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SUPERSEDING
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MILITARY SPECIFICATION

CABLE, ELECTRIC, FILTER LINE, RADIO FREQUENCY ABSORPTIVE

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

1. SCOPE

* 1.1 Scope. This specification covers the requirements for radio frequency absorptive component wires and finished cables which function electrically as distributed low-pass filters. Materials and construction details are specified in the applicable specification sheet.

1.2 Classification. Products in accordance with this specification shall be of the following types, as specified in the applicable specification sheet.

Component Wire — A single conductor, insulated as specified in the applicable specification sheet.

Finished Cable — Any construction other than component wire, utilizing a wire or wires with or without shielding, or with or without an outer jacket.

1.2.1 Current rating. The current rating shall be determined in accordance with MIL-W-5088.

1.2.2 Temperature rating. The maximum conductor temperature of the component wire or finished cable for continuous use shall be as specified in the applicable specification sheet.

1.2.3 Voltage rating. The maximum voltage rating of the component wire or finished cable for continuous use shall be as specified in the applicable specification sheet.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commanding Officer, Naval Air Engineering Center, ESSD, Code 93, Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 6145

* 1.2.4 Component wire and finished cable designation. Component wire and finished cable shall be identified by a combination of digits and letters (not to exceed 15).

* 1.2.4.1 Component wire. Component wire designation shall be as shown in the following example:

M85485	/5	-22	-7L
Basic Specification	Applicable Specification Sheet	Wire Size	Color Code
1.2.4.1.1	1.2.4.1.2	1.2.4.1.3	1.2.4.1.4

Example: M85485/5-22-7L

* 1.2.4.1.1 Basic specification. The basic specificaton shall describe the performance requirements of components and finished cable.

* 1.2.4.1.2 Applicable specification sheet. The specification sheet shall describe the material and construction details of finished cable and components.

* 1.2.4.1.3 Wire size. The component wire size shall be identified. All component wire used in a cable shall be of the same size.

* 1.2.4.1.4 Color. The component wire color shall be designated in accordance with MIL-STD-681. The preferred color of component wire is light violet, designated 7L.

* 1.2.4.2 Finished cable. Finished cable designation shall be as shown in the following example:

M85485	/8	-22	U	3	A
Basic Specification	Applicable Specification Sheet	Wire Size	Construction	Number of Components	Color Code Designator
1.2.4.1.1	1.2.4.1.2	1.2.4.1.3	1.2.4.2.1	1.2.4.2.2	1.2.4.2.3

Example: M85485/8-22U3A

* 1.2.4.2.1 Construction. A letter symbol shall be used to designate the construction in accordance with the following:

(a) Shielded, jacketed cable construction

Letter Code	Conductor Type	Shield Type
T	Tin-coated copper	Tin-coated copper
S	Silver-coated copper	Silver-coated copper
N	Nickel-coated copper	Nickel-coated copper
M	Silver-coated high-strength copper alloy	Silver-coated high-strength copper alloy
P	Nickel-coated high-strength copper alloy	Nickel-coated high-strength copper alloy
U	Silver-coated-high-strength copper alloy	Tin-coated copper
V	Silver-coated high-strength copper alloy	Silver-coated copper
W	Nickel-coated high-strength copper alloy	Nickel-coated copper

(b) Unshielded, unjacketed cable construction

Letter Code	Conductor Type
T	Tin-coated copper
S	Silver-coated copper
N	Nickel-coated copper
M	Silver-coated high-strength copper alloy
P	Nickel-coated high-strength copper alloy

* 1.2.4.2.2 Number of components. A single digit shall be used to designate the number of component wires in the finished cable.

* 1.2.4.2.3 Color code designator. The letter symbol A shall be used to designate the component color code described in 3.6.3.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

* 2.1.1 Specifications, standards, and handbooks. Unless otherwise specified, the following specifications, standards, and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

TT-I-735	Isopropyl Alcohol
TT-S-735	Standard Test Fluids; Hydrocarbon

MILITARY

MIL-C-915	Cable and Cord Electrical, for Shipboard Use, General Specification for
MIL-G-3056	Gasoline, Automotive, Combat
MIL-W-5088	Wiring, Aerospace Vehicle
MIL-H-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-T-5624	Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-L-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-A-8243	Anti-Icing and Deicing-Defrosting Fluid
MIL-C-12000	Cable, Cord, and Wire, Electric, Packaging of
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-C-25769	Cleaning Compound, Aircraft Surface, Alkaline Waterbase
MIL-C-43616	Cleaning Compound, Aircraft Surface
MIL-T-81533	1, 1, 1 Trichloroethane (Methyl Chloroform) Inhibited, Vapor Degreasing
MIL-H-83306	Hydraulic Fluid, Fire Resistant, Phosphate Ester Base, Aircraft

STANDARDS

FEDERAL

FED-STD-228	Cable and Wire, Insulated; Methods of Testing

MILITARY

MIL-STD-104	Limits for Electrical Insulation Color
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-681	Identification Coding and Application of Hook Up and Lead Wire

SUPPLEMENT

See Supplement 1 for list of applicable specification sheets.

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein.

PUBLICATIONS

Defense Logistics Agency Handbooks

H4-1	Federal Supply Code for Manufacturers Part 1, Name to Code
H4-2	Federal Supply Code for Manufacturers Part 2, Code to Name

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

* 2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

American Society for Testing and Materials (ASTM)

B33-78	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
B63-49 (1975)	Standard Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials

B298-74a	Standard Specification for Silver-Coated Soft or Annealed Copper Wire
B355-74	Standard Specification for Nickel-Coated Soft or Annealed Copper Wire
B624-77	Standard Specification for High-Strength, High-Conductivity Copper-Alloy Wire for Electronic Application
D1153-77	Standard Specification for Methyl Isobutyl Ketone
E104-51	Standard Recommended Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions
E595-77	Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials From Outgassing in a Vacuum Environment
F777-82	Standard Test Method for Resistance of Electrical Wire Insulation Materials to Flame at 60°

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

National Electrical Manufacturers Association (NEMA)

NEMA HP1-1979	High-Temperature Insulated Wire - Impulse Dielectric Testing

(Copies of NEMA publications may be obtained from NEMA, 2101 L Street, N.W., Washington, D.C. 20037.)

3. REQUIREMENTS

3.1 Specification sheets. The requirements for the component wire and finished cable furnished under this specification shall be as specified herein and in accordance with the applicable specification sheet. In the event of discrepancy between this specification and the requirements of the applicable specification sheet, the requirements of the specification sheet shall govern.

3.2 Classification of requirements. The applicable requirements are classified herein as follows:

Requirement	Paragraph
Qualification	3.3
Materials	3.4
Construction	3.5
Component Wire and Finished Cable	3.6

3.3 Qualification. The component wire or finished cable furnished under this specification shall be a product which is qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3). The provisions of 4.6 for retention of qualification are included in this requirement.

3.4 Materials.

3.4.1 Conductor material. All strands used in the manufacture of the conductors shall be soft annealed copper conforming to ASTM B33, B298, or B355, as applicable, or shall be high-strength copper alloy conforming to ASTM B624. Strands shall be free from lumps, kinks, splits, scraped or corroded surfaces and skin impurities. In addition, the strands shall conform to the following requirements as applicable.

3.4.1.1 Tin-coated copper strands. No additional requirements. The tin coating shall be as specified in ASTM B33.

3.4.1.2 Silver-coated copper strands. The strands shall have a coating thickness of not less than 40 micro-inches of silver when tested in accordance with ASTM B298.

3.4.1.3 Nickel-coated copper strands. The strands shall have a coating thickness of not less than 50 micro-inches of nickel when tested in accordance with ASTM B355. Adhesion of the nickel coating shall be such that, after subjection to the procedures of 4.7.7.1, the strands shall still pass the continuity of coating test in ASTM B355.

