without adherence. The concentricity shall be not less than 70 percent when measured in accordance with 4.5.3.1.

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3.3.2.2 Elongation.- Elongation of the primary insulation, shall be not less than 1-1/2 inches (2-inch specimen stretched to 3-1/2 inches), when measured in accordance with 4.5.3.2.

3.3.2.2.1 Elongation after accelerated aging.- The primary insulation of the wire shall have an elongation after the accelerated aging specified in 4.5.3.3 of at least 70 percent of the elongation of the unaged specimen for qualification testing and 90 percent of the elongation of the unaged specimen for acceptance testing.

3.3.2.3 Extruded insulation flaws.- One hundred percent of the wire after the application of the primary insulation and prior to the application of any other material shall pass the test specified in 4.5.3.4 without electrical breakdown.

3.4 Finished wire.-

3.4.1 Wire diameter.- The diameter of the finished wire shall be within the dimensional tolerances specified in the applicable MS standard.

3.4.2 Wire weight.- The weight of the finished wire shall not exceed the values specified in the applicable MS standard when measured in accordance with 4.5.4.3.

3.4.3 Wire outer surface.- The outer surface of the wire shall be non-corrosive and flexible and shall be finished smooth. Adjacent layers of the wire, when wound on a reel, shall not stick to one another at any temperature under 105° C (221° F).

3.4.4 Color.- The color of the finished wire shall be white in accordance with Standard MIL-STD-104.

3.4.5 Conductor resistance.- The resistance of the conductor of the finished wire shall not exceed the values specified in table I, when measured in accordance with 4.5.4.10.

3.4.6 Finished wire flaws.- One hundred percent of the finished wire shall pass the test specified in 4.5.4.1 without electrical breakdown.

3.4.7 Life cycle.- Following the tests specified in 4.5.4.4.1 and 4.5.4.4.2, there shall be no cracking of the outer surface of the primary insulation, as viewed visually without magnification. The test specimen shall then pass the test specified in 4.5.4.4.3 without electrical breakdown or flashover. The insulation shall not cause pitting of the conductor during the test specified in 4.5.4.4.4.

3.4.8 Cold bend.- The wire shall withstand a temperature of -55° ±2° C (-67° ±4° F) without cracking of the outer surface or extruded insulation, as viewed visually without magnification, when tested in accordance with 4.5.4.5. The test specimen shall then pass the test specified in 4.5.4.4.3 without electrical breakdown or flashover.

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3.4.9 Immersion.- After being subjected to the test specified in 4.5.4.6, the finished wire shall show no evidence of cracking of the outer surface or extruded insulation, as viewed visually without magnification, and shall withstand the test specified in 4.5.4.4.3 without electrical breakdown or flashover. The increase in diameter of the finished wire shall not exceed 5 percent.

3.4.10 Flammability.- The flame rate of travel along the wire during the test specified in 4.5.4.7 shall not exceed 3 inches per minute and shall be self-extinguishing within 30 seconds after removal of flame. Burning particles or drippings, if any, shall not cause the tissue paper to burst into flames. Charred holes or charred spots in the tissue paper do not constitute failure.

3.4.11 Abrasion resistance.- The abrasion resistance shall be not less than that specified in the applicable MS standard when tested in accordance with 4.5.4.8 for a previously untested wire specimen. Wire tested in accordance with 4.5.4.8.2 shall have an abrasion resistance not less than 70 percent of that specified in the applicable MS standard.

3.4.12 Smoke.- The finished wire shall not give off visible smoke when tested in accordance with 4.5.4.9.

3.4.13 Stripping.- All insulation shall be readily removable by conventional wire-stripping devices.

3.5 Identification of product.- The finished wire shall be identified by a printed marking applied to the outer surface. The printing shall be light green in color, in intervals of not more than 3 feet (from beginning to beginning), and in accordance with Standard MIL-STD-104, except that the dark limit shall be Munsell 10.0 GY 5.5/8.0 (renotation). The printed identification shall consist of the following legend:

MS part number
 Manufacturer's code designation (as provided in the
 Federal Supply Cataloging System)

3.5.1 Use of AN, MIL, or MS designations.- AN, MIL, or MS designations shall not be applied to a product, except for qualification inspection samples, nor referred to in correspondence, until notice of approval has been received from the activity responsible for qualification.

