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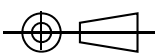
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FORM 12-01

THIRD ANGLE PROJECTION 	CUSTODIAN ENGINEERING MANAGEMENT COMMITTEE	REVISION 5
PROCUREMENT SPECIFICATION NONE	TITLE WIRE, ELECTRICAL, INSULATED, COPPER, HIGH TEMPERATURE, HOOK-UP AND GENERAL PURPOSE, FOR 200 °C SERVICE	CLASSIFICATION SPECIFICATION DIAS703 SHEET 1 OF 17

ISSUE DATE: DECEMBER 15, 1953 REVISION DATE: MARCH 31, 2015

1. SCOPE

1.1 Applicability

This specification covers tetrafluoroethylene resin (PTFE) insulated copper hook-up and general purpose wire suitable for use in temperatures ranging from -65 °C to 200 °C (-85 °F to 392 °F).

1.2 Types and Classification

Wire shall be furnished in the following types, classes and colors:

1.2.1 Type U: Unshielded

Class A for 1,000 volt service
Class C for 600 volt service

1.2.2 Type S: Shielded

Class A for 1,000 volt service
Class C for 600 volt service

1.2.3 Type SJ: Shielded, Jacketed

Class A for 1,000 volt service
Class C for 600 volt service

1.2.4 Colors

1.2.4.1 Type U, Class A

This wire is available in all the colors shown in Table I. Wire with white primary insulation is available with two colored tracers in sizes AWG 26 and larger. Sizes AWG 28 and smaller may have one colored tracer only. If one color is specified, the primary insulation shall be solid color throughout. When tracers are required, the tracer colors, mentioned by numbers shown in Table I, shall be listed in increasing numerical order following the number 9, which indicates white base.

TABLE I – WIRE COLORS

COLOR	NO.	COLOR	NO.
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet	7
Orange	3	Gray	8
Yellow	4	White	9

1.2.4.2 Type U, Class C

Available in the same colors as mentioned in 1.2.4.1 for Class A wire, except that only one colored tracer may be used on AWG 20 and smaller and two colored tracers may be used on AWG 18 and larger.

1.2.4.3 Type SJ, Classes A and C

Available with all solid colors and with one or two colored tracers on a white jacket. The primary insulation shall be white in all cases.

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2. APPLICABLE DOCUMENTS

2.1 Government Documents

- ⑤ Federal
- | | |
|---------------|--|
| FED-STD-228 | Test Methods for Cables and Wire, Insulated |
| ⑤ TT-N-97 | Naphtha, Aromatic |
| A-A-59282 | Chemicals, Analytical; General Specification for |
| A-A-53880 | Alcohol, USP |
| 27 CFR 21.35 | Formula No. 3-A |
| 27 CFR 20.112 | Special Industrial Solvents General-Use Formula |
| 27 CFR 20.113 | Proprietary Solvents General-Use Formula |

Military

- ⑤
- | | |
|---------------|--|
| MIL-DTL-915 | Cable, Electrical, for Shipboard Use, General Specification for |
| MIL-PRF-5606 | Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance |
| MIL-DTL-5624 | Turbine Fuel, Aviation, Grades JP-4 and JP-5 |
| MIL-PRF-6081 | Oil; Jet Engine |
| MIL-F-7100 | Fluid; Hydraulic, Non-flammable, Aircraft |
| MIL-PRF-7254 | Propellant, Nitric Acid |
| MIL-DTL-16878 | Wire, Electrical, Insulated, High Temperature |
| MIL-STD-104 | Limits for Electrical Insulation Color |

Navy Department

General Specification for Inspection of Material – Applicable to Navy Procurement

2.2 Other Publications

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

ASTM International

- | | |
|------------|--|
| ASTM B298 | Silver Coated Soft or Annealed Copper Wire |
| ASTM D470 | Standard Test Methods for Crosslinked Insulations and Jackets for Wire and Cable |
| ASTM D910 | Standard Specification for Aviation Gasolines |
| ASTM D3487 | Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus |

(Copies can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, www.astm.org.)

⑤ Aerospace Industries Association

- | | |
|--------|---|
| NAS702 | Wire, Electrical, Insulated, Copper Hook-up and General Purpose (for 105°C Service) |
|--------|---|

(Copies can be obtained from the Aerospace Industries Association, 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209. www.aia-aerospace.org)

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3. REQUIREMENTS

3.1 Selection of Materials

All materials used in the construction of the completed wire shall be of the quality and form best suited for the purpose intended. Where materials, methods of test, or other qualifications are not specifically designated, it is understood that recognized best commercial practice shall apply.

3.2 Construction

Type U. This wire shall consist of (1) silver coated and stranded copper conductor and (2) tetrafluoroethylene resin primary insulation.

Type S. This wire shall consist of (1) Type U wire and (2) silver coated copper shielding braid.

Type SJ. This wire shall consist of (1) Type U wire and (2) silver coated copper shielding braid and (3) tetrafluoroethylene resin jacket.

3.2.1 Conductors

The conductors shall be in accordance with Table II and the following:

3.2.1.1 Material

All strands used shall be annealed or soft-drawn copper wire from the best obtainable commercially pure wire bars. Wire shall be free from lumps, kinks, splits, abrasions, scraped or corroded surfaces, and skin impurities.

3.2.1.2 Silver Coating

Individual strands of the conductor and shield shall be uniformly coated with a smooth continuous layer of silver in accordance with ASTM B298 with a minimum of 40 microinches.