3.4.1.4 High-strength copper alloy. The strands shall be of the applicable AWG gage specified in Table I and of such tensile properties that the conductor from the finished wire conforms to the requirements of 3.5.1.3.2 for elongation and breaking strength. The strands shall be silver-coated or nickel-coated in accordance with 3.4.1.2 or 3.4.1.3 as applicable.

3.4.2 Shield material.

3.4.2.1 Braided round wire strands. Braided round wire strands shall meet all the applicable conductor material requirements of 3.4.1 prior to braiding.

3.4.2.2 Braided flattened wire strands. Braided flattened wire strands shall meet all the applicable conductor material requirements of 3.4.1 prior to flattening and braiding.

3.4.3 Insulation material. All insulating and filter layer materials shall be in accordance with the applicable specification sheet and shall meet all applicable requirements of Table III and the applicable specification sheet.

3.5 Construction. Construction of the component wire and finished cable shall be as specified herein and in the applicable specification sheet.

3.5.1 Conductor.

3.5.1.1 Stranding.

3.5.1.1.1 Concentric-lay stranding. The conductors of wire sizes 30 through 10 shall be concentric-lay conductors constructed as specified in Table I. Concentric-lay shall be interpreted to be a central strand surrounded by one or more layers of helically wound strands. It is optional for the direction of lay of the successive layers to be alternately reversed (true concentric lay) or to be in the same direction (unidirectional lay). The strands shall be assembled in a geometric arrangement of concentric layers, so as to produce a smooth and uniform conductor, circular in cross-section and free of any crossovers, high strands, or other irregularities. The direction of lay of the individual strands in the outer layer of the concentrically stranded conductors shall be left hand. The length of lay of the outer layer shall not be less than 8 nor more than 16 times the maximum conductor diameter as specified in the applicable specification sheet.

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* 3.5.1.2 Splices. Splices in individual strands or members shall be butt brazed. There shall not be more than one strand-splice in any two lay lengths of a stranded concentric-lay conductor. In no case shall the whole conductor be spliced at one point.

3.5.1.3 Conductor elongation and breaking strength.

3.5.1.3.1 Soft or annealed copper. The individual strands removed from component wires with soft or annealed copper conductors, wire sizes 20 and larger, or the whole soft or annealed copper conductor removed from component wire, sizes 22 and smaller, shall have the following minimum elongation when tested in accordance with 4.7.6.1:

Sizes 24 and smaller - 6 percent (minimum)
Sizes 22 and larger - 10 percent (minimum)

There shall be no breaking strength requirements for soft or annealed copper conductors.

3.5.1.3.2 High-strength copper alloy. The whole conductor removed from component wires with high-strength copper alloy conductors shall exhibit elongation of 6 percent, minimum, and a breaking strength conforming with Table I, when tested in accordance with 4.7.6.2.

TABLE I. Details of conductors.

Size Desig-nation	Nominal Conductor Area (Cir. Mils) 1/	Stranding (No. of Strands x AWG Gage of Strands)	Allowable No. of Missing Strands (Max)	Nominal Dia of Individual Strands (inch) 1/	Diameter of Stranded Conductor: Min. (inch)	Diameter of Stranded Conductor, Max (inch): General Purpose, Silver Coated	General Purpose, Nickel or Tin Coated	Small Dia(Cu), Silver Coated	Small Dia(Cu), Nickel or Tin Coated	Small Dia(Alloy), Silver Coated	Small Dia(Alloy), Nickel Coated	Maximum Resistance of Stranded Conductor (Ohms/1,000 Ft. at 20°C): Soft or Annealed Copper, Silver Coated	Soft or Annealed Copper, Nickel Coated	Soft or Annealed Copper, Tin Coated	High Str Cu Alloy, Silver Coated	High Str Cu Alloy, Nickel Coated	Breaking Strength, Alloy Conductor (lbs)(min)
30	112	7 x 38	0	0.0040	0.011	0.012	0.013	0.012	0.013	0.012	0.013	100.7	110.7	108.4	117.4	129.6	5.17
28	175	7 x 36	0	0.0050	0.014	0.015	0.016	0.015	0.016	0.015	0.016	63.8	67.9	68.6	74.4	79.0	8.16
26	304	19 x 38	0	0.0040	0.018	0.020	0.021	0.019	0.020	0.020	0.020	38.4	42.2	41.3	44.8	49.4	14.2
24	475	19 x 36	0	0.0050	0.023	0.025	0.026	0.024	0.024	0.024	0.025	24.3	25.9	26.2	28.4	30.1	22.4
22	754	19 x 34	0	0.0063	0.029	0.032	0.033	0.030	0.031	0.031	0.031	15.1	16.0	16.2	17.5	18.6	35.8
20	1,216	19 x 32	0	0.0080	0.037	0.040	0.041	0.038	0.039	0.039	0.040	9.19	9.77	9.88	10.7	11.4	58.1
18	1,900	19 x 30	0	0.0100	0.046	0.050	0.051	0.048	0.049	-	-	5.79	6.10	6.23			
16	2,426	19 x 29	0	0.0113	0.052	0.057	0.058	0.054	0.055	-	-	4.52	4.76	4.81			
14	3,831	19 x 27	0	0.0142	0.065	0.072	0.073	0.068	0.069	-	-	2.88	3.00	3.06			
12	5,874	37 x 28	0	0.0126	0.084	0.089	0.090	0.087	0.089	-	-	1.90	1.98	2.02			
10	9,354	37 x 26	0	0.0159	0.106	0.112	0.114	0.110	0.112	-	-	1.19	1.24	1.26			
8	16,983	133 x 29	0	0.0113	0.158	0.169	0.173	0.166	0.169	-	-	0.658	0.694	0.701			
6	26,818	133 x 27	0	0.0142	0.198	0.213	0.217	0.208	0.212	-	-	0.418	0.436	0.445			
4	42,615	133 x 25	0	0.0179	0.250	0.268	0.274	0.263	0.268	-	-	0.264	0.275	0.280			
2	66,500	665 x 30	2	0.0100	0.320	0.340	0.340	-	-	-	-	0.170	0.177	0.183			
1	81,700	817 x 30	2	0.0100	0.360	0.380	0.380	-	-	-	-	0.139	0.144	0.149			
0	104,500	1,045 x 30	3	0.0100	0.405	0.425	0.425	-	-	-	-	0.108	0.113	0.116			
00	133,000	1,330 x 30	3	0.0100	0.450	0.475	0.475	-	-	-	-	0.085	0.089	0.091			
000	166,500	1,665 x 30	4	0.0100	0.515	0.540	0.540	-	-	-	-	0.068	0.071	0.071			
0000	210,900	2,109 x 30	5	0.0100	0.580	0.605	0.605	-	-	-	-	0.054	0.056	0.056			

1/ Nominal values are for information only. Nominal values are not requirements.

3.5.1.4 Conductor diameter. The diameter of the conductor shall be as specified in Table I. Applicability of the "general purpose" or of the "small diameter" Table I requirements for maximum conductor diameter shall be as indicated in the specification sheet.

3.5.2 Shield. The shield shall be constructed as specified in the applicable specification sheet.

* 3.5.3 Insulation. The insulating and filter layers shall be constructed as specified in the applicable specification sheet. All component insulation shall be readily removable by conventional wire stripping devices without damage to the conductor.

3.6 Component wire and finished cable. The component wire and finished cable shall conform to the requirements of Table III and those of the applicable specification sheet. The requirements of 3.6.1 through 3.6.10 also apply. Unless otherwise specified, component wire shall conform to all applicable requirements prior to assembly into the finished cable.

* 3.6.1 Blocking. Adjacent turns or layers of the component wire or cable jacket shall not stick to one another when tested as specified in 4.7.4 at the temperature specified in the applicable specification sheet.