3.6 Workmanship.- The wire shall be constructed and finished in a manner in accordance with high grade cable production technique. It shall be free from lumps, kinks, splits, abrasions, scraped or corroded surfaces, and skin impurities (see 4.5.1).

4. QUALITY ASSURANCE PROVISIONS

4.1 Inspection responsibility.- The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.2 Classification of inspection.- The inspection of wire shall be classified as follows:

- (a) Qualification inspection (4.3)
- (b) Acceptance inspection (4.4)

4.3 Qualification inspection.-

4.3.1 Sampling instructions.- Qualification inspection samples upon which qualification is desired shall consist of 100 feet of finished wire for each of wire sizes 6 and 0. Two feet of each size strand used in the manufacture of wire samples shall be submitted with the wire qualification inspection samples. When approved, wire size 6 will qualify wire sizes 8 through 2, and wire size 0 will qualify wire sizes 1 through 0000.

4.3.1.1 Samples and manufacturer's test report shall be forwarded to the testing laboratory designated in the letter of authorization from the activity responsible for qualification (see 6.3). Samples shall be plainly identified by securely attached durable tags marked with the following information:

Sample for qualification inspection
 WIRE, ELECTRIC, 600-VOLT, ALUMINUM, AIRCRAFT
 MS part number
 Name of manufacturer and manufacturer's code designation
 Manufacturer's identification (catalog number, brand, code, etc.)
 Comprehensive description and prime manufacturer's name and
 formulation number of the base materials from which the product
 is made. (This information will not be divulged by the Government.)
 Primary insulation
 Braid (when applicable)
 Outside protective coating
 Additional information not covered by above

4.3.2 Inspection.- Qualification inspection of wire shall consist of all the tests specified in 4.5.

4.4 Acceptance inspection.-

4.4.1 Definitions.- Standard MIL-STD-109 shall apply for definitions of inspection terms used herein. For the purpose of this specification, the following definitions shall apply.

4.4.1.1 Inspection lot.- An inspection lot shall consist of all units of product with a single MS part number offered for inspection at one time except that the inspection lot shall not exceed 300 units of product or one week's production, whichever is less.

4.4.1.2 Unit of product.- A unit of product is one continuous length of finished wire as offered for inspection.

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4.4.1.3 Sample.- A sample is one or more units of product chosen at random from any one inspection lot for the purpose of inspection. The sample size or number of units of product to be chosen from each inspection lot is determined by the sampling plan.

4.4.1.4 Specimen.- A specimen is a length of wire cut from each sample unit and of sufficient length to permit the performance of each inspection.

4.4.2 Inspection.- Acceptance inspection shall consist of the examinations and tests listed in table II and specified in 4.5.

TABLE II

Acceptance inspection

Group	Inspection	Requirement	Examination or test
I	Conductor tensile	3.2.1	4.5.2
	Conductor stranding	3.3.1.1	4.5.1
	Conductor diameter	3.3.1.4	4.5.4.2
	Conductor resistance	3.4.5	4.5.4.10
	Finished wire outer surface	3.4.3	4.5.1
	Finished wire diameter	3.4.1	4.5.4.2
	Finished wire weight	3.4.2	4.5.4.3
	Identification of product	3.5	4.5.1
II	Concentricity	3.3.2.1	4.5.3.1
	Primary insulation elongation	3.3.2.2	4.5.3.2
	Abrasion	3.4.11	4.5.4.8
III	Primary insulation accelerated aging	3.3.2.2.1	4.5.3.3
	Flammability	3.4.10	4.5.4.7
	Cold bend	3.4.8	4.5.4.5
	Smoke	3.4.12	4.5.4.9
	Life cycle	3.4.7	4.5.4.4
	Dielectric	3.4.7	4.5.4.4.3

4.4.3 Sampling for acceptance inspection.- For each group of inspections a random sample of the size specified shall first be selected from an inspection lot. Then, from each sample, unit specimens of sufficient length shall be selected for the specified inspections.

