

INCH-POUND

MIL-DTL-76E
w/AMENDMENT 1
17 March 2022
SUPERSEDING
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MILITARY SPECIFICATION
WIRE AND CABLE, HOOKUP, ELECTRICAL, INSULATED, GENERAL
SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies
of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers single-conductor, synthetic-resin insulated, electrical hookup wire and cable for use, at temperatures from -55 °C to +90 °C (see 6.5.3), in the internal wiring of electrical and electronic equipment. For the purpose of this specification, single-conductor hookup wire and cable are hereinafter referred to as wire.

1.2 Classification.

1.2.1 Part or Identifying Number (PIN). The PIN consists of the following form:

M76LWC247B903						
M76	LW*	C	24	7	B	903
Military specification (1.2.1.1)	Type of wire (1.2.1.2)	Conductor material (1.2.1.3)	Conductor size (1.2.1.4)	Stranding (1.2.1.5)	Construction (1.2.1.6)	Color code (1.2.1.7)

* Designates the applicable insulation type

1.2.1.1 Military specification. The military specification designation consists of a prefix M which indicates a military specification item, and the specification number.

1.2.1.2 Type of wire. The type of wire is identified by a three-letter or two letter symbol which indicates its application characteristics (see table I).

Note: The letter "P" designates type IP Polyvinyl Chloride (PVC) Insulation, and the letter "R" designates type IS Styrene Butadiene Rubber (SBR) Insulation. PVC-insulated wire is not to be used in aerospace applications or aboard Navy ships.

1.2.1.3 Conductor material. The conductor material is identified by the letter "C" for copper or the letter "S" for copper-clad steel (see table III and table IV).

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Columbus, Attn: VAI, P.O. Box 3990, Columbus, Ohio, 43218-3990 or emailed to WireCable@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil/>.



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1.2.1.4 Conductor size. The conductor size is identified by a one- or two-digit number which indicates the American Wire Gage (AWG) size (see [table I](#)).

1.2.1.4.1 When a range of AWG sizes is indicated herein, the sizes embraced are even-numbered. However, in the case of types MWP and MWR wire, AWG size 7 is included, and in the case of types HWP and HWR wire, AWG sizes 1, 0, and 00 are included, when applicable, in addition to the even-numbered sizes.

TABLE I. Type of wire and conductor sizes.

Type of wire	Conductor size range (AWG), inclusive, nominal	Application characteristic	Voltage rating maximum (see 6.4.2) Volts, RMS
LWP	30 to 20	General purpose	300
MWP	24 to 6 ^{1/}		1,000
HWP	22 to 16		2,500
	14 to 00		600
HF	24 to 16	Radio frequency	1,000
LWR	30 to 20	General purpose	300
MWR	24 to 6 ^{1/}		1,000
HWR	22 to 16		2,500
	14 to 00		600

^{1/} In sizes 10, 8, 7, and 6, the permissible constructions are limited to B, E, and H (see 1.2.1.6).

1.2.1.5 Stranding. Stranding is indicated by a single, double and triple digit number, which indicated the number of strands permitted by [table III](#), irrespective of the number of strands actually used. For solid conductor, the number is a single digit number (1).

1.2.1.6 Construction of finished wire. The construction of finished wire (see 6.2) is identified by a one-letter symbol which indicates the type of covering over the insulated wire (see [table II](#)).

TABLE II. Construction of finished wire.

Symbol	Covering over insulated wire
A	None
B	Jacket
C	Braid
D	Shield
E	Jacket and shield
F	Braid and shield
G	Shield and outer jacket
H	Jacket, shield, and outer jacket
I	Braid, shield, and outer jacket

1.2.1.7 Color code identification numbers. The identification numbers assigned to color are as specified in Standard MIL-STD-681.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-228 - Test Methods for Cables and Wire, Insulated .

COMMERCIAL ITEM DESCRIPTIONS

A-A-59551 - Wire, Electrical, Copper (Uninsulated).

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-572 - Cords, Yarns and Monofilaments Organic Synthetic Fiber.
MIL-DTL-3432 - Cables, (Power and Special Purpose) and Wire, Electrical (300 and 600 Volts)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-104 - Limits for Electrical Insulation Color.
MIL-STD-681 - Identification Coding and Application of Hookup and Lead Wire.

(Copies of these documents are available online at <https://quicksearch.dla.mil>.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM International (ASTM)

ASTM D150 - Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation.
ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

(Copies of these documents are available online at www.astm.org.)

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THE INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)

J-STD-006 - Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications.

(Copies of these documents are available online at <https://www.ipc.org/>.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.3.

3.2 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered, environmentally preferable, or biobased materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3 Materials and component parts. The materials and component parts for the wire shall be as specified herein. When a definite material is not specified, the manufacturer shall be responsible for selection of materials such that the product meets the requirements. Acceptance or approved of any constituent material or component part shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Conductors. The conductors shall be stranded or solid, as specified (see 1.2.1.5 and 6.2). Solid conductors and the strands comprising the stranded conductors shall be tinned (see 3.4.3). The strands before coating shall be one of the following, as specified (see 6.2).

- a. Soft or drawn-and-annealed copper wire conforming to Specification A-A-59551 for all types and sizes of wire.
- b. Copper-clad steel of 40-percent conductivity for all types and sizes of wire.

The conductors shall be round in shape, uniform in cross section, and free from flaws, scales, and other imperfections. Coated strands, coated solid conductors, and stranded conductors with coated strands, shall meet the applicable constructional requirements specified in table III and table IV, as well as the applicable requirements for tensile strength and elongation of Specification A-A-59551, splicing (see 3.4.4) and direct-current (DC) resistance (see 3.12.1).

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TABLE III. Stranded-conductor requirements.

Conductor size (AWG) nominal	Constructional Requirements					DC at 20 °C, Copper	Resistance Maximum Copper-clad steel
	Number of strands, minimum	Strand diameter, nominal (with minimum stranding)	Lay of strands, maximum	Diameter over conductor, maximum	Cross-sectional area, calculated, nominal (with minimum stranding)		
		Inches	Inches	Inches	Cir mils	Ohms	/1,000 ft
30	3	0.0063	0.25	0.014	119	93.6	234.0
28	7	0.0050	0.375	0.016	175	70.0	175.0
26	7	0.0063	0.375	0.020	278	49.0	122.5
24	7	0.0080	0.375	0.025	448	28.4	71.0
22	7	0.0100	0.50	0.033	700	19.0	47.5
20	7	0.0113	0.75	0.041	1,111	13.12	32.8
18	16	0.0142	0.75	0.052	1,600	7.89	19.7
16	19	0.0179	1.00	0.065	2,426	4.97	12.3
14	19	0.0159	1.38	0.078	3,831	3.13	7.8
12	19	0.0113	1.60	0.098	6,088	1.92	4.8
10	37	0.0126	2.00	0.122	9,354	1.27	3.8
8	127	0.0142	2.25	0.175	16,217	0.732	1.83
7	127	0.0179	2.50	0.200	20,162	0.59	--
6	127	0.0201	2.50	0.220	25,608	0.454	1.47
4	127	0.0179	2.75	0.277	40,699	0.27	1.13
2	161	0.0201	3.00	0.349	65,046	0.178	0.675
1	259	0.0179	3.75	0.390	82,986	0.141	0.445
0	259	0.0201	4.00	0.441	104,639	0.113	0.2825
00	259	0.0226	4.75	0.493	132,287	0.086	0.2150

^{1/} 1 CIR mils = 1/1000 inches

TABLE IV. Solid-conductor requirements.

