

NATIONAL AEROSPACE STANDARD

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC., 1725 DE SALES STREET, N. W., WASHINGTON, D. C. 20036

FED SUP CLASS

6145

SPECIFICATION

WIRE, ELECTRICAL, INSULATED, COPPER

HOOK-UP AND GENERAL PURPOSE (For 105°C Service)

1. SCOPE

1.1 This specification covers insulated copper hook-up and general purpose wire suitable for use in temperatures ranging from -55°C to 105°C.

1.2 Types and Classification. - Wire shall be furnished in the following types, classes and colors for circuit identification:

1.2.1 Type U - Unshielded. -

Class A - For 1000 volt general purpose service

Class B - For 2500 volt general purpose service

Class C - For 600 volt hook-up service

1.2.2 Type S - Shielded. -

Class A - For 1000 volt general purpose service

Class B - For 2500 volt general purpose service

Class C - For 600 volt general purpose service

1.2.3 Colors. -

1.2.3.1 Type U, Class A and Class B. - The wire is available in all the colors shown in Table I. Wire with white primary insulation is also available with one or two colored tracers in all AWG sizes and with three colored tracers on those AWG sizes having a marking surface diameter greater than 0.064 inches. If one color is specified, the primary insulation shall be solid color throughout. When tracers are required, the tracer colors mentioned shall be listed in increasing numerical order following the number 9, which indicates white base or clear base for extruded Type S jackets.

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

* The number 9 shall indicate clear for extruded Type S jackets.

TABLE I

1.2.3.2 Type U, Class C. - Available in the same colors as mentioned in 1.2.3.1 for Class A and Class B wire except that only one or two colored tracers may be specified.

1.2.3.3 Type S, Class A, B and C. - White primary and available with clear extruded or white braided jacket and with one, two or three colored tracers applied to the outer nylon covering. The method of specifying tracers shall be in accordance with 1.2.3.1.

List of Active Sheets		List of Active Sheets		List of Active Sheets	
Sheet No.	Revision No.	Sheet No.	Revision No.	Sheet No.	Revision No.
1	3	5	3	10	3
2	3	6	3	11	3
3	3	7	3	12	3
4	3	8	3	13	3
		9	3	14	3

CUSTODIAN: Electronic Parts Committee

PROCUREMENT
SPECIFICATION

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CLASSIFICATION
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NAS Documents
Sheet 1 of 14

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31 July 1981

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28 Feb. 1961

2

5-15-55

1

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12-15-53

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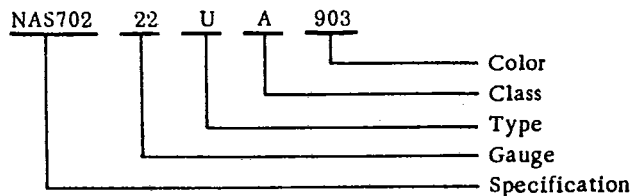
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- 1.3 Method of Designation on Orders. - The method of designation shall be as follows:



2. APPLICABLE SPECIFICATIONS

- 2.1 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:

Federal

VV-O-401 Oil; Insulating (For Transformers, Switches and Circuit Breakers)

Military

MIL-C-572 Cords, Yarns and Monofilaments Organic Synthetic Fiber
 MIL-C-915 Cable, Cord and Wire, Electrical (Shipboard Use)
 MIL-T-5438 Tester; Abrasion, Electrical Cable.
 MIL-F-5572 Fuel; Aircraft Reciprocating Engine
 MIL-O-5606 Oil; Hydraulic, Aircraft Petroleum Base
 MIL-F-5624 Fuel; Aircraft Turbine and Jet Engine Grades JP-4 and JP-5
 MIL-O-6081 Oil; Jet Engine
 MIL-F-7083 Fluid; Hydraulic, Non-flammable, Hydrolube, Aircraft
 MIL-P-20693 Plastic Compounds, Molding and Extrusion, Polyamide

Federal Standards

Fed. Test Method Std. 151 - Metals; Test Methods

Military Standards

Mil-Std-104 Limits for Electrical Insulation Color

ASTM Standards

D-470 Insulated Wire and Cable (Tentative)

3. REQUIREMENTS

- 3.1 Selection of Materials. - Where materials, methods of test or other qualifications are not specifically designated, best commercial practice shall apply.

- 3.2 Construction. -

Type U - This wire shall consist of (1) tinned, stranded conductor, (2) polyvinyl chloride type resin primary insulation and (3) nylon jacket.

Type S - This wire shall consist of (1) Type U wire, (2) tinned copper shielding braid and (3) nylon jacket.

- 3.2.1 Conductor. - The conductor shall be in accordance with Table II and the following sub-paragraphs.

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

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NAS 702
 Sheet 2

Inactive For New Design
 After 1/30/81.