4.4.3.1 Group I inspections.- Group I inspections are for minor defects. Sampling inspection for group I inspections shall be in accordance with Standard MIL-STD-105, using an Acceptance Quality Level (AQL) of 6.5 percent. Inspection levels L-5 and L-4 shall be used for normal and reduced inspection, respectively.

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4.4.3.2 Group II inspections.- Group II inspections are for those major defects which result from random deficiencies in the process of insulating the wire. Sampling inspections for group II inspections shall be in accordance with Standard MIL-STD-105, using an AQL of 1.5 percent. Inspection levels L-7 and L-6 shall be used for normal and reduced inspection, respectively.

4.4.3.3 Group III inspections.- Group III inspections are for those defects which result from inferior or substitute materials and which are usually common to the entire inspection lot. These inspections are relatively costly and time consuming; as such they are not applicable to statistical sampling. Sampling inspection for group III inspections shall be two samples for inspection lots of less than 250,000 feet of wire and three samples for inspection lots of over 250,000 feet of wire, with an acceptance number of zero and a rejection number of one.

4.4.4 Process control inspection.- These inspections are of such a nature that they cannot be performed on finished wire submitted for inspection and, therefore, must be conducted at the most appropriate stage of manufacturing operations. The process control inspections shall consist of the tests listed in table III.

TABLE III

Process control inspection

Examination	Requirement	Test
Conductor material	3.2.1	4.5.2
Splices	3.3.1.3	4.5.1
Extruded insulation flaws (primary)	3.3.2.3	4.5.3.4
(finished)	3.4.6	4.5.4.1

4.4.4.1 Sampling for process control inspection.-

4.4.4.1.1 Conductor material.- From each week's production of individual strands or from every 1,000 pounds of finished strand, whichever is less, three 10-foot lengths of strand shall be selected in such a manner as to be representative of the material to be used in the finished insulated wire.

4.4.4.1.2 Splices.- The manufacturer's method of splicing individual strands shall be subject to observation by the Government inspector.

4.4.4.1.3 Insulation flaws.- One hundred percent of the wire after application of the primary insulation, and 100 percent of the finished wire, shall be submitted to the tests specified in 4.5.3.4 and 4.5.4.1, respectively.

4.5 Test methods.-

4.5.1 Examination of product.- All samples of wire shall be carefully examined for conformance to all requirements of this specification not covered by specific tests.

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4.5.2 Conductor tensile.— Tensile tests on the aluminum strand shall be conducted in accordance with Method 3211 of Specification J-C-98. The strand shall be pulled at a uniform rate not to exceed 12 inches per minute.

4.5.3 Primary insulation.—

4.5.3.1 Concentricity.— The concentricity of the primary insulation shall be determined by first locating and recording the minimum wall thickness measured on a cross section of the insulation. From this point on the outer rim of the insulation or extrusion at which the minimum wall thickness was measured, three more reference points 90 degrees apart on the outside rim of the insulation shall be established. At each of these three reference points, select the nearest stranded member of the rope lay conductor on the outermost strand of the size 8 conductor, and measure the insulation wall thickness between that member of the rope lay conductor or the outermost strand of the size 8 conductor and the outer rim of the primary insulation. The average of the four readings shall be considered to be the average wall thickness. The ratio of the minimum wall thickness to the average wall thickness times 100 shall define the percent concentricity. A wall thickness measurement shall be interpreted to be the minimum distance between the outer rim of the primary insulation and the rim of the outermost strand of the stranded member of the rope-lay conductor or the outer rim of the outermost strand of the size 8 conductor. All wall thickness measurements shall be determined under suitable magnification.