* 3.6.2 Cabling. The required number of component wires as specified in the applicable specification sheet shall be cabled together with a left hand lay. For cables having multiple layers, the outer layer shall be left hand and the inner layer or layers may be either right hand or left hand lay. The lay length of the individual component wires shall be not less than 8 times nor more than 16 times the diameter of the applicable layer. Fillers and binders shall be used only as specified in the applicable specification sheet.

* 3.6.3 Color. Unless otherwise specified in the contract or purchase order, the color of component wire shall be light violet, designated by 7L. The preferred colors for components in a finished cable shall be light violet for component number 1 and light violet with stripe designators for remaining component wires as follows:

Component number	1	2	3	4	5	6	7
Color designation	7L	7L6	7L3	7L5	7L2	7L0	7L4

All solid colors and the colors of all striping shall be in accordance with MIL-STD-104, Class 1, unless otherwise specified. Color striping, if applicable, shall conform to MIL-STD-681 and shall be capable of withstanding the striping durability test of 4.7.11 for the number of strokes and with the weight specified in the applicable specification sheet.

* 3.6.4 Crosslinking proof test and life cycle. When samples are tested in accordance with 4.7.10, there shall be no cracking of the insulation or jacket and no dielectric breakdown, as applicable.

* 3.6.5 Conductor and shield continuity. One hundred percent of all finished cable shall be tested for continuity prior to shipment. There shall be no indication of discontinuity in any of the component wires or shields.

* 3.6.6 Continuous lengths. The individual continuous lengths of component wire or finished cable in each inspection lot shall be of such footage that, when inspected in accordance with 4.7.9, the inspection lot shall conform to the continuous length requirements of Table II. Unless otherwise specified in the contract or order, the footage of the individual continuous lengths in each spool or reel shall be marked on the spool or reel in the sequence in which the lengths will be unwound by the user.

* Table II. Minimum continuous lengths.

PRODUCT DESCRIPTION	REQUIRED MINIMUM PERCENT OF THE TOTAL INSPECTION LOT FOOTAGE IN CONTINUOUS LENGTHS GREATER THAN		
	250 feet	100 feet	50 feet
Component Wire	85%	100%	--
Finished Cable	--	85%	100%

* 3.6.7 Identification of product. The component wire or finished cable shall be identified by a printed marking applied to the outer surface, or visible through the outer surface, of the wire or cable insulation. Identification marking of unshielded, unjacketed cable shall be located on component number 1. Identification marking of components of finished cable shall not be required. Printing of the color code designator on surface of wire insulation or jacket is not required. The printed marking shall consist of the following information:

Specification sheet part number
Manufacturer's code as specified in publications H4-1 and H4-2

For finished shielded and jacketed cable, the words "FILTER LINE" shall follow the manufacturer's code.

3.6.7.1 Identification intervals. For the component wire, the identification shall be at intervals of 9 inches to 60 inches, as measured from the beginning of one complete marking to the beginning of the succeeding completed marking. For finished cable, the distance between the end of one complete marking and the beginning of the next complete marking shall not be greater than 12 inches.

* 3.6.7.2 Identification color. The printing shall be white in color in accordance with MIL-STD-104, Class 1. Identification printing shall be applied with the vertical axes of the printed characters lengthwise of the component wire or finished cable when the nominal diameter is 0.050 inch or smaller. The vertical axes of the printed characters may be either crosswise or lengthwise of the component wire or finished cable when the nominal diameter exceeds 0.050 inch. All printed characters shall be complete and legible.

3.6.7.3 Durability of identification. Identification printing, when applied to the outer surface of the component wire or finished cable, where applicable, shall be capable of withstanding the durability test specified in 4.7.11 for the number of cycles and with the weight specified in the applicable specification sheet.

* 3.6.8 Insulation and jacket flaws. When required by the applicable specification sheet, one hundred percent of the component wire and finished cable shall pass the spark test of 4.7.17.1 or the impulse dielectric test of 4.7.17.2. Testing of finished component wire or cable shall be performed during the final winding on shipment spools or reels. Component wire intended for finished cable shall be tested prior to cabling.

3.6.9 Workmanship. All details of workmanship shall be in accordance with high grade wire and cable manufacturing practice. The insulation shall be free of cracks, splits, irregularities, and imbedded foreign material.

* 3.6.10 Wrap test. When component wires are tested in accordance with 4.7.29, there shall be no cracking of insulation.

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* 3.6.11 Jacket resistivity. When tested in accordance with 4.7.1, the jacket resistivity for conductive jackets shall be 150 ohm-cm, maximum.

* 3.6.12 Low temperature (cold bend). When samples are tested in accordance with 4.7.19, there shall be no cracking of the insulation or jacket and no dielectric breakdown.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Classification of inspections. The examinations and tests of component wire and finished cable under this specification shall be divided into the following classifications:

Classification	Paragraph
Qualification inspection	4.3
Quality conformance inspection	4.4
Process control inspection	4.5
Periodic qualification re-evaluation	4.6

* 4.3 Qualification inspection. Qualification inspection shall consist of the examination and tests listed in Tables III and IV of this specification as applicable to the component wire or finished cable. Qualification approval for finished cable must be obtained both for the components and for the finished construction.

* 4.3.1 Sampling for qualification inspection. Except as provided in 4.3.1.1, a component wire or finished cable sample of the required length shall be tested for each range of component wire or finished cable sizes for which qualification is desired. The sample may be any size of component wire or finished cable within the size range specified below. Within each size range for which qualification is desired for shielded, jacketed cable, both a single-conductor and a multiple-conductor finished cable sample must be tested if they fall within that size range. Ten linear feet of the coated conductor strand used in the manufacture of the finished wire sample shall be submitted with the finished wire sample.

Component Wire Size Range	Required Length of Sample (Feet)
24 and smaller	200
22 through 18	200
16 and larger	200

Finished Cable Size Range Nominal Overall Diameter (Inch)	Required Length of Sample (Feet)
< 0.100	100
> 0.100 and <0.150	100
> 0.150 and <0.225	100
> 0.225	100

* 4.3.1.1 Optional qualification samples. In cases where two or more specification sheets cover component wire or finished cable identical in materials and construction except for conductor and/or shield material (i.e., the specified conductor or shield may be tin-coated copper, silver-coated high strength copper alloy or as specified in the applicable specification sheet), the component wire or finished cable sample in accordance with 4.3.1 may qualify any one of the specification sheets. For those sheets so qualified by similarity, a conductor and/or strand shall be tested in accordance with the applicable conductor and/or strand requirements of Table III. One conductor and/or strand shall be tested for each size range specified in 4.3.1. Approval of the qualification sample shall also qualify the same component wire or finished cable size range or ranges in each of the other specification sheets. Ten linear feet of the conductor strand and shield strand applicable

* TABLE III. Properties of component wire and finished cable.