Conductor size (AWG)	Conductor diameter, nominal	Cross-sectional area, nominal	DC resistance at 20°, maximum	
			Copper	Copper-clad steel
	Inches	Cir mils	Ohms/1,000 ft	Ohms/1,000 ft
30	0.0100	100	112.1	280.2
28	0.0126	159	72.9	182.2
26	0.0159	253	46.0	115.0
24	0.0201	404	28.3	70.7
22	0.0254	640	17.6	44.0
20	0.0320	1,020	11.1	27.8
18	0.0403	1,620	6.92	17.3
16	0.0508	2,580	4.35	10.9
14	0.0641	4,110	2.72	6.8

3.4 Construction (see [4.6.1](#)).

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3.4.1 Stranded conductors. For stranded conductors, the minimum number and maximum lay of strands and maximum diameter over conductor shall be as specified in [table III](#). However, a larger number of strands may be used, provided the maximum lay, maximum diameter over conductor, and DC resistance of the conductor are as specified (see [table III](#) and [3.12.1](#)). Nominal strand diameter and calculated cross-sectional area of conductor are furnished for information only. All strands in a stranded conductor shall be of the same nominal diameter.

3.4.1.1 Lay. Unless otherwise specified herein, concentric or bunch stranding may be used for AWG sizes 30 to 10, inclusive. Rope stranding shall be employed for AWG sizes 8 to 00, inclusive. The lay of the strands of bunch-stranded conductors, and of the two outer layers of concentric-stranded conductors, shall not exceed the values shown in [table III](#). In rope-stranded conductors, the lay of the stranded members of the two outer layers of the conductor, and of the strands in the stranded members, shall not exceed the values shown in [table III](#).

3.4.2 Solid conductors. The diameters of solid conductors shall not vary from the nominal values specified in [table IV](#) by more than the tolerances specified in [table V](#).

TABLE V. Permissible Tolerances in diameters of solid conductors and shield wires.

Solid-conductor and shield-wire diameter, nominal (Inches)	Permissible tolerances	
	Plus	Minus
Under 0.100	0.0003 inches (0.3 mils)	0.0001 inches (0.1 mils)
0.0100 and over	3 percent	1 percent

3.4.3 Coating. To provide ease of soldering, each strand of a stranded conductor, and each solid conductor, shall be coated with either commercially pure tin coating or with a 70-30 tin-lead coating if tin is not available. No bare copper shall be visible to the naked eye (see [4.6.1](#)). If a flux is used, all flux residue shall be removed after coating.

3.4.4 Splices. Splices shall not be made in a stranded conductor as a whole. However, individual strands of stranded conductors, as well as solid conductors, may be spliced, in which case they shall be electro-welded or brazed with silver (Ag) composition solder conforming to Specification J-STD-006. Splices shall be of the butt type except that splices in strands and solid conductors of AWG size 28 and smaller may be twisted, in which case they shall have a minimum overlap of $\frac{1}{2}$ an inch. Splices shall be constructed and distributed throughout the conductor that the diameter, configuration, DC resistance, flexibility, and mechanical strength of the completed conductor are not adversely affected (see [4.6.1](#)).

3.4.5 Insulation. The insulation shall be free from splinters, blisters, and other non-homogeneities visible to the normal eye, and shall be capable of being readily stripped from the conductor by standard methods, leaving the conductor clean for soldering. The insulation shall be applied directly over the conductor in such a manner that the conductor is well centered. The minimum insulation wall thickness and the maximum diameter over the insulation, when measured at any cross section (see [4.6.1](#)), shall be as specified in [table VI](#) and [table VII](#), as applicable.

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TABLE VI. Type and thickness of insulation.

Type of wire	Type of insulation	Conductor size range (AWG) inclusive, nominal	Insulation wall-thickness (Mils)	
			Nominal	Minimum
LWP	General purpose	30 to 20	10	8
MWP	General purpose	24 to 10	16	13
		8 to 6	31	28
HWP	General purpose	22 to 16	31	28
		14 to 4	45	42
		2 to 00	60	57
HF	Low loss	24 to 16	16	13
LWR	General purpose	30 to 20	10	8
MWR	General purpose	24 to 10	16	13
		8 to 6	31	28
HWR	General purpose	22 to 16	31	28
		14 to 4	45	42
		2 to 00	60	57

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TABLE VII. Maximum diameter over insulation.

Conductor size (AWG), nominal	Maximum diameter over insulation (Inches)						
	Type LWP	Type MWP	Type HWP	Type HF	Type LWR	Type MWR	Type HWR
30 solid	0.033				0.033		
30 stranded	0.037				0.037		
28 solid	0.037				0.037		
28 stranded	0.039				0.039		
26 solid	0.040				0.040		
26 stranded	0.043				0.043		
24 solid	0.044	0.057		0.057	0.044	0.057	
24 stranded	0.049	0.062		0.062	0.049	0.062	
22 solid	0.049	0.062	0.098	0.062	0.049	0.062	0.098
22 stranded	0.057	0.070	0.106	0.070	0.057	0.070	0.106
20 solid	0.056	0.069	0.105	0.069	0.056	0.069	0.105
20 stranded	0.065	0.078	0.114	0.078	0.065	0.078	0.114
18 solid		0.077	0.113	0.077		0.077	0.113
18 stranded		0.089	0.125	0.089		0.089	0.125
16 solid		0.088	0.124	0.088		0.088	0.124
16 stranded		0.102	0.138	0.102		0.102	0.138
14 solid		0.101	0.166			0.101	0.166
14 stranded		0.115	0.180			0.115	0.180
12 stranded		0.135	0.200			0.135	0.200
10 stranded		0.159	0.224			0.159	0.224
8 stranded		0.242	0.277			0.242	0.277
7 stranded		0.273				0.273	
6 stranded		0.286	0.322			0.286	0.322
4 stranded			0.373				0.373
2 stranded			0.473				0.473
1 stranded			0.522				0.522
0 stranded			0.573				0.573
00 stranded			0.625				0.625

3.4.5.1 Types LWP, MWP, HWP and LWR, MWR, HWR wire. Wire for general purpose applications (types LWP, MWP, HWP and LWR, MWR, HWR) shall be insulated with a tight-fitting, continuous, concentric layer of types IP or IS insulating compound see [table VIII](#) or with any other resin having the same physical properties, except for types LWP and LWR wire in AWG sizes 30 to 26, inclusive, for which the insulation shall also conform to the aging-stability requirements specified in [3.12.6](#).