4.5.3.2 Elongation (insulation).— Specimens of the primary insulation removed from a finished wire shall be subjected to the test specified in Method 3031 of Specification J-C-98.

4.5.3.3 Accelerated aging.—

4.5.3.3.1 For qualification.— Specimens of primary insulation, removed from finished wire and of a suitable shape, shall be placed in a vented gravity convection-type oven at $113^{\circ} \pm 2^{\circ} \text{ C}$ ($235^{\circ} \pm 4^{\circ} \text{ F}$) and maintained at this temperature for a period of 60 days. The elongation of the specimens shall be measured within 16 to 48 hours after removal from the air oven in accordance with the procedure of Method 3031 of Specification J-C-98.

4.5.3.3.2 For acceptance.— Specimens of primary insulation, removed from the finished wire, shall be aged and tested in accordance with 4.5.3.3.1, except that the oven shall be maintained at a temperature of $135^{\circ} \pm 2^{\circ} \text{ C}$ ($275^{\circ} \pm 4^{\circ} \text{ F}$) and the time shall be 4 days.

4.5.3.4 Extruded insulation flaws.— The wire, after application of the extruded primary insulation and prior to the application of any other material, shall be passed through a chain-electrode spark-test device, using the voltage specified in the applicable MS standard. The electrode shall be of a suitable bead chain of fine mesh construction that will give intimate metallic contact with practically all the wire insulation surface. Electrode length and speed of wire movement shall be such that the insulation is subjected to the test voltage for a minimum of 0.2 second.

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4.5.4 Finished wire.-

4.5.4.1 Finished wire flaw test.- The wire shall be passed through a suitable chain-electrode spark-test device, using the voltage shown in the applicable MS standard under "finished wire".

4.5.4.2 Dimensional examination.- The wire shall be given a careful visual and dimensional examination to determine conformance with the applicable MS standard.

4.5.4.3 Wire weight.- The weight of each lot of finished wire shall be determined by 4.5.4.3.1. When a referee test is required the test specified in 4.5.4.3.2 shall be used. Acceptance inspection sampling shall not apply to 4.5.4.3.2.

4.5.4.3.1 The length and weight of a specimen at least 10 feet long shall be accurately measured with the resultant measurements transposed to pounds per 1,000 feet.

4.5.4.3.2 The net weight of the finished wire on each reel or spool shall be obtained by subtracting the tare weight of the reel or spool from the gross weight of the reel or spool containing the finished wire. The net weight of wire on each reel or spool shall be divided by the accurately determined length of finished wire on that reel or spool and the resultant transposed to pounds per 1,000 feet. When wood or other moisture-absorbent materials are used for reel or spool construction, weight determination shall be made under substantially the same conditions of relative humidity.

4.5.4.4 Life cycle.-

4.5.4.4.1 Air oven.- One inch of the insulation shall be removed from each end of a 24-inch sample of the finished wire. The central portion of the specimen shall then be bent at least half way around a cylindrical mandrel having a diameter as specified in the applicable MS standard. Each end of the conductor shall be loaded in such a manner that the portion of the compound between the conductor and mandrel is under compression while the conductor is under the tension specified in the applicable MS standard. The condition shall be maintained for a period of 120 hours in an air oven maintained at a constant temperature of $121^{\circ} \pm 2^{\circ} \text{C}$ ($250^{\circ} \pm 4^{\circ} \text{F}$). After completion of this test, the specimen shall be cooled to $25^{\circ} \pm 10^{\circ} \text{C}$ ($77^{\circ} \pm 18^{\circ} \text{F}$) within a period of 1 hour. When cooled, the wire shall be freed from tension, removed from the mandrel, and straightened. The specimens shall then be subjected to the tests specified in 4.5.4.4.2, 4.5.4.4.3, and 4.5.4.4.4, successively.