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- 3.2.1.2 **Tinning.** - Individual strands shall be uniformly coated with a smooth, continuous layer of commercially pure tin. Continuity of the coating shall be determined by subsection of samples to the Tinning Test described in 4.3.3.
- 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. Tests 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 not be 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.

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.

AWG8 and AWG10 must be rope-lay stranded conductors.

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Conductor Size Approx. AWG	No. of Strands	Strand Size AWG	Max. Conductor Dia. Inch	Nom. Conductor Area (Cir. Mils)	* Max. Conductor Resistance (Ohms per 1000 Feet at 20°C (68°F)	Length of Lay Inches
26	19	38	0.021	304	38.6	0.20 - 0.30
24	19	36	0.026	475	24.3	0.25 - 0.35
22	19	34	0.033	754	15.4	0.33 - 0.43
20	19	32	0.041	1216	9.66	0.45 - 0.55
18	19	30	0.052	1900	6.01	0.50 - 0.70
16	19	29	0.060	2426	4.76	0.70 - 0.90
14	19	27	0.074	3831	2.99	.80 - 1.00
12	19	25	0.093	6088	1.88	1.05 - 1.30
10	105	30	0.135	10500	1.11	**1.7 - 2.1
8	133	29	0.176	16983	0.68	**

* **NOTE:** The maximum resistance is based on tinned copper wire having the following characteristics:

Diameter (In)	Conductivity (IACS)	Resistance (ohms/mil foot)
0.0030 - 0.0110	93.15	11.133
0.0111 - 0.0200	94.16	11.015

The area in these calculations shall be considered as 98 percent of the nominal given in the table. An increment of increase due to lay (2 percent for sizes 26 thru 10 and 4 percent for size 8) shall be added to the calculated resistance.

2 TABLE II. - DETAILS OF CONDUCTOR

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

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- 3.2.4 Shielding. - Type S wire shall incorporate one closely woven braid of AWG size 36 tinned copper wire applied directly over Type U wire having a coverage not less than 90 percent when calculated in accordance with 4.3.12. The angle of the braid to the axis of the wire shall be 30 ± 5 degrees.
- 10

3.3 Characteristics of the Finished Wire. -

- 3.3.1 Life Cycle. - The completed wire shall be subjected to the Life Cycle Test given in 4.3.5.1. Upon completion of this test the wire shall not crack as a result of the Bend Test and shall meet the Dielectric Test without breakdown.
- 3.3.2 Cold Bend. - The finished wire shall withstand a temperature of -55°C without cracking when bent over a mandrel as specified in 4.3.9. After bending, the wire shall withstand the Dielectric Test without breakdown.
- 3.3.3 Water and Solvent Resistance. - After being subjected to the Immersion Test given in 4.3.10, the wire shall show no evidence of cracking and shall withstand the Dielectric Test without breakdown. The increase in diameter of the finished wire shall not exceed 5 percent.
- 3.3.4 Flammability. - The finished wire shall evidence a rate of burning not in excess of 1 inch per minute, shall not release burning particles and shall be self extinguishing when subjected to the test specified in 4.3.13.
- 3.3.5 Insulation Flaws. - One hundred percent of the wire prior to application of jackets or shielding shall meet the Insulation Flaws Test given in 4.3.11.
- 3.3.6 Resistance. - The resistance of the finished wire shall not exceed the values specified in Table II.
- 3.3.7 Wire Diameter. - The diameter of the finished wire shall be in accordance with Table III.

Wire Size	FIN. DIA. OF TYPE U WIRE $\pm .004$ inch, 26 thru 16 $\pm .005$ inch, 14 thru 8			FIN. DIA. OF TYPE S WIRE $\pm .005$ inch, 26 thru 16 $\pm .006$ inch, 14 thru 8		
	Class A	Class B	Class C	Class A	Class B	Class C
26	0.058	0.085	0.046	0.091	0.116	0.078
24	0.062	0.088	0.048	0.094	0.120	0.080
22	0.070	0.094	0.056	0.102	0.126	0.088
20	0.078	0.102	0.064	0.110	0.134	0.096
18	0.089	0.113	0.072	0.121	0.145	0.104
16	0.098	0.122	0.081	0.132	0.154	0.113
14	0.117	0.137		0.151	0.169	
12	0.137	0.157		0.171	0.189	
10	0.182	0.204		0.218	0.240	
8	0.217	0.247		0.261	0.283	

TABLE III. - FINISHED WIRE DIAMETERS

- 3.3.8 Insulation Resistance. - The insulation resistance of the finished wire (all types and classes) shall be not less than 500 megohms - 1000 feet at a temperature of 20 to 25°C or 0.1 megohm - 1000 feet at a temperature of 94 to 96°C when tested as required in 4.3.8.

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