EXAMINATION OR TEST	REQUIREMENT	METHOD
COMPONENT WIRE		
Adhesion of nickel coating	3.4.1.3	4.7.7.1
Attenuation (insertion loss)	Specification sheet	4.7.2
Blocking	3.6.1	4.7.4
Color	3.6.3	4.7.12
Component wire diameter	Specification sheet	4.7.12
Concentricity	Specification sheet	4.7.5
Conductor diameter	Table I and 3.5.1.4	4.7.12
Conductor elongation and breaking strength	3.5.1.3	4.7.6
Conductor material	Specification sheet and 3.4.1	4.7.7
Conductor resistance	Table I	4.7.8
Conductor splices	3.5.1.2	4.5.1.3
Conductor stranding	Table I and 3.5.1.1	4.7.12
Construction and materials	Specification sheet, 3.4 and 3.5	4.7.12
Continuous lengths	3.6.6	4.7.9
Crosslinking proof test	3.6.4	4.7.10
Durability of marking and color striping	3.6.3 and 3.6.7.3	4.7.11
Flammability	Specification sheet	4.7.13
Humidity resistance	Specification sheet	4.7.14
Identification of product	3.6.7	4.7.12
Immersion	Specification sheet	4.7.15
Insulation elongation and tensile strength	Specification sheet	4.7.16
Insulation and jacket flaws	Specification sheet and 3.6.8	4.7.17
Insulation resistance	Specification sheet	4.7.18
Insulation thickness	Specification sheet	4.7.12
Life cycle	3.6.4	4.7.10
Low temperature (cold bend)	3.6.12	4.7.19
Removability of insulation	3.5.3	4.7.12
Shrinkage	Specification sheet	4.7.21
Smoke	Specification sheet	4.7.22
Surface resistance	Specification sheet	4.7.23
Thermal shock resistance	Specification sheet	4.7.25
Thermal stability	Specification sheet	4.7.26
Vacuum stability	Specification sheet	ASTM E595-77
Voltage withstand (post-environmental)	Specification sheet	4.7.27.2
Weight	Specification sheet	4.7.28
Workmanship	3.6.9	4.7.12
Wrap test	Specification sheet and 3.6.10	4.7.29

TABLE III. (Continued)

EXAMINATION OR TEST	REQUIREMENT	METHOD
FINISHED CABLE		
Blocking	3.6.1	4.7.4
Cabling	Specification sheet and 3.6.2	4.7.12
Color	3.6.3	4.7.12
Concentricity	Specification sheet	4.7.5
Conductor and shield continuity	3.6.5	4.7.12
Construction and materials	Specification sheet, 3.4 and 3.5	4.7.12
Continuous lengths	3.6.6	4.7.9
Crosslinking proof test	3.6.4	4.7.10
Durability of marking and color striping	3.6.3 and 3.6.7.3	4.7.11
Finished cable diameter	Specification sheet	4.7.12
Flammability	Specification sheet	4.7.13
Identification of product	3.6.7	4.7.12
Immersion	Specification sheet	4.7.15
Jacket elongation and tensile strength	Specification sheet	4.7.16
Insulation and jacket flaws	Specification sheet and 3.6.8	4.7.17
Jacket resistivity	3.6.11	4.7.1
Jacket thickness	Specification sheet	4.7.12
Life cycle	3.6.4	4.7.10
Low temperature (cold bend)	3.6.12	4.7.19
Shield coverage and angle	Specification sheet	4.7.20
Surface transfer impedance, effective	Specification sheet	4.7.24
Thermal stability	Specification sheet	4.7.26
Vacuum stability	Specification sheet	ASTM E595-77
Voltage withstand (dielectric)	Specification sheet	4.7.27.1
Voltage withstand (post-environmental)	Specification sheet	4.7.27.2
Weight	Specification sheet	4.7.28
Workmanship	3.6.9	4.7.12

to the same wire or cable size range as the finished wire or cable samples shall be submitted when qualification by similarity is requested. (Note: For purposes of determining identity of construction in specification sheets under this provision, small differences in specified component wire or finished cable diameter or weight which are due to differences in the specified conductor or shield shall not be considered as constituting differences in construction of the component wire or finished cable.)

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

Sample for qualification test
CABLE, ELECTRIC, FILTER LINE,
  RADIO FREQUENCY ABSORPTIVE
Specification sheet part number
Manufacturer's name and code number
  (Publications H4-1 and H4-2)
Manufacturer's part number
Comprehensive description and 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.)
Place and date of manufacture of sample
Submitted by (name) (date) for qualification tests
  in accordance with the requirements of MIL-C-85485A
  under authorization (reference authorizing letter).

The tags or spools must be stamped by the government inspector as representative samples of the manufacturer's normal production capability. Samples submitted without the stamp will not be accepted.

4.4 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests listed in Table IV and described under "Test Methods" (4.7). Quality conformance inspection shall be performed on every lot of component wire or finished cable procured under this specification.

4.4.1 Sampling for quality conformance inspection. MIL-STD-109 shall apply for definitions of inspection terms used herein. For purposes of this specification, the following shall apply.

4.4.1.1 Lot. The inspection lot shall include all component wire or finished cable of one part number subjected to inspection at one time.

4.4.1.2 Unit of product. The unit of product for determining lot size for sampling shall be one continuous length of component wire or finished cable as offered for inspection.

* TABLE IV. Quality conformance inspection.

EXAMINATION OR TEST	REQUIREMENT	METHOD
Group I Characteristics		
Cabling	Specification sheet and 3.6.2	4.7.12
Color	3.6.3	4.7.12
Component wire diameter	Specification sheet	4.7.12
Conductor diameter	Table I and 3.5.1.4	4.7.12
Conductor elongation and breaking strength	3.5.1.3	4.7.6
Conductor resistance	Table I	4.7.8
Conductor stranding	Table I and 3.5.1.1	4.7.12
Durability of marking and color striping	3.6.3 and 3.6.7.3	4.7.11
Finished cable diameter	Specification sheet	4.7.12
Identification of product	Specification sheet and 3.6.7	4.7.12
Insulation elongation and tensile strength	Specification sheet	4.7.16
Insulation resistance	Specification sheet	4.7.18
Removability of insulation	3.5.3	4.7.12
Shield coverage and angle	Specification sheet	4.7.20
Weight	Specification sheet	4.7.28
Workmanship	3.6.9	4.7.12

TABLE IV (continued)

EXAMINATION OR TEST	REQUIREMENT	METHOD
Group II Characteristics		
Attenuation (insertion loss) (component wire only)	Specification sheet	4.7.2
Concentricity	Specification sheet	4.7.5
Crosslinking proof test	3.6.4	4.7.10
Flammability	Specification sheet	4.7.13
Insulation thickness	Specification sheet	4.7.12
Jacket resistivity	3.6.11	4.7.1
Jacket thickness	Specification sheet	4.7.12
Low temperature (cold bend)	3.6.12	4.7.19
Shrinkage	Specification sheet	4.7.21
Surface transfer impedance, effective	Specification sheet	4.7.24
Thermal shock resistance	Specification sheet	4.7.25
Voltage withstand (post-environmental)	Specification sheet	4.7.27.2
Wrap test	Specification sheet and 3.6.10	4.7.29
Group III Characteristics		
Conductor and shield continuity	3.6.5	4.7.12
Insulation and jacket flaws	Specification sheet and 3.6.8	4.7.17
Voltage withstand (dielectric)	Specification sheet	4.7.27.1
Group IV Characteristics		
Continuous lengths (component wires)	3.6.6	4.7.9

4.4.1.3 Sample unit (Groups I and II tests). The sample unit for Groups I and II tests, except for the Group I insulation resistance test, shall consist of a single piece of component wire or finished cable chosen at random from the inspection lot and of sufficient length to permit all applicable examinations and tests. Unless otherwise specified, the length of the sample unit for Group I tests of Table IV, other than insulation resistance, shall be 20 feet and the length of the sample unit for Group II tests shall be 25 feet. Not more than one sample unit for each group of tests shall be taken from a single unit of product.

4.4.1.3.1 Sample unit for insulation resistance test (Group I). The sample unit for the Group I insulation resistance test shall be a specimen at least 26 feet in length selected at random from component wire which has passed the Group III insulation flaws test. It is optional whether the specimen is tested on the reel or removed from the reel for the test, provided the length of the specimen can be determined.

4.4.1.4 Inspection levels and acceptable quality levels (AQL) (Groups I an II tests). For Group I characteristics, including the insulation resistance test, the inspection level shall be S-2 and the AQL shall be 6.5 percent defective units in accordance with MIL-STD-105. For Group II characteristics, the inspection level shall be S-3 and the AQL shall be 1.5 percent defective units.