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TABLE VIII. Type IP and IS insulating compound physical properties.

	Type IS		Type IP
	Wall thickness		
	6 to 20 mils	over 20 mils	
Unaged:			
Tensile strength, minimum psi	450	600	1800
Elongation, minimum %	200	250	80
Set, maximum, inches	.500	.500	--
After 95 ±½ hour oxygen bomb aging at 70 °C:			
Tensile strength, minimum % of original	75	75	--
Elongation, minimum % of original	65	65	80
Ozone resistance (after air oven conditioning and 168 ±1 hour in ozone) at 100 °F	no visible cracks		--
Brittleness temperature, unaged, max, °C	-40		
After aging, max °C			

3.4.5.2 Type HF wire. Wire for radio-frequency applications (type HF) shall be insulated with a tight-fitting, continuous, concentric layer of polyethylene conforming to group 2, class 1, grade 3 of ASTM D4976.

Note: Type IP is Polyvinyl Chloride (PVC) and its use must comply with current Department of Defense guidance. PVC-insulated wire is not to be used in aerospace applications or aboard Navy ships.

3.5 Jacket. When the construction includes a jacket, a wall of clear, transparent, heat-stabilized polyamide (nylon), or other material specifically approved, shall be extruded over the insulation. The color of the insulation and color coding thereon if used shall be clearly distinguishable through the jacket (see 3.8). When the jacket is color-coded, the finished wire shall conform to this specification. The increase in the overall diameter due to the jacket, when measured at any cross section (see 4.6.1), shall be as specified for the individual type of wire (see 3.10).

3.6 Braid. When the construction includes a braided covering, a closely woven braid either of synthetic yarn conforming to type P of Specification MIL-PRF-572, or of electrical-grade, untreated, continuous-filament glass yarn, as specified (see 6.2), shall be applied over the insulation. Colored carriers used in glass braids shall be composed either of synthetic yarn or of glass yarn conforming, respectively, to the above requirements. If synthetic-yarn carriers are used for color coding in glass braid, the number of such carriers shall not exceed 25 percent of the total number of carriers. Braids shall be saturated and coated with noncorrosive, nontoxic, flexible, transparent, and colorless lacquer or lacquers which, in their finished state, are resistant to moisture, flame, and fungus. The lacquer coating shall be thin, continuous, and smooth. It shall bond the braid sufficiently to prevent fraying under normal conditions of installation. Five to eight percent salicylanilide shall be added to the saturant and coating materials. The increase in the overall diameter due to the saturated-and-coated braid shall be as specified for the individual type of wire (see 3.10).

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3.7 Shield. When the construction includes a shield, a tight-fitting, closely woven braid of coated (see 3.4.3) soft or drawn-and-annealed copper strands shall be applied over the jacket or braid, or directly over the insulation. The shield shall be applied in such a manner as to provide at least 80-percent coverage over the construction beneath (see 4.6.1). The size of the strands and the increase in the overall diameter due to the shield shall be as specified for the individual type of wire (see 3.10). The strand diameter tolerance and the elongation of the strands prior to braiding shall be as specified (see table IV and Specification (A-A-59551).

3.7.1 Outer jacket. When the construction includes an outer jacket over the shield, this jacket shall be in accordance with 3.5. The increase in the overall diameter due to the outer jacket shall be as specified for the individual type of wire (see 3.10). If specified (see 6.2), color coding of the finished outer-jacketed wire shall be accomplished by one of the methods indicated in 3.8, as applicable.

3.8 Color coding. Color coding of hookup wire shall be in accordance with Standard MIL-STD-681 (see 6.2). The colors shall be fast to direct sunlight, to heat, and to chemical action of solvents used (see 4.6.10). Colors in the finished wire shall withstand, without changing, fading, or running, the conditions of all other tests to which they are subjected, except aging stability (see 4.6.8) and elongation after aging. The colors in the finished wire shall fall within the light and dark limits of the applicable color chips of Standard MIL-STD-104.

3.8.1 Printing or stamping. An alternative to the methods described above is to print or stamp code designations on the wire. When this system is used for constructions having no braids, the insulation shall be white for types LWP, MWP, HWP, LWR and MWR, HWR wire, and clear for type HF wire. When this system is used for constructions incorporating braids, the braid shall be white, and the insulation preferably white or clear. The wire may be coded by the purchaser after delivery or by the manufacturer before delivery, as specified (see 6.2).

3.9 Manufacturer's identification marker threads. When manufacturer's identification marker threads are used, they shall be synthetic, conforming to type P of Specification MIL-PRF-572. They shall be located among the conductor strands, between the conductor and insulation, or between the insulation and braid, as applicable. The thread used shall disintegrate when immersed in molten solder at a temperature between 370 °C and 425 °C. If the marker thread is located within the conductor strands, no gassing or other damage shall be visible after the hot-solder-dip operation.

3.10 Wire construction. The construction of wire shall be as follows, and as specified (see 1.2.1 and 6.2).

- First - A conductor conforming to 3.3.1 to 3.4.4, inclusive, as applicable. A separator may be used to prevent the ingress of rubber compound into the strands and to all strippability.
- Second - A wall of insulation of the type and thickness specified in table VI, and conforming to 3.4.5 to 3.4.5.2, inclusive, as applicable.
- Third - When specified (see 6.2), a jacket conforming to 3.5 or a synthetic-yarn or glass-yarn braid conforming to 3.6.
- Fourth - When specified (see 6.2), a shield conforming to 3.7 applied over the jacket or braid or directly over the insulation.
- Fifth - When specified (see 6.2), an outer jacket conforming to 3.7.1 applied over the shield.

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The finished wire shall also meet the requirements for color coding (see 3.8). The diameter shall be no greater than that specified in table VII plus the sum of the applicable increases due to outer covering allowed in table IX.

TABLE IX. Increase in overall diameter of hookup wire due to outer coverings.