4.5.4.4.2 Bend.- In a temperature maintained at $25^{\circ} \pm 10^{\circ} \text{C}$ ($77^{\circ} \pm 18^{\circ} \text{F}$), the specimen shall be secured to the mandrel and the other end to the load weight specified in the applicable MS standard. The mandrel shall be rotated until the full length of the specimen is wrapped around the mandrel and is under the specified tension with adjoining coils in contact. The mandrel shall then be rotated in reverse direction until the full length of the cable which was outside during the first wrapping is now next to the mandrel. This procedure shall be repeated until two bends in each direction have been formed in the same section of the wire.

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4.5.4.4.3 Dielectric.- The uninsulated ends of the specimen shall be fastened in metallic contact to a metal bar. The distance between the two uninsulated ends of the wire shall be equal to the diameter of the bend test mandrel specified in the applicable MS standard, or less, at the option of the manufacturer. The specimen shall be so immersed in a solution consisting of 95 parts water to 5 parts sodium chloride at a temperature of $25^{\circ} \pm 10^{\circ} \text{C}$ ($77^{\circ} \pm 18^{\circ} \text{F}$), that the insulation protrudes 1-1/2 inches from the surface of the liquid. After submersion for 5 hours, 1,500 volts (V) root mean square (rms) at 60 cycles per second (cps) frequency, shall be applied between the conductor and electrode in contact with the liquid. This potential shall be increased at a uniform rate from 0 to 1,500V within 1/2 minute and maintained at 1,500V for a period of 5 minutes.

4.5.4.4.4 Pitting.- The insulation of the specimens shall be removed and the conductor examined for pitting.

4.5.4.4.5 Cold temperature (cold bend).- One end of a previously untested specimen of suitable length shall be secured to a rotatable mandrel in a cold chamber. Provision shall be made for rotating the mandrel by means of a handle or control located outside of the chamber. The diameter of the mandrel and the load attached to the other end of the specimen shall be as specified in the applicable MS standard. The wire and mandrel assembly shall be lowered to $-55^{\circ} \pm 2^{\circ} \text{C}$ ($-67^{\circ} \pm 4^{\circ} \text{F}$) at a rate not to exceed 50°C (122°F) per minute. After maintaining this temperature for 4 hours, and while still at this low temperature, the cable shall be wrapped around the mandrel for 180 degrees without opening the cold chamber. The time required for bending the sample around 180 degrees of the mandrel shall be 30 seconds at a uniform rate of speed. The specimen shall then be examined for cracks, in accordance with 3.4.7. The insulation shall be removed for a distance of 1 inch from each end of the specimen and the specimen subjected to the test specified in 4.5.4.4.3, with the bent portion submerged.

4.5.4.4.6 Immersion.- Separate specimens of wire, at least 24 inches long, shall be immersed to within 6 inches of their ends in each of the fluids listed in (a), (b), (c), and (d) below for 20 hours at a temperature of $49^{\circ} \pm 2^{\circ} \text{C}$ ($120^{\circ} \pm 4^{\circ} \text{F}$), except that isopropyl alcohol and jet fuel shall be used at $25^{\circ} \pm 10^{\circ} \text{C}$ ($77^{\circ} \pm 18^{\circ} \text{F}$):

- (a) Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, Specification MIL-L-7808.
- (b) Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance, Specification MIL-H-5606.
- (c) Jet Fuel, Grade JP-4, Specification MIL-J-5624.
- (d) Fluid, Anti-Icing (Isopropyl Alcohol), Specification MIL-F-5566.

Upon removal from the liquids, the specimen shall remain for 1 hour in free air at room temperature. The insulation, braid, and protective coating shall be removed for a distance of 1 inch from each end of the specimen subjected to the tests specified in 4.5.4.4.2, 4.5.4.4.3, and 4.5.4.4.4. During the immersion tests, the radius of bend of the wire shall be not less than 14 times the maximum specified diameter of that particular size wire.