* 4.4.1.5 Sampling and acceptance for the Group III tests. The sample for the Group III tests shall be 100 percent of the component wire or finished cable and every length of the wire or cable shall be subjected fully to these tests. Insulation breakdowns resulting from the test and ends or portions not subjected to the test shall be cut out of the component wire or finished cable.

4.4.1.6 Sampling and acceptability for Group IV examination. The inspection level and acceptable quality level for continuous lengths examination shall be as required by 4.7.9.

4.4.2 Nonconforming inspection lots. Disposition of inspection lots found unacceptable under initial quality conformance inspection shall be in accordance with MIL-STD-105.

4.5 Process control inspection. This inspection comprises tests and examinations of such a nature that they cannot be performed on the component wire or finished cable as submitted for inspection and therefore must be conducted at the most appropriate stage of the manufacturing operations. The process control tests shall consist of the tests listed in Table V. Process control inspection shall be performed on every lot of component wire or finished cable procured under this specification.

* TABLE V. Process Control Inspection.

EXAMINATION OR TEST	REQUIREMENT	METHOD
Conductor material 1/	Specification sheet and 3.4.1	4.7.7
Conductor splices	3.5.1.2	4.5.1.3
Construction and materials	Specification sheet, 3.4 and 3.5	4.7.12
Spark test of primary insulation (when specified)	3.6.8	4.7.17.1

1/ Except adhesion of nickel coating. See Table VI.

4.5.1 Sampling for process control inspection.

4.5.1.1 Conductor material. From each week's production of individual coated strands or from every 1000 pounds of such strands, 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 component wire.

4.5.1.2 Insulation material. Three samples representative of each inspection lot shall be selected after extrusion.

4.5.1.3 Conductor splices. The method of conductor splicing shall be in accordance with 3.5.1.2. At the discretion of the Government representative, the method may be observed.

* 4.5.1.4 Spark test of primary insulation. When a spark test of the primary insulation is required (3.6.8), the test sample shall be one hundred percent of the wire after application of the primary insulation and prior to application of any other material. One hundred percent of the wire shall be tested at this stage in production. Portions showing dielectric breakdown under test shall be cut out and testing of the balance of production shall be resumed.

* 4.5.2 Rejection and retest in process control inspection. When a sample selected from a production run fails to meet the specified tests, no items still on hand or later produced shall be accepted until the extent and cause of the failure have been determined. After investigation, the contractor shall advise the Government acquiring activity and qualification activity of the action taken and, after corrections have been made, shall repeat all the process control tests. Rejection after corrective action will require that the contractor advise the procuring activity of the details surrounding the retest and cause for rejection. Nonconformities of primary insulation in the spark test shall be handled as provided in 4.5.1.4.

4.5.2.1 Effect of process control failure on quality conformance testing. Quality conformance testing may be continued during the investigation of the failure of a process control sample, but final acceptance of the material shall not be made until it is determined that the lot meets all the process control requirements and quality conformance requirements of the specification.

4.6 Retention of qualification. Periodic qualification re-evaluations shall be made at two-year intervals after the date of the qualification test reference specified in the letter of notification of the product's acceptability for qualification. If the manufacturer receives no prior instructions from the qualification activity, materials from current production shall be evaluated against the requirements of Table VI in addition to the quality conformance requirements and process control requirements of Table IV and Table V.

* TABLE VI. Tests applicable only to qualification inspection and qualification re-evaluation.

EXAMINATION OR TEST	REQUIREMENT	METHOD
Adhesion of nickel coating	3.4.1.3	4.7.7.1
Attenuation (insertion loss) (finished cable only)	Specification sheet	4.7.2
Blocking	3.6.1	4.7.4
Humidity resistance	Specification sheet	4.7.14
Immersion	Specificaton sheet	4.7.15
Life cycle	3.6.4	4.7.10
Smoke	Specification sheet	4.7.22
Surface resistance	Specification sheet	4.7.23
Thermal stability	Specification sheet	4.7.26
Vacuum stability	Specification sheet	ASTM E595-77

4.6.1 Re-evaluation procedure. It shall be the responsibility of the qualified supplier to furnish to the Government, at two-year intervals, the data necessary to establish the continued conformity of the product to all qualification requirements. The data shall be complete test results of a sample representative of current production, tested against all the requirements of the specification. A sample shall be selected from each component wire and each cable specification sheet except as permitted by 4.3.1.1. The sample shall be from the range of sizes 30 through 10. At the discretion of the qualifying activity, test records from current production may be accepted for the re-evaluation to the extent they are available and samples from current production need be subjected to only the tests for which no production test records are available. The samples, each 200 feet long, and test reports with supporting data shall be submitted to the qualifying activity as specified in 4.3.2. All conductor and strand samples shall be 10 feet long. If a failure occurs, no product represented by the sample nor any other product manufactured with the same materials and processes, which has not already been submitted for quality conformance inspection, shall be offered for acceptance until the cause for failure has been determined and concurred in by the qualifying activity as not affecting the ability of the product to pass qualification inspection requirements. In the event the date for re-evaluation has passed, the supplier shall still be eligible for contract award, but final acceptance of product from such a supplier is contingent upon his product meeting all the qualifying requirements of the specification.

4.7 Test methods.

* 4.7.1 Jacket resistivity.

* 4.7.1.1 Specimen preparation. A six-inch specimen of conductive jacket material shall be prepared by removing the jacket from the cable. The jacket may be pulled from the end of the cable as a tube, or it may be slit longitudinally and removed.

* 4.7.1.2 Measurement procedure. The resistivity of the jacket material shall be determined in accordance with ASTM B63 except as described above.

4.7.2 Attenuation (insertion loss).

4.7.2.1 Configuration. The configuration of specimen and test equipment for determining attenuation is shown in Figure 1. Matching pads shall be used, when specified, to reduce measurement SWR. The cable under test and the matching pads, if required, are connected between a signal generator and a detector. The matching pads should have a characteristic impedance of 50 ± 2 ohms on one end, and Z_0 ± 10% on the other end, where Z_0 is the characteristic impedance of the cable configuration under test, as determined by MIL-C-915. Unless otherwise specified, single conductor cables shall be measured between conductor and shield and cables of two or more conductors shall be tested between one conductor, and all other shields and conductors grounded together at both ends of the cable specimen.

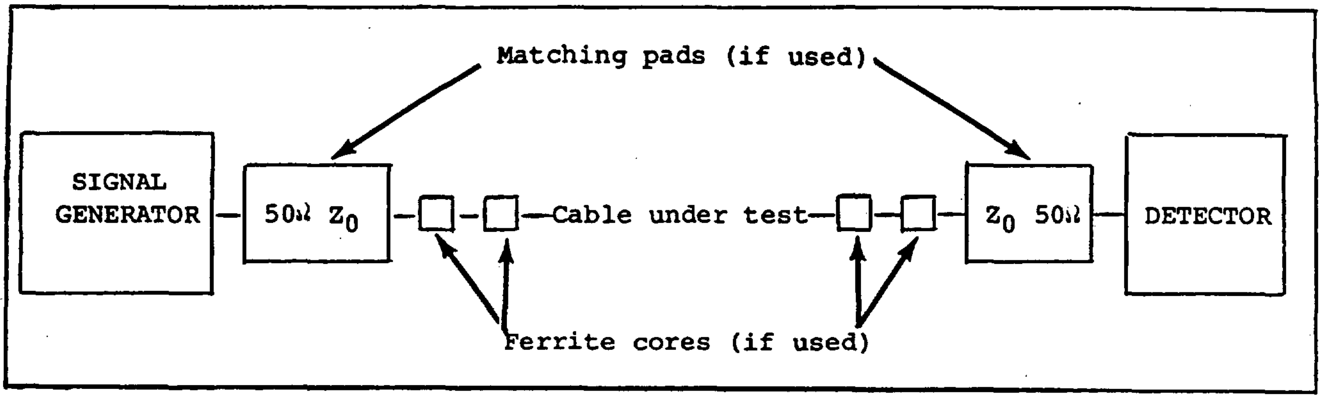


Figure 1. Configuration of specimen and test equipment.