3.2.1.3 Splices

Splices in individual strands shall be brazed. Splices in individual bunched strands in rope-lay construction shall be finished off so that the conductor diameter is not increased at the point of brazing. In no case shall the whole conductor be spliced at one point. Individual brazed splices in any section of the conductor shall not occur closer together than 10 feet.

3.2.1.4 Elongation

The individual strands from the finished copper conductor, after stranding, shall be capable of withstanding an elongation of 10 percent of their length in 10 inches before breaking. The method of testing shall be in accordance with 4.3.2.

3.2.1.5 Stranding

Stranding shall be concentric or rope-lay unless otherwise specified and as specified in Table II. The direction of lay of the outer layer of concentric conductors shall be left hand and the length of lay shall be in accordance with Table II. The direction of lay of the outer layer of rope-lay-stranded conductors shall be left hand. For rope-lay-stranded conductors the length of lay of the wires composing the bunch stranded members shall be not more than 30 times the diameter of the members, and the length of lay of the outer layer of rope-lay-stranded conductor shall be not less than 8 nor more than 16 times the outside diameter of the completed conductor.

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Concentric lay shall be interpreted to be a central core surrounded by one or more layers of helically wound strands. It is optional for the direction of lay for the successive layers to be alternately reversed (true concentric lay) or to be in the same direction (unidirectional lay). If the direction of lay for successive layers is the same, the pitch of length of lay shall increase with each successive layer.

3.2.2 Primary Insulation

The primary insulation shall be tetrafluoroethylene resin (PTFE) applied concentrically about the conductor by taping, dip coating or extrusion and may be solid or laminate in structure. However, laminate structures shall be fused and sintered into a homogeneous wall during processing. The insulation shall be concentric with the conductor and shall strip freely without adherence. At any section along the length of the completed wire, the minimum thickness of the insulation shall be not less than 41 percent of the difference between measured diameter over insulation and measured diameter over conductor or not less than 70 percent of the maximum thickness at that cross section.

3.2.3 Shielding

Type S wire shall incorporate one closely woven braid of multiple ends of silver coated copper wire applied directly over the primary insulation. Shielding wire shall be AWG 38 for Types S and SJ Class A and Class C, sizes AWG 32 to 26 Inclusive. Other sizes shall all use shielding wire AWG 36. The coverage shall not be less than 90% and the angle of the braid to the axis of the wire shall be 30 +5/-10 degrees, when calculated in accordance with 4.3.10.

TABLE II – CONDUCTORS

Conductor Size AWG (Approx)	Number of Strands	Strand Size AWG	Maximum Conductor Inch Dia	Nominal Conductor (Cir. Mils)	Maximum Conductor Resistance (OHM/1000 Ft. at 20 °C)	Length of Lay Inches (Max)
32	7	40	.010	67	171	.25
30	7	38	.013	100	101	.25
28	7	36	.016	175	64	.25
26	19	38	.021	304	36.9	.25
24	19	36	.026	475	23.2	.33
22	19	34	.033	754	14.6	.33
20	19	32	.041	1,216	9.05	.50
18	19	30	.052	1,900	5.80	.80
16	19	29	.060	2,426	4.54	1.00
14	19	27	.074	3,831	2.87	1.00
12	19	25	.093	6,088	1.81	1.30
10	105	30	.135	10,500	1.05	1.80
8	133	29	.176	16,983	.66	/a/

/a/ See 3.2.1.5 for the direction and length of lay of rope-lay-stranded conductors.

3.2.4 Jacket

The jacket shall be polytetrafluoroethylene or equal applied to the shield and may be solid or laminate in structure. However, laminate structures shall be fused into a homogeneous wall during processing.

3.3 Characteristics of the Completed Wire

3.3.1 Heat Resistance

The completed wire shall be subjected to the test given in 4.3.3. Upon completion of the Heat Resistance Test, the wire insulation shall not crack as a result of the Bend Test and shall meet the Dielectric Test without breakdown.

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3.3.2 Cold Bend

The wire shall withstand a temperature of -65 °C (-85 °F) without cracking when bent over a mandrel as specified in 4.3.7. After bending the wire shall meet the Dielectric Test without breakdown.

3.3.3 Acid Resistance

The wire insulation shall withstand immersion in fuming nitric acid as specified in 4.3.8 and shall withstand the Dielectric Strength Test without failure.

3.3.4 Water and Solvent Resistance

After being subjected to the Immersion Test given in 4.3.9, the wire shall show no evidence of swelling or cracking and shall withstand the Dielectric Strength Test without failure.

3.3.5 Flammability

The finished wire shall not support combustion when tested in accordance with the Vertical Flame Test given in ASTM D470.

3.3.6 Insulation Flaws

The finished wire shall be capable of withstanding the following potentials when subjected to the Spark Test given in 4.3.5.1. In addition, the insulated wire used in Type S and SJ shall be tested prior to application of the shield.

The jacket of Type SJ cable shall be capable of withstanding 1,500 volt dielectric between the shield and ground during water immersion when subjected to the spark test given in 4.3.5.2.

Type U and S, Class A – 4,000 volts (RMS)

Type U and S, Class C – 3,000 volts (RMS)

Type SJ – 1,500 volts (RMS) Jacket only

3.3.7 Resistance

The resistance of the finished wire shall not exceed the values specified in Table II.

3.3.8 Wire Diameter

The diameter of the finished wire shall conform to the dimensions specified in Table III.

3.3.9 Insulation Resistance

The primary insulation of the finished wire shall have an insulation resistance of 10,000 megohms – 1,000 feet when measured in accordance with 4.3.6.

3.3.10 Abrasion Resistance

The finished wire shall meet the minimum requirements specified in Table VIII. The method of testing shall be in accordance with 4.3.11.

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