	AWG Size Range						
	30	28 and 26	24 to 16 incl	14 and 12	10	8 to 6 incl	4 to 00 incl
Increase in overall diameter due to primary jacket	1	1	1	1	1	1	1
Braid, max, inches: Types LWP, MWP, LWR, MWR, HF	0.015	0.015	0.015	0.015	-	-	-
Types MWP and HWR	-	-	0.015	0.029	0.020	0.025	0.025
Shields: strand size (AWG)	40	38	36	36	34	34	34
Max increase, inches	0.015	0.020	0.023	0.023	0.030	0.030	0.030
Outer jacket	1	1	1	1	1	1	1

^{1/} For wires 0.060 inches and smaller diameter under the jacket, 0.003 inches minimum and 0.006 inches maximum.

For wires 0.061 inches to 0.400 inches, inclusive, diameter under the jacket, 5 percent of the diameter under the jacket minimum, and 10 percent maximum, except that in no case shall the minimum increase be greater than 0.032 inches.

For wires 0.401 inches and larger diameter under the jacket, 0.020 inches minimum and 0.032 inches maximum.

3.11 **Spark test.** The insulated wire (construction A) and the primary insulated wire prior to shielding in constructions D and G shall withstand, without breakdown, the spark-test voltages specified in table IX for uncovered insulated wire. Braided or jacketed wire (construction C or B) and braided or jacketed wire prior to shielding in constructions F, E, I, and H shall withstand, without breakdown, the spark-test voltages specified in table X for covered insulated wire (see 4.6.2).

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TABLE X. Spark-test voltages.

Type of wire	Conductor size range (AWG), inclusive, nominal	Volts, rms	
		Uncovered insulated wire	Covered insulated wire
LWP	30 to 20	2,000	3,000
MWP	24 to 10	4,000	5,000
	8 to 6	6,000	7,500
HWP	22 to 20	6,000	7,500
	18 to 16	7,500	10,000
	14 to 00	12,500	15,000
LWR	30 to 20	2,000	3,000
MWR	24 to 10	4,000	5,000
	8 to 6	6,000	7,500
HWR	22 to 20	6,000	7,500
	18 to 16	7,500	10,000
	14 to 00	12,500	15,000
HF	24 to 20	5,000	7,500
	18 and 16	7,500	10,000

3.12 Performance.

3.12.1 DC resistance. DC resistance of stranded and of solid conductors, as measured in the finished wire, shall not exceed the values specified in [table III](#) and [table IV](#), respectively (see [4.6.3](#)).

3.12.2 Voltage withstand. Wire shall withstand for 1 minute, without breakdown, the applicable voltage specified in [table XI](#) (see [4.6.4](#)).

3.12.3 Insulation resistance. Insulation resistance of the wire, at or corrected at 15.6 °C, shall be as specified in [table XI](#). If the value of insulation resistance is equal to or greater than that specified in [table XI](#), when the measurement is made at a temperature greater than 15.6 °C, no correction factor need be employed (see [4.6.5](#)).

3.12.4 Cold bend. When tested at a temperature of -55 °C ±2 °C over mandrels as specified in [table XI](#), the wire shall exhibit no cracking of the insulation or other component parts, and shall withstand for 1 minute, without breakdown, the applicable voltage-withstand voltage specified in [table XI](#) (see [4.6.6](#)).

3.12.5 Heat resistance. After being subjected to the test temperature specified in [table XI](#), wire shall exhibit no cracking of the insulation or other component parts, and shall withstand for 1 minute, without breakdown, the applicable voltage-withstand voltage specified in [table XI](#) (see [4.6.7](#)). In constructions incorporating braids, no exudation of the insulation through the braid shall occur.

3.12.6 Aging stability (applicable only to type LWP and LWR wire in AWG sizes 30 to 26, inc). After aging at the test temperature specified in [table XI](#), wire shall exhibit no cracking of the insulation and shall withstand for 1 minute, without breakdown, the applicable voltage-withstand voltage specified in [table XI](#) (see [4.6.8](#)).

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3.12.7 Flammability (not applicable to type LWP and LWR wire in AWG sizes 30 to 26, inclusive nor to type HF wire). Wire shall not burn at a rate exceeding that specified in [table XI](#), and no charred or burning particles shall fall from the wire during this test (see [4.6.9](#)). A self-extinguishing specimen (see [4.6.9.3](#)) shall be considered to have passed the test if no burning particles are released.

3.12.8 Solvent resistance. After immersion in the solvents specified in [table XI](#), wire shall evidence no fading, running of color, or exudation of the insulation through the braid, as applicable, and shall withstand for 1 minute, without breakdown, the applicable voltage-withstand voltage specified in [table XI](#) (see [4.6.10](#)). The lacquer in braided wires shall not degrade to such an extent as to inhibit the positive identification of color coding.

3.12.9 Surface resistivity. Wire shall exhibit surface resistivity of not less than that specified in [table XI](#). The wire shall then withstand, without breakdown, the applicable voltage-withstand voltage specified in [table XI](#) (see [4.6.11](#)).

3.12.10 Soldering (not applicable to type HF wire). Insulation of the wire shall not recede more than 1/8 inches, shall not flare away from the conductor, and shall not break open over the bent portion of the conductor (see [4.6.12](#)).

3.12.11 Power factor and dielectric constant (applicable only to HF wire). Wire shall evidence a power factor not exceeding 0.005 and a dielectric constant not exceeding 2.50 (see [4.6.13](#)).

3.13 Workmanship. Wire shall be manufactured and processed in such a manner as to meet all the requirements of this specification.

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TABLE XI. Performance characteristics of hookup wire and cable.

	Type LWP	Type MWP	Type HMP	Type LWR	Type MWR	Type HWR	Type IF
Voltage-withstand							
AWG, inclusive, nominal:	Test voltage (Volts, rms)						
30 to 26	1,500	--	--	1,500	--	--	--
24	1,500	3,000	--	1,500	3,000	--	3,000
22	1,500	3,000	6,000	1,500	3,000	6,000	3,000
20	1,500	3,000	6,000	1,500	3,000	6,000	3,000
18 and 16	--	3,000	6,000	--	3,000	6,000	3,000
14 and 12	--	3,000	6,000	--	3,000	6,000	--
10	--	3,000	6,000	--	3,000	6,000	--
8 to 6	--	4,000	6,000	--	4,000	6,000	--
4 to 2	--	--	6,000	--	--	6,000	--
1 to 00	--	--	6,000	--	--	6,000	--
Insulation resistance							
AWG, inclusive, nominal:	Resistance (minimum megohms – 1,000 feet at 15.6 °C)						
30	330	--	--	330	--	--	--
28	300	--	--	300	--	--	--
26	255	--	--	255	--	--	--
24	215	310	--	215	310	--	9,300
22	175	255	430	175	255	430	7,600
20	145	215	375	145	215	375	6,400
18	--	175	320	--	175	320	5,300
16	--	145	275	--	145	275	4,400
14	--	130	235	--	130	235	--
12	--	105	275	--	105	275	--
10	--	85	230	--	85	230	--
8	--	120	170	--	120	170	--
7	--	120	--	--	120	--	--
6	--	100	140	--	100	140	--
4	--	--	115	--	--	115	--
2	--	--	125	--	--	125	--
1	--	--	110	--	--	110	--
0	--	--	100	--	--	100	--
00	--	--	90	--	--	90	--