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4.5.4.7 Flammability.-

4.5.4.7.1 Apparatus.- The apparatus shall consist of a Bunsen burner, having a 1/4-inch inlet, a nominal bore of 3/8 inch, and a stem or burner length of approximately 4 inches above the air inlets. The Bunsen burner shall be of the type having a needle valve for gas adjustment built into the bottom of the burner. A wing top flame spreader having a 1/16- by 2-inch opening shall be fitted on the top of the burner.

4.5.4.7.2 Procedure.- The air inlet valve and the gas needle valve shall be adjusted so that a 2-inch high all blue flame is obtained having a temperature of $870^{\circ} \pm 30^{\circ} \text{C}$ ($1,598^{\circ} \pm 54^{\circ} \text{F}$) at the top. It is optional to use a 2-inch high flame having an inner cone 1/3 its height, provided the tip of the inner cone shall have the specified temperature. The shape of the 2-inch flame spreader and of the flames shall be as illustrated in figure 1. A sample of completed wire of sufficient length shall be suspended taut in a horizontal position within an enclosure which allows a flow of sufficient air for combustion but is free from drafts. The tension applied to the specimen during application of the flame shall be sufficient to prevent sagging of the specimen. A piece of facial tissue paper conforming to Specification UU-T-450 shall be suspended taut and horizontal 9-1/2 inches directly below the cable and at least 1/2 inch away from table top. Melted or dripping material, if any, from the wire specimen shall fall on the tissue paper. The top of the 2-inch flame or the top of the inner cone of the optional flame shall be applied directly under the center section of the specimen for a period of 30 seconds. The stem of the burner shall be in a vertical position and the flame spreader opening shall be parallel to the wire specimen. The position of apparatus in relation to the specimen shall be in accordance with figure 1. Before removal of the gas flame from the specimen and at the end of the ignition period, a marking wire or indicator shall be placed approximately 1/2 inch away from the wire, locating on the burning specimen the outer edge of burning at each side of the flame. The rate of flame travel and self-extinguishing time shall be measured from both indicating points. During the entire flame test, the Bunsen burner supporting rack shall remain stationary.

4.5.4.8 Abrasion.-

4.5.4.8.1 Previously untested specimen.- This test shall be conducted on an abrasion machine in accordance with Specification MIL-T-5438. One inch of insulation shall be removed from one end of a 30-inch specimen of the finished wire. The specimen shall then be placed in the test machine and subjected to the tension load specified in the applicable MS standard. Using the weight specified in the applicable MS standard, the specimen shall then be subjected to the abrasion test. After each reading, the specimen shall be moved forward 2 inches and rotated clockwise 90 degrees. Eight readings shall be obtained for each sample. An average shall be obtained by calculating the arithmetic mean of all those readings which are individually less than the arithmetic mean of all the eight readings per wire. This average shall define the abrasion resistance of the wire under test.

4.5.4.8.2 Specimen after immersion test.- Previously untested specimens of wire, each 26 inches long, shall be immersed in fluids in accordance with the procedure specified in 4.5.4.7. After removal from the fluids, the specimens shall be air dried at $25^{\circ} \pm 10^{\circ} \text{C}$ ($77^{\circ} \pm 18^{\circ} \text{F}$) for 24 hours and shall then be subjected to the test specified in 4.5.4.8.1.

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4.5.4.9 Smoke.- This test shall be conducted in still air at an ambient temperature of $25^{\circ} \pm 10^{\circ} \text{ C}$ ($77^{\circ} \pm 18^{\circ} \text{ F}$). A specimen of the wire approximately 15 feet long shall be so suspended that at least the central 10-foot section is horizontal and unsupported. One end of the wire shall be suitably weighted in order that no sagging will occur throughout the test. An electric current shall be applied to the wire, and the voltage drop measured over the central 10-foot portion. From the current and voltage values, the resistance of the wire shall be calculated. The temperature of the wire conductor shall be determined from the change in resistance. The current shall be so adjusted that the conductor temperature stabilizes at $110^{\circ} \pm 2^{\circ} \text{ C}$ ($230^{\circ} \pm 4^{\circ} \text{ F}$). This conductor temperature shall be thus maintained for 1 hour. A flat black background shall be used.