* 4.7.2.1.1 Data bus cable. When attenuation measurements are to be performed on two-conductor shielded and jacketed cables that are designated for data bus applications, the signal shall be applied between the two conductors with the shield electrically floating. To prevent surface leakage, each end of the cable shall be looped four times through ferrite cores (toroids). The ferrite cores shall have an approximate 2.5-inch outside diameter, a 1.4-inch inside diameter and a 0.5-inch thickness. The initial permeability shall be 4700 nominal. In cases where the specimen length will not allow four loops at each end, as many loops as practical shall be used.

4.7.2.2 Measurement procedure. With the measuring system configured as shown in Figure 1, connect the Z_0 ends of the matching pads together. If matching pads are not used, connect the signal generator to the detector. At each test frequency, record the detector reading. Designate this reading V_0. Then separate the matching pads (or signal generator and detector) and insert the cable to be tested. Again record the detector reading at each test frequency. Designate this reading V_1. Designate the length of cable tested L (feet). The raw attenuation data at each test frequency is given by:

$$\text{Attenuation (dB/foot)} = \frac{20}{L} \text{Log}_{10} \left[\frac{V_0}{V_1} \right] \quad (1)$$

Measurements shall be made at a minimum of 10 frequencies per decade, shall be spaced in a reasonably uniform manner throughout the decade, and shall include both the beginning and the end of the decade.

4.7.2.2.1 Pass band measurements. Unless otherwise specified, the frequency range shall be 0.1 to 10 MHz. The length of cable used shall be sufficient to produce an attenuation of at least 14 dB/100 feet at 10 MHz. An 80 to 100-foot length will usually be suitable. A standard regression analysis shall be performed on the raw attenuation data derived from equation (1), expressed in dB/100 feet. The regression analysis is used to smooth out SWR effects. The regression polynomial used shall be:

$$A(f) = a_1 \sqrt{f} + a_2 f \qquad (2)$$

Where:

f = frequency in MHz
a_1, a_2 = coefficients determined by regression analysis
A(f) = attenuation in dB/100 feet at frequency (f)

Using the coefficients a_1 and a_2 determined by the regression analysis, calculate the attenuation A(f) using equation (2) at the frequencies specified in the applicable specification sheet. These values shall be designated as the pass band cable attenuation.

4.7.2.2.2 Transition band measurements. Unless otherwise specified, the frequency range shall be 10 to 1000 MHz. More than one cable length may be necessary to obtain accurate attenuation data for the entire band. An appropriate range of specimen lengths will be 6 to 120 inches. A standard regression analysis shall be performed on the raw data given by equation (1). The regression polynomial used shall be:

$$B(f) = b_0 + b_1 f + b_2 f^2 + b_3 f^3 \qquad (3)$$

Where:

f = frequency in MHz
b_0, b_1, b_2, b_3 = coefficients determined by regression analysis
B(f) = attenuation in dB/foot at frequency (f)

Data points falling in the noise level of the measuring system may be excluded from the regression analysis, provided that the noise level is numerically greater than 100 dB/foot. If more than one cable length is used, and if the data sets taken on the various cable lengths overlap, then any disparity between data sets should be resolved by using the data from the longer length in the regression analysis. Using the coefficients b_0, b_1, b_2 and b_3 determined by the regression analysis, calculate the attenuation B(f) using equation (3) at the frequencies specified in the applicable specification sheet. These values shall be designated as the transition band cable attenuation.

4.7.2.2.3 Stop band measurements. Unless otherwise specified, the frequency range shall be 1 to 18 GHz. The length of cable shall be 6 inches. The measured values of attenuation as determined by equation (1) shall be designated as the stop band cable attenuation.

* 4.7.3 Bend test (post-environmental). At a temperature maintained between 20 and 25°C (68 and 77°F), one end of a component wire or finished cable specimen shall be secured to the mandrel and the other end to the weight specified. For component wire the mandrel and weight shall be as specified in the applicable specification sheet. For finished cable specimens, the mandrel shall be as specified in Table VII and sufficient weight shall be used to maintain contact with the mandrel. 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 turns in contact. The mandrel then shall be rotated in the reverse direction until the full length of the specimen 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 specimen. The specimen then shall be examined for cracking of the insulation or jacket, as applicable.

TABLE VII. Mandrel diameters for cables for bend test, crosslinking proof test, immersion, life cycle and low temperature (cold bend).

Finished Cable Diameter (Inch)	Mandrel Diameter (Inch)
< .125	3
> .125 and < .250	6
> .250 and < .360	10
> .360 and < .750	18
> .750 and < 1.200	30
> 1.200 and < 2.000	48

4.7.4 Blocking. One end of a piece of component wire or finished cable, of sufficient length to perform the test, shall be affixed to a mandrel. The mandrel size shall be determined based upon the component wire or finished cable diameter and using the corresponding mandrel size as specified for bend testing in Table VII. The specimen shall then be wound helically on the mandrel for at least three turns, with the succeeding turns in close contact with one another. The tension for winding component wire shall be equal to the test load specified for the cold bend test of the same size wire in the applicable specification sheet and for finished cable shall be of sufficient weight to keep the cable in contact with the mandrel. The winding shall be continued until there are at least three closely wound layers of such helical turns on the mandrel. The free end of the specimen shall then be affixed to the mandrel so as to prevent unwinding or loosening of the turns or layers and the mandrel and specimen shall be placed for 6 hours in an air-circulating oven at the temperature specified on the applicable specification sheet. At the end of the 6-hour period, the mandrel and specimen shall be removed from the oven and allowed to cool to room temperature. After cooling, the specimen shall be unwound manually, meanwhile being examined for evidence of adhesion (blocking) of adjacent turns or layers.

* 4.7.5 Concentricity and average thickness. The concentricity of finished cable jacket and of component primary insulation and jacket shall be determined in accordance with the procedures of 4.7.5.1 and 4.7.5.2, as applicable. All wall thickness measurements shall be made on cross sections of the component wire or cable jacket under suitable magnification.

* 4.7.5.1 Component wire layers. The concentricity of the component wire layers shall be determined by locating and recording the minimum and maximum wall thicknesses on a cross section of the component wire. The wall thickness shall be the shortest distance between the outer rim of the layer and the

outer rim of the underlying layer or conductor. The percent concentricity is defined as 100 times the ratio of the minimum wall thickness to the maximum wall thickness. The average wall thickness is defined as the mean of the maximum and minimum wall thicknesses.

*

* 4.7.5.2 Cable jacket. The concentricity of the finished cable jacket shall be determined by first locating and recording the minimum wall thickness measured on a cross section of the jacket. The maximum wall thickness of this same cross section of the jacket shall be measured and recorded. For cable jackets, 100 times the ratio of the minimum wall thickness to the maximum wall thickness shall define the concentricity.

4.7.6 Conductor elongation and breaking strength.

4.7.6.1 Soft or annealed copper. Elongation tests of soft or annealed copper conductors shall be performed in accordance with Method 3211 of FED-STD-228. For wire sizes 20 and larger, the tests shall be performed upon individual strands taken from the conductor of the component wire. For sizes 22 and smaller, the tests shall be performed upon the whole conductor removed from the component wire and the elongation shall be measured when the first strand of the conductor breaks. For wire sizes 20 and larger, only the values obtained with individual strands shall be considered and, for wire sizes 22 and smaller, only the values obtained with the whole conductor shall be considered in determining the conformance of soft or annealed copper conductors to elongation requirements of this specification.