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TABLE XI. Performance characteristics of hookup wire and cable. – Continued

	Type LWP		Type MWP		Type HWP		Type HF	
Cold bend:	Constructions		Constructions		Constructions		Constructions	
	A, B, D, C, E, F	H, I, G	A, B, D, C, E, F	H, I, G	A, B, D, C, E, F	H, I, G	A, B, D, C, E, F	H, I, G
Test temperature	-55 °C ±2 °C							
AWG, inclusive, nominal:	Test mandrel diameter (inches)							
30 to 26	1/2	1	--	--	--	--	--	--
24	1	2	1	2	--	--	1	2
22 and 20	1	2	1	2	1	2	1	2
18 and 16	--	--	1	2	1	2	1	2
14 and 10	--	--	2	3	2	--	--	--
8 to 6	--	--	3	6	3	6	--	--
4 to 00	--	--	--	--	3	6	--	--
Heat-resistance test temperature	120 °C ±2 °C						100 °C ±1 °C	
Aging stability:	AWG sizes 30 to 26, incl		--					
Air-oven temperature	100 °C ±1 °C							
Cold-bend temperature	-55 °C ±2 °C							
Flammability, maximum	AWG sizes 24 to 20, incl		All sizes		All sizes		--	
	1 inch/minute							
Solvent resistance	Resistant to salt water, aviation-grade gasoline, motor oil, ethylene glycol, alcohol.							
Surface resistivity, minimum:	Construction		Construction		Construction		Construction	
	B	Other	B	Other	B	Other	B	Other
Surface resistivity	100 meg	10 meg	100 meg	10 meg	100 meg	10 meg	100 meg	10 meg
AWG sizes:	Voltage-withstand voltage:							
30 to 26, incl	1,000 volts rms		--		--		--	
All others	2,500 volts rms		2,500 volts rms		2,500 volts rms		2,500 volts rms	
	(Conditioned at 65 °C ±1 °C and 90-95 percent PM for 96 hours prior to measurements).							
Soldering	Insulation does not recede more than 1/8 inch, flare away from conductor, or break open over the bent portion of conductor.						--	
Power factor, maximum	--						0.005	
Dielectric constant, maximum							2.5	

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TABLE XI. Performance characteristics of hookup wire and cable. – Continued

	Type LWR		Type MWR		Type HWR	
Cold bend:	Constructions		Constructions		Constructions	
	A, B, D, C, E, F	H, I, G	A, B, D, C, E, F	H, I, G	A, B, D, C, E, F	H, I, G
Test temperature	-55 °C ±2 °C					
AWG, inclusive, nominal:	Test mandrel diameter (inches)					
30 to 26	1/2	1	--	--	--	--
24	1	2	1	2	--	--
22 and 20	1	2	1	2	1	2
18 and 16	--	--	1	2	1	2
14 and 10	--	--	2	3	2	--
8 to 6	--	--	3	6	3	6
4 to 00	--	--	--	--	3	6
Heat-resistance test temperature	120 °C ±2 °C					
Aging stability:	AWG sizes 30 to 26, incl		--			
Air-oven temperature	100 °C ±1 °C					
Cold-bend temperature	-55 °C ±2 °C					
Flammability, maximum	AWG sizes 24 to 20, incl		All sizes		All sizes	
	1 inch/minute					
Solvent resistance	Resistant to salt water, aviation-grade gasoline, motor oil, ethylene glycol, alcohol.					
Surface resistivity, minimum:	Construction		Construction		Construction	
	B	Other	B	Other	B	Other
Surface resistivity	100 meg	10 meg	100 meg	10 meg	100 meg	10 meg
AWG sizes :	Voltage-withstand voltage					
30 to 26, incl	1,000 volts rms		--			
All others	2,500 volts rms		2,500 volts rms		2,500 volts rms	
	(Conditioned at 65 °C ±1 °C and 90-95 percent HH for 96 hours prior to measurements.)					
Soldering	Insulation does not recede more than 1/8 inch, flare away from conductor, or break open over the bent portion of conductor.					
Power factor, maximum	--					
Dielectric constant, maximum						

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4. VERIFICATION

4.1 Inspection conditions. Unless otherwise specified herein, all inspection shall be made at the conditions specified in FED-STD-228.

4.1.1 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of test equipment to the satisfaction of the Government.

4.1.2 Government. Acceptance of the wire shall be based upon verification by the Government of the supplier's compliance with the requirements and the sampling and inspection procedures of this specification. The Government may, at its option, repeat any or all of the inspections specified herein.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. First article inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.3 First article inspection. First article inspection shall consist of basic-materials inspection and groups A, B, and C.

4.4 Conformance inspection. First article inspection shall consist of basic-materials inspection and groups A and B. Conformance inspection shall be performed on every lot of wire procured under this specification.

4.5 Basic and group inspections.

4.5.1 Resubmitted lots. If an inspection lot (see 6.4.2) is rejected, the manufacturer may rework the lot or screen out defectives and resubmit it for inspection. Resubmitted lots shall be kept separate from new lots. The resubmitted lot shall be inspected, using tightened inspection.

4.5.2 Basic-materials inspection. Basic-materials inspection shall consist of verification that the component materials listed in table XII, prior to fabrication of the wire, are in accordance with the applicable requirements or referenced specifications.

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TABLE XII. Basic-materials inspection.

Material	Requirement paragraph	Applicable specification
Copper strands	3.3.1(a)	A-A-59551
Copper-clad steel strands	3.2.1(b)	--
Solder	3.4.4	J-STD-006
Insulation		
For types LWP, MWP, HWP	3.4.5.1	--
and LWR, MWR, HWR	3.4.5.1	--
For type HF	3.4.5.2	ASTM D4976
Jacket	3.5	--
Braid	3.6	MIL-PRF-572
Shield	3.7	A-A-59551
Outer jacket	3.7.1	--
Manufacturer's identification marker threads	3.9	MIL-PRF-572

4.5.3 Group A inspection. Group A inspection shall consist of the examinations and tests specified in [table XIII](#). Sampling shall be in accordance with [table XIV](#).