4.5.4.10 Conductor resistance.- The direct current resistance measurement made on the conductor shall be in accordance with Method 6021 of Specification J-C-98.

4.6 Packaging, packing, and marking.- Preparation for delivery shall be inspected for conformance to section 5.

5. PREPARATION FOR DELIVERY

5.1 Packaging.-

5.1.1 Wire shall be delivered wound on nonreturnable wood or metal reels or spools (see 6.2), each having an appropriate diameter for the respective size. In no case shall the barrel of the reel or spool be less than 14 inches in diameter. Unless otherwise specified in the contract or order, the wire lengths shall conform to table IV.

TABLE IV

Wire lengths

Wire size	Nominal lengths on reel or spool (feet)	Minimum acceptable length (feet)
8 to 6, incl.	250	50
4 to 2, incl.	150	50
1 to 0000, incl.	75	25

5.1.2 Not less than 85 percent of the total quantity of each size of wire ordered shall be in lengths equal to or greater than the nominal length specified in table IV. No cable will be accepted in lengths shorter than the specified minimum acceptable length. The maximum quantity of wire in a single length shall be limited only by manufacturing and handling facilities. Special lengths, when required, shall be specified by the procuring activity in the procurement document (see 6.2).

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5.2 Packing.-

5.2.1 Levels A and B.- Unless otherwise specified, reels or spools shall be packed in snug-fitting cleated plywood or nailed wood boxes conforming to Specification PPP-B-601 or PPP-B-621, respectively. Plywood used in cleated plywood boxes shall conform to type I, class 1 of Specification MM-P-515. Exterior shipping containers shall be provided with a sealed waterproof bag liner of barrier material conforming to Specification UU-P-271. Seams and closures shall be sealed with water-resistant adhesive conforming to Specification MIL-A-140 and shall have water resistance equal to that of the barrier material. Boxes shall be strapped in accordance with the applicable box specification.

5.2.2 Level C.- Unless otherwise specified, electrical wire shall be delivered in standard commercial containers so constructed as to insure acceptance by common or other carrier, for safe transportation at the lowest rate, to the point of delivery.

5.3 Marking.- Each reel, spool, or container shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Intended use.- The electric wire covered by this specification is intended for installation in aircraft electrical systems where the potential does not exceed 600 volts (rms). This wire is primarily intended for use where a significant saving in weight can be realized over copper wire of equivalent current capacity. For applications at altitudes above 60,000 feet, the voltage rating for the wire should be reviewed for each specific application.

* 6.1.1 Terminals.- Terminals in accordance with Specification MIL-T-7099 are designed for use with this wire.

6.2 Ordering data.- Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) MS part number of wire. (see 1.2).
- (c) Manner in which wire is to be delivered, with respect to reels or spools (see 5.1.1).
- (d) Whether special lengths are desired (see 5.1.2).
- (e) Level of packaging and packing (see 5.2).

6.3 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, 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. The activity responsible for the Qualified Products List is the Bureau of Naval Weapons, Navy Department, Washington 25, D. C., and information pertaining to qualification of products may be obtained from that activity.

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NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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Air Force - AFSC

Preparing activity:
Navy - Wep

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER		2. DOCUMENT TITLE	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
b. ADDRESS (Street, City, State, ZIP Code)		<input type="checkbox"/> VENDOR	
		<input type="checkbox"/> USER	
		<input type="checkbox"/> MANUFACTURER	
		<input type="checkbox"/> OTHER (Specify): _____	
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

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