4.7.6.2 High-strength copper alloy. Elongation and breaking strength tests of high-strength alloy conductors shall be performed in accordance with Method 3211 of FED-STD-228, except that the tensile strength shall be reported as the breaking strength of the conductor rather than in pounds per square inch. The tests shall be performed upon the whole conductor removed from the component wire. Conductor elongation shall be measured when the first strand of the conductor breaks, and the total tensile force indicated by the testing machine at break of that strand shall be regarded as the breaking strength of the conductor. Only the values thus obtained with the whole conductor shall be considered in determining the conformity of high-strength alloy conductors to the elongation and breaking strength requirements of this specification.

4.7.7 Conductor material. Conductor strands, prior to use in the conductor, shall be tested for conformity to ASTM B33, B298, B355, or B624, as applicable. Thickness of silver or nickel coating shall also be determined by the applicable method of ASTM B298 or B355.

4.7.7.1 Adhesion of nickel coating. Two 6-inch specimens shall be cut from the sample of nickel-coated strand. One specimen shall be wrapped over its own diameter for eight close turns. The second specimen shall remain in its straight form. Both specimens shall then be subjected to ten continuous cycles of temperature change. Each cycle of temperature change shall consist of 4 hours at 250 ± 3°C (482 ± 5.4°F) followed by 4 hours at room temperature. Upon completion of the thermal cycling, the straight specimen shall be wrapped over its own diameter for eight close turns in a manner identical to that of the first specimen. Both wrapped specimens shall then be tested for continuity of coating in accordance with the procedure given in ASTM B355.

4.7.8 Conductor resistance. The DC resistance of the conductor shall be measured in accordance with Method 6021 of FED-STD-228 except that the component wire shall be tested dry without immersion.

4.7.9 Continuous lengths. Unless otherwise specified in the ordering data (6.2), the inspection requirements for continuous component wire lengths shall be satisfied by the supplier's certificate of conformity and the presence of the required piece length markings on the spools or reels (3.6.6). However, the Government reserves the right to examine such certified lots if deemed necessary to assure that the lengths actually conform to requirement. When the ordering data specifies examination of the component wire lengths, the Government representative shall examine the wire at his own discretion to determine conformity in this characteristic. In measuring continuous component wire lengths where the wire has been marked or stripped of insulation in lieu of being cut to mark insulation failures or identify untested or improperly tested areas (4.7.17.2), such marking or stripping shall be conidered equivalent to complete severance of the wire at the two ends of each marked or stripped area.

4.7.10 Crosslinking proof test and life cycle.

4.7.10.1 Component wire. For component wire, 1 inch of insulation shall be removed from each end of a 24-inch specimen. The central portion of the specimen then shall be bent at least halfway around a horizontally positioned smooth stainless steel mandrel of the diameter specified in the applicable specification sheet. To prevent sticking of the specimen to the mandrel, the mandrel shall be covered with a dispersion coating of polytetrafluoroethylene. Each end of the conductor shall be loaded with the weight specified in the applicable specification sheet so that the portion of the insulation between the conductor and mandrel is under compression while the conductor is under tension. The specimen, so prepared on the mandrel, shall be conditioned in an air-circulating oven for the time and at the temperature specified in the applicable specification sheet. The velocity of air past the specimens (measured at room temperature) shall be between 100 and 200 feet per minute. After conditioning, the oven shall be shut off, the door opened, and the specimens allowed to cool in the oven for at least one hour. When cool, the specimens shall be freed from tension, removed from the mandrel, and straightened. The component wire then shall be subjected to the bend test (4.7.3) followed by the voltage withstand test (4.7.27.2).

* 4.7.10.2 Finished cable. For finished cable, 2 inches of jacket shall be removed from each end of a 24-inch specimen. If the cable is shielded, the shield shall be pushed back and formed into a pigtail at each end of the specimen so that it will not interfere with other preparations. One inch of the insulation of each of the component wires then shall be removed from each end of the specimen. The conductors shall be tied together at each end and loaded with weights equal to 0.5 times the number of conductors times the test load specified for the component wire. Weights shall not be hung on the shield. The central portion of the specimen then shall be bent

at least halfway around a horizontally positioned smooth stainless steel mandrel of the diameter specified in Table VII. To prevent sticking of the specimen to the mandrel, the mandrel shall be covered with a dispersion coating of polytetrafluoroethylene. The specimen, so prepared on the mandrel, shall be conditioned in an air-circulating oven for the time and at the temperature specified in the applicable specificacation sheet. The velocity of air past the specimens (measured at room temperature) shall be between 100 and 200 feet per minute. After conditioning, the oven shall be shut off, the door opened, and the specimens allowed to cool in the oven for at least one hour. When cool, the specimens shall be freed from tension, removed from the mandrel, and straightened. The finished cable specimens then shall be subjected to the bend test (4.7.3) followed by the voltage withstand test (4.7.27.2).

4.7.11 Durability of marking and color striping. The durability of product identification or color markings shall be evaluated at 20 to 25°C (68 to 77°F) as follows:

4.7.11.1 Durability testing apparatus. The marking durability tester shall be designed to hold a short specimen firmly clamped in a horizontal position with the upper longitudinal surface of the specimen fully exposed. The instrument shall be capable of rubbing a small cylindrical steel mandrel, which shall be a sewing needle 0.025 inch in diameter, repeatedly over the upper surface of the specimen, in such a position that the longitudinal axes of the mandrel and the specimen are at right angles to each other with cylindrical surfaces in contact. A weight affixed to a jig above the mandrel shall control the thrust exerted normal to the surface of the insulation. A motor driven, reciprocating cam mechanism and counter shall be used to deliver an accurate number of abrading strokes in a direction parallel to the axis of the specimen. The length of the stroke shall be 3/8 inch and the frequency shall be 120 strokes (60 stroking cycles) per minute.

4.7.11.2 Durability testing procedure. In performing the test, a specimen shall be mounted in the specimen clamp and the weight specified in the applicable specification sheet shall be applied through the abrading mandrel to the marked surface. The counter shall be set at zero and the drive motor started. The specimen shall be subjected to the number of strokes of the mandrel specified in the applicable specification sheet and shall then be examined. If a continuous line of solid color insulation coating or of the stripe, band, or printed marking, as applicable, has been erased or obliterated by the mandrel, the specimen shall be considered as having failed. Three specimens shall be tested from each sample unit, and failure of any specimen shall constitute failure of the sample unit.

4.7.12 Examination of product. All samples shall be examined carefully to determine conformance to this specification and to the applicable specification sheets with regard to requirements not covered by specific test methods.

* 4.7.13 Flammability. Flammability shall be tested in accordance with ASTM F777 using a 30 second flame application.
*

4.7.14 Humidity resistance. A 52-foot specimen of component wire shall be subjected to the following:

4.7.14.1 Test apparatus. The apparatus shall consist of a test chamber capable of maintaining an internal temperature of 70 ± 2°C (158 ± 3.6°F) and an internal relative humidity of 95 ± 5 percent. The test chamber shall be capable of being so sealed as to retain the total moisture content in the test space. The heat loss from the chamber shall be sufficient to reduce the internal temperature from the above specified operating temperature to not more than 38°C (100.4°F) within a period of 16 hours from the time of removal of the source of heat. Distilled or demineralized water shall be used to obtain the required humidity.

4.7.14.2 Test procedure. The specimen shall be placed in the test chamber and the temperature and relative humidity raised over a 2-hour period to the values specified in 4.7.14.1 and maintained at such for a period of 6 hours. At the end of the 6-hour period the heat shall be shut off. During the following 16-hour period, the temperature must drop to 38°C (100.4°F) or lower. At the end of the 16-hour period, heat shall be again supplied for a 2-hour period to stabilize at 70 ± 2°C (158 ± 3.6°F). This cycle (2 hours heating, 6 hours at high temperature, 16 hours cooling) shall be repeated a sufficient number of times to extend the total time of the test to 360 hours (fifteen cycles). At the end of the fifteenth cycle, the 50-foot center section of the specimen shall be immersed in a 5 percent, by weight, solution of sodium chloride in water at room temperature. The insulation resistance of the specimen shall be measured with the outer surface of the specimen grounded, through an electrode in the electrolyte, and with a potential of 250 to 500 volts DC applied to the conductor of the specimen after 1 minute of electrification at this potential. The insulation resistance shall be converted to megohms for 1000 feet by the calculation shown in 4.7.18.