TABLE XIII. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph
Visual and dimensional examination	(see table XVIII)	4.6.1
DC resistance	3.12.1	4.6.3
Voltage withstand	3.12.2	4.6.4
Insulation resistance	3.12.3	4.6.5

TABLE XIV. Inspection sample.

Inspection lot size	Accept on zero
1	1
2 to 8	2
9 to 90	3
91 to 150	12
151 to 280	19
281 to 500	21
501 to 1,200	27
1,201 to 3,200	36
3,201 to 10,000	38
10,001 to 35,000	46

1/ Lot size is based on the number of units of product

4.5.4 Group B inspection. Group B inspection shall consist of the tests specified in [table XV](#).

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TABLE XV. Group B inspection.

Test	Type of wire and sizes (AWG), nominal	Requirement paragraph	Method paragraph
Physical properties of insulation ^{1/}	LWP, LWR in sizes 24 to 20, incl; MWP, MWR and HWP, HWR in all sizes.	3.4.5.1	(See Spec MIL-DTL-3432)
Cold bend	All	3.12.4	4.6.6
Heat resistance	All	3.12.5	4.6.7
Aging stability ^{2/}	LWP, LWR in sizes 30 to 26 incl.	3.12.6	4.6.8
Flammability ^{3/}	LWP, LWR in sizes 24 to 20, incl; MWP, MWR and HWP, HWR in all sizes.	3.12.7	4.6.9

^{1/} To be performed on specimens of insulation removed from finished wire, unless otherwise specified.

^{2/} To be performed on insulated wire (construction A). If insulated wire (construction A) is part of more comprehensive constructions, it shall be removed therefrom. However, if removing insulated wire from jacketed constructions is excessively difficult, the construction prior to the jacketing operation may be used, at the discretion of the Government.

^{3/} To be performed on finished wire. Before testing constructions D, E, and F, the shield shall be removed.

4.5.4.1 Sampling procedure. The sampling procedure shall be in accordance with [table XIV](#).

4.5.5 Group C inspection. Group C inspection shall consist of the tests specified in [table XVI](#).

TABLE XVI. Group C inspection.

Test	Type of wire and sizes (AWG), nominal	Requirement paragraph	Method paragraph
Solvent resistance ^{1/}	All	3.12.8	4.6.10
Surface resistivity ^{1/}		3.12.9	4.6.11
Soldering ^{2/}	LWP, MWP, HWP and LWR, MWR, HWR in all sizes.	3.12.10	4.6.12
Power factor and dielectric constant ^{2/}	HF in all sizes	3.12.11	4.6.13

^{1/} To be performed on finished wire. Before testing constructions D, E, and F, the shield shall be removed.

^{2/} To be performed on insulated wire (construction A). If insulated wire (construction A) is part of more comprehensive constructions, it shall be removed therefrom. However, if removing insulated wire from jacketed constructions is excessively difficult, the construction prior to the jacketing operation may be used, at the discretion of the Government.

4.5.5.1 Sampling procedure. Units of product (see [6.4.3](#)) shall be selected in accordance with [table XVII](#), and one specimen (see [6.4.4](#)) shall be cut from each unit for each group C test. When a test has more than one part and each part requires separate specimens, an additional specimen shall be cut from each unit for each additional part of the test.

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TABLE XVII. Sampling procedure for group C inspection.

Inspection lot size	Sample size	Acceptance number
Under 66	2	0
66 to 180, incl.	3	0
181 to 500, incl.	5	0
501 to 800, incl.	7	0
801 to 1,300 incl.	10	0
1,301 and over	15	0

4.5.5.2 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall take corrective action on the process and on all units of product which can be corrected and which were manufactured under the same conditions, and with the same materials, processes, etc., and which are considered subject to the same failure. Inspection shall be discontinued until corrective action has been taken. After the corrective action has been taken, specimens from units of product which have been corrected shall be subjected to group C inspection (all inspections or the inspections which the sample failed, at the option of the Government). Groups A and B inspection may be reinstituted; however, final acceptance shall be withheld until the group C inspection has shown that the corrective action was successful.

4.6 Methods of examination and test. The specimens shall be of the types, constructions, materials, components, and lengths specified herein. However, if the lengths are not specified, they shall be determined by the special conditions of the testing.

4.6.1 Visual and dimensional examination. Wire shall be examined to verify that the requirements listed in [table XVIII](#) are in accordance with this specification. When applicable, the examinations and measurements shall be made on convenient lengths of specimens cut from the sample units, after unwinding not less than 10 feet from the outside end of the spool or reel. At least one sample unit of each construction and type in the lot shall be selected. Overall diameter shall be determined by using the applicable portions of method 1011, thickness of insulation and jacket by using method 1018, and shield coverage by using method 8121, of FED-STD-228.

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TABLE XVIII. Visual and dimensional examination.

Requirements	Requirement paragraph
Construction:	
Stranded conductor	3.4.1
Number of strands	3.4.1
Diameter over conductor	3.4.1
Lay	3.4.1.1
Coating of strands	3.4.3
Splices	3.4.4
Solid conductor:	
Construction	3.4.2
Diameter	3.4.2
Coating	3.4.3
Insulation:	3.4.5
Wall thickness	3.4.5
Diameter over insulation	3.4.5
Jacket:	3.5
Diameter over jacket	3.10
Braid:	3.6
Diameter over braid	3.10
Shield:	
Percent coverage	3.7
Stranding	3.10
Diameter over shield	3.10
Outer jacket:	3.7.1
Diameter over outer jacket	3.10
Color coding	3.8
Manufacturer's identification marker threads (if used)	3.9
Workmanship	3.13

4.6.2 Spark test (to be performed during manufacture). All production lengths of wire (before shielding, when a shield is employed) shall be passed through an electrode that makes intimate contact with their surfaces, as described in method 6211 of FED-STD-228 (see [3.11](#)).

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4.6.3 DC resistance. DC resistance of the stranded or solid conductors in the finished wire shall be determined in accordance with method 6021.1 of FED-STD-228. (see 3.12.1). When DC resistance of the strand is being determined, a length of finished wire shall be stripped of insulation, unstranded, and the average length of the strands determined. The DC resistance of a single strand shall be determined as follows:

$$R_s = R \times \frac{L_s}{L_c} \times n$$

Where:

- R_s = DC resistance of a strand.
- R = DC resistance of stranded conductor
- L_c = length of conductor.
- L_s = average length of strand in L_c .
- n = number of strands.

4.6.4 Voltage withstand (see 3.12.2). The finished wire shall be tested in accordance with method 6111 of FED-STD-228, except that:

- a. The test shall be performed on finished wire only.
- b. The immersion period shall be at least 12 hours.
- c. The stirrer need not be used.
- d. Specimens shall be at least 5 feet long.
- e. The test voltage (see table XI) shall be applied for a period of 60 +5, -0 seconds from the time it is reached.

4.6.5 Insulation resistance (see 3.12.3). Insulation resistance of the finished wire shall be determined in accordance with method 6031 of FED-STD-228 except that:

- a. The test shall be performed on specimens of the finished wire which have passed the voltage-withstand test, as soon thereafter as practicable.
- b. The test voltage shall be not less than 100 volts nor more than 500 volts DC.
- c. The polarity of the wire shall be maintained negative with respect to the water, or the shield if the construction includes a shield. The test may be terminated in less than 1 minute if the instrument has ceased fluctuating and the reading indicates that a steady insulation-resistance value has been obtained. A guard circuit may be used.
- d. If the measurement is made at a temperature lower than 15.6 °C, the manufacturer shall correct the measured value to the resistance at 15.6 °C. The manufacturer shall demonstrate that the correction factor is accurate for his compound.

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4.6.6 Cold bend. Specimens of the finished wire at least 5 feet long shall be prepared for testing by skinning approximately 1 inch at each end to the bare conductor. Specimens of the wire shall then be placed in a cold chamber maintained at $-55\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The lower ends of all specimens shall be weighted and their upper ends shall be attached to mandrels; mandrel diameters shall be as specified in [table XI](#). The specimens shall then be conditioned for a period of 4 hours. At the end of this period, and while still at the above-specified temperature, the specimens shall be wrapped around the mandrels at a uniform rate of 15 ± 3 revolutions per minute for a minimum of six complete turns. The weights attached to the lower ends of the specimens shall be sufficient to keep them taut during the bending operations so that close turns of the specimens upon the mandrels will be obtained. A suitable traversing mechanism may be used in lieu of weights. The specimens shall then be removed from the mandrels and, without straightening, immersed for 1 hour in tapwater at not more than $30\text{ }^{\circ}\text{C}$, with approximately 6 inches of each end of each specimen protruding above the water. The specimens shall then be subjected to the applicable voltage-withstand voltage specified in [table XI](#), in the manner specified in [4.6.4](#) (see [3.12.4](#)).

4.6.7 Heat resistance. Specimens of the finished wire at least 5 feet long shall be prepared for testing by skinning approximately 1 inch at each end to the bare conductor. The specimens shall then be wound tightly around a mandrel three times their outside diameter for five close turns, exclusive of the bared portion. The ends of the specimens shall be securely taped to the mandrel. The specimens and mandrels shall then be placed for 24 hours in an oven maintained at $120\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$; however, for type HF wire, the oven temperature shall be maintained at $100\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$. At the end of this period, the specimens and mandrels shall be removed and allowed to return to room temperature. The coiled sections of the specimens shall then be immersed for 1 hour in tapwater at not more than $30\text{ }^{\circ}\text{C}$, with approximately 6 inches of each end protruding above the water. The specimens shall then be subjected to the applicable voltage-withstand voltage specified in [table XI](#), in the manner specified in [4.6.4](#) (see [3.12.5](#)).

4.6.8 Aging stability (applicable only to types LWP and LWR wire in AWG sizes 30 to 26, inclusive). Specimens of the finished wire shall be prepared for testing by skinning approximately 1 inch at each end to the bare conductor. The specimens shall then be aged in an air oven. They shall be suspended vertically without touching one another or the walls of the oven. Heated air at atmospheric pressure shall be circulated so as to maintain a uniform temperature of $100\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$, in the oven, using baffles to avoid local overheating or dead spots. The source of heat shall be located in the air supply outside the oven proper, and the supply shall be controlled by upper and lower vents to provide a continuous change of air approximately once per hour during the test. The specimens shall be conditioned for a period of 96 hours. After the conditioning period, they shall be cooled to room temperature for at least 1 hour, and then subjected to a cold-bend test in accordance with [4.6.6](#), except that a 3/4-inch mandrel shall be employed (see [3.12.6](#)).

4.6.9 Flammability (not applicable to type LWP or LWR wire in AWG sizes 30 to 26, inclusive nor to type HF wire).

4.6.9.1 Specimens. Specimens of the finished wire shall be supported in a horizontal position in the center of the test chamber. They shall be supported at the ends and shall be under sufficient tension to prevent sagging. Each specimen shall be marked off with fine thread (or by other suitable means) at eight points located as follows:

- a. An ignition point placed a convenient distance from one end of the specimen.
- b. A test-starting point located 5 inches from the ignition point.
- c. Six additional markers, spaced 1 inch apart, beginning at the test-starting point.

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4.6.9.2 Apparatus. The test chamber shall be of metal and shall measure 18 inches high by 18 inches wide by 12 inches deep. It shall have a sliding glass front which can be lowered to within 1/2 inch of the bottom of the chamber. Its top shall contain a slot 3/8 inch wide, running the width of the chamber and so centered that it is directly above the specimen. A Bunsen burner, having a 1/4-inch inlet, a nominal bore of 3/8 inch, and a length of approximately 4 inches from its top to its primary inlet, shall be used. The burner shall be adjusted to produce a 2-inch flame with an inner cone one-third of the flame height.

4.6.9.3 Procedure. The burner shall be fed with ordinary illuminating gas at normal pressure. The glass front of the chamber shall be raised sufficiently to permit application of the flame to the wire. The portion of the flame midway between its tip and the tip of the inner cone shall be applied continuously to the ignition-point marker for a period of 30 seconds. If, after removal of the test flame, the specimen continues to burn until the leading edge of the flame reaches the 5-inch marker, the time consumed in traversing each subsequent 1-inch section (to a maximum of 6 inches) shall be measured by means of a stopwatch or other timing device. If, after removal of the test flame, the specimen does not continue to burn until the leading edge of the flame reaches the 5-inch marker, the specimen shall be considered self-extinguishing (see 3.12.7).

4.6.10 Solvent resistance. Five specimens of the finished wire, each at least 2 feet long, shall be prepared for testing by skinning approximately 1 inch at each end to the bare conductor. The center 1-foot section of each specimen shall be immersed for 24 hours at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$, in one of the following solvents; a different solvent shall be used for each specimen.

- a. Saturated solution of salt water.
- b. Aviation-grade gasoline.
- c. Motor oil (SAE No. 20 or 30, oxidation inhibited).
- d. Ethylene glycol.
- e. Alcohol (commercial methyl or ethyl).

At the end of the immersion period, the specimens shall be removed from the solvents and wiped clean with a dry cloth. The center 1-foot sections shall be given careful visual examination and, within 15 minutes after removal from the solvents, shall then be immersed for 1 hour in tap water at not over 30°C . The specimens shall then be subjected to the applicable voltage-withstand voltage specified in table XI, in the manner specified in 4.6.4 (see 3.12.8).

4.6.11 Surface resistivity.

4.6.11.1 Specimens. Specimens of the finished wire, each 6 inches long, shall be prepared for testing by skinning approximately 1 inch at one end to the bare conductor. The coverings, if any, shall be cut evenly so that no loose ends protrude. Two metal-foil (or similar) electrodes, approximately 1/4 inch wide, shall be wrapped snugly around the axis of each specimen in such a manner as to provide a 1-inch space between the bare conductor and the first electrode and also between the first and second electrodes. This test shall apply only to finished wire; when the outermost covering is a shield, it shall be removed and the construction beneath shall be tested.

4.6.11.2 Conditioning. The specimens shall be conditioned for a period of 96 hours at a temperature of $65^{\circ}\text{C} \pm 1^{\circ}\text{C}$, and a relative humidity of 90 to 95 percent. At the end of this period, while the specimens are still in the chamber at the conditioning temperature and humidity, the tests specified in 4.6.11.3 shall be performed by the use of suitable leads tied to the electrodes and bare conductors.

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4.6.11.3 Procedure. After conditioning of the specimens, the resistance shall be measured, first between the bare conductor and the first electrode, and then between the first and second electrodes, utilizing the applicable procedure specified in 4.6.5. No temperature correction shall be employed. The resistivity in both instances shall be computed as follows:

$$r = 3.14 d * R.$$

Where:

r = resistivity.

d = diameter of specimen.

R = measured resistance.

Next, a voltage of 2,500 volts root mean square (rms) (1,000 volts for type LWP and LWR wire in AWG sizes 30 to 26, incl.) shall be applied in accordance with the applicable procedures of 4.6.4 between the bare conductor and the first electrode, and then between the first and second electrodes (see 3.12.9).

4.6.12 Soldering (not applicable to type HF wire). Specimens of the insulated wire, each 6 inches long, shall be prepared for testing by skinning 1/2 inch at one end to the bare conductor. The specimens shall then be given a 90° bend over mandrels of their own diameter, the center of the bend being at a point 1 inch from the skinned end. The skinned ends shall then be immersed for 5 seconds, to within 1/8 inch of the insulation, a pot of molten 60-40 tin-lead solder maintained at approximately 320 °C (see 3.12.10).

4.6.13 Power factor and dielectric constant (applicable only to type HF wire). Specimens of the insulated wire shall be of such length that the capacitance of each, when measured, will be not less than 100 Picofarads. Specimens shall be prepared for testing by skinning approximately 1 inch at each end to the bare conductor. Power factor and capacitance shall be measured between the conductor and the outer surface of insulation by immersing all of the specimen, except the ends, in mercury; an alternate method is to use suitable wrap-around electrodes. Determinations shall be made using the apparatus and procedure described in ASTM D150 (see 3.12.11).

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. Wire covered by this specification are intended for use in the internal wiring of electrical and electronic equipment.

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6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Complete Part or Identifying Number (PIN) (see 1.2.1).
- c. Whether braid, if required, is to be of synthetic yarn or glass yarn (see 3.6 and 3.10).
- d. Color-coding method to be used (see 3.8).
- e. Lengths required (see section 5).
- f. That the cost of the spools or reels be included in the tender price, and that the spools or reels remain the property of the Government.
- g. Levels of packaging and packing, and applicable marking (see section 5).
- h. First article contract requirements (see 6.2.1).

6.2.1 First article. When first article inspection is required, the contracting officer should provide specific guidance to offerors, whether the item(s) should be a preproduction sample, a first article sample, a first production item, a sample selected from the first production items, a standard production item from the contractor's current inventory (see 3.1), and the number of items to be tested as specified in 4.3. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.3 Indirect shipments. The packaging, packing, and marking specified in section 5 apply only to direct purchases by or direct shipments to the Government and are not intended to apply to contracts or orders between the manufacturer and prime contractor.

6.4 Definitions.

6.4.1 Finished wire. Finished wire is wire on which all manufacturing operations have been completed and which is ready to be submitted for inspection.

6.4.2 Inspection lot. An inspection lot is finished wire of any one type or construction, within the size ranges listed in table XIX, produced under substantially the same conditions and offered for inspection at one time.

TABLE XIX. Similar inspection lot size range.

Wire size range (AWG), inclusive, nominal
30 to 26
24 to 16
14 to 10
8 to 4
2 to 00

6.4.3 Unit of product. The unit of product is the continuous length of wire contained on a spool or reel, or in a package.

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6.4.4 Specimen. A specimen consists of the individual piece of the unit of product upon which the test is made.

6.4.5 Defective unit. Failure in any one test constitutes a defect. However, if the same unit of product fails more than one test in any one group, it is counted as only one defective unit in that group.

6.4.6 Sample. A sample consists of a group of articles (spools, reels, or package) chosen from an inspection lot for purposes of inspection and treated as an entity.

6.5 Engineering information.

6.5.1 Construction D. When insulated wire with shield (construction D) is used, caution should be taken to prevent short circuiting of shield to conductor which may be caused by soldering.

6.5.2 Voltage rating. In DC circuits, the wire covered by this specification may be used at voltages 1.4 times the rms voltage ratings shown in . Cognizance should be taken of possible corona, particularly when using types HWP and HWR wire in AWG sizes 22 to 16, inclusive.

6.5.3 Temperature rating. The temperature rating of 90 °C (see 1.1) indicates primarily that the wire covered by this specification is not intended for high-temperature applications. This rating is approximate; it applies to the insulated wire without covering and may be raised slightly when the construction includes a covering over the insulation. The rating is ambient temperature plus temperature rise due to conductor current. When a nylon jacket is used, the temperature rating may be raised to approximately 100 °C.

6.5.4 Abrasion resistance. When wire is subject to abrasion, it is recommended that nylon-jacketed wire be used, since nylon jacket is known to possess superior abrasion resistance.

6.6 Subject term (key word) listing.

Braid, glass yarn
Braid, synthetic yarn
Polyethylene
Polyvinyl Chloride
Shield, copper
Single-conductor
Styrene Butadiene Rubber
Synthetic-resin insulated

6.7 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

Note: Caution should be taken during handling and disposal of all solvents, insulating, jacketing, soldering, and other materials in accordance with ASTM C930 and FED-STD-313.

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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.

CONCLUDING MATERIAL

Custodian:
Army – CR
Air Force – 85
DLA - CC

Preparing activity:
DLA - CC

Review activities:
Army – CR4, EA
Navy – OS

(Project 6145-2022-009)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.