4.7.15 Immersion. Specimens of component wire or finished cable of sufficient length to perform the subsequent tests shall be measured at their midpoints to determine their initial diameters and then shall be immersed to within 6 inches of their ends in each of the fluids (using a separate specimen for each fluid) for the time and at the temperature specified in Table VIII. During immersion, the radius of bend of the specimens shall be not less than 14 times, nor more than 35 times, the specified maximum diameter of the component wire or finished cable under test. Upon removal from the fluids, the specimens shall remain for one hour in free air at room temperature. The diameters then shall be remeasured at the original point of measurement and compared to the initial diameters. The percent change in diameter then shall be calculated. For component wire, 1 inch of insulation shall be removed from each end of a 24-inch length of each specimen. For finished cable, 2 inches of the jacket shall be removed from each end of a 24-inch length of each specimen. If applicable, the shield shall be pushed back and formed into a pigtail at each end of the specimen. One inch of the insulation of each of the component wires then shall be removed from each end of the specimen. The specimens then shall be subjected to the bend test (4.7.3), followed by the voltage withstand test (4.7.27.2).

TABLE VIII. Immersion test fluids.

	Test Fluid	Test Temperature	Immersion Time
(a)	MIL-L-23699, Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	48° to 50°C (118° to 122°F)	20 hours
(b)	MIL-H-5606, Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance	48° to 50°C (118° to 122°F)	20 hours
(c)	TT-I-735, Isopropyl Alcohol	20° to 25°C (68° to 77°F)	168 hours
(d)	MIL-T-5624, Turbine Fuel, Aviation, Grade JP-4	20° to 25°C (68° to 77°F)	168 hours
(e)	MIL-A-8243, Anti-Icing and Deicing-Defrosting Fluid, undiluted	48° to 50°C (118° to 122°F)	20 hours
(f)	MIL-A-8243, Anti-Icing and Deicing-Defrosting Fluid, diluted 60/40 (fluid/water) ratio	48° to 50°C (118° to 122°F)	20 hours
(g)	MIL-C-43616, Cleaning Compound, Aircraft Surface, undiluted	48° to 50°C (118° to 122°F)	20 hours
(h)	ASTM D 1153, Methyl Isobutyl Ketone (for use in organic coatings)	20° to 25°C (68° to 77°F)	168 hours
(i)	MIL-H-83306, Hydraulic Fluid, Fire Resistant, Phosphate Ester Base, Aircraft	48° to 50°C (118° to 122°F)	20 hours
(j)	MIL-L-7808, Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	118° to 121°C (244° to 250°F)	30 minutes
(k)	MIL-C-25769, Cleaning Compound, Aircraft Surface, Alkaline Waterbase, undiluted	63° to 68°C (145° to 154°F)	20 hours
(l)	MIL-C-25769, Cleaning Compound, Aircraft Surface, Alkaline Waterbase, diluted 25/75 (fluid/water) ratio	63° to 68°C (145° to 154°F)	20 hours
(m)	TT-S-735, Standard Test Fluids; Hydrocarbon, type I	20° to 25°C (68° to 77°F)	168 hours
(n)	TT-S-735, Standard Test Fluids; Hydrocarbon, type II	20° to 25°C (68° to 77°F)	168 hours
(o)	TT-S-735, Standard Test Fluids; Hydrocarbon, type III	20° to 25°C (68° to 77°F)	168 hours
(p)	TT-S-735, Standard Test Fluids; Hydrocarbon, type VII	20° to 25°C (68° to 77°F)	168 hours
(q)	Dielectric-coolant fluid, synthetic silicate ester base, Monsanto Coolanol 25 or equivalent	20° to 25°C (68° to 77°F)	168 hours
(r)	MIL-T-81533, 1, 1, 1 Trichloroethane (Methyl Chloroform) Inhibited, Vapor Degreasing	20° to 25°C (68° to 77°F)	168 hours
(s)	Azeotrope of trichlorotrifluoroethane and methylene chloride, DuPont Freon TMC or equivalent	20° to 25°C (68° to 77°F)	168 hours
(t)	MIL-G-3056, Gasoline, Automotive, Combat	20° to 25°C (68° to 77°F)	168 hours

4.7.16 Insulation elongation and tensile strength. Specimens of the entire component insulation shall be carefully removed from the conductor and tested for tensile strength and elongation in accordance with FED-STD-228, Methods 3021 and 3031, respectively, using 1-inch bench marks, a 1-inch initial jaw separation, and a jaw separation speed of 2 inches per minute. For finished cable insulation, the method shall be the same, but only the cable jacket shall be tested.

4.7.17 Insulation and jacket flaws.

4.7.17.1 Spark test of component insulation or cable jacket. The component wire or finished cable shall be passed through a bead chain electrode spark test device using the voltage and frequency specified in the applicable specification sheet. The conductor and shield, as applicable, shall be grounded at one or both ends. The electrode shall be of a suitable bead chain or fine mesh construction that will give intimate metallic contact with practically all the insulation surface. Electrode length and speed of specimen movement shall be such that the insulation is subjected to the test voltage for a minimum of 0.2 second. Any portion showing insulation breakdown shall be cut out including at least 2 inches of wire or cable on each side of the failure.

4.7.17.2 Impulse dielectric test of component insulation or cable jacket. Component wire or finished cable shall be tested in accordance with NEMA HP1-1979 at the voltage specified in the applicable specification sheet. For finished cable the conductor and shield, as applicable, shall be grounded at one or both ends. When specified in the contract or order (6.2) dielectric failure, untested portions, or portions which have been exposed to fewer or more than the specified number of pulses may be marked by stripping the insulation or by any other suitable method of marking as specified in the contract in lieu of being cut out of the wire or cable.

4.7.18 Insulation resistance. The uninsulated ends of a component wire specimen at least 26 feet in length shall be connected to a positive DC terminal and the specimen shall be immersed to within 6 inches of its ends in a water bath, at 25 ± 5°C (77 ± 9°F), containing 0.5 to 1.0 percent of an anionic wetting agent. The specimen shall remain immersed for not less than 4 hours, after which a potential of not less than 250 volts nor more than 500 volts shall be applied between the conductor and the water bath which serves as the second electrode. The insulation resistance shall be determined after 1 minute of electrification at this potential, and shall be expressed as megohms for 1000 feet by the following calculation:

$$\text{Megohms for 1000 feet} = \frac{\text{Specimen resistance (megohms)} \times \text{immersed length (feet)}}{1000}$$

4.7.19 Low temperature (cold bend). One end of the component wire or finished cable specimen 36 inches in length shall be secured to a rotatable mandrel in a cold chamber and the other end to the load weight specified in the applicable specification sheet for component wire and to a load weight sufficient to keep the cable vertical and tangent for finished cable. The diameter of the mandrel shall be as specified in the specification sheet for component wire, and as specified in Table VII for finished cable. Provision shall be made for rotating the mandrel by means of a handle or control located outside the chamber. The specimen and the mandrel shall be conditioned for the time and at the temperature specified in the applicable specification sheet. At the end of this period and while both mandrel and specimen are still at this low temperature, the specimen shall be wrapped helically for 20 turns for component wires and for 5 turns for finished cables, or its entire length, whichever is the lesser number of turns, around the mandrel without opening the chamber. The bending shall be accomplished at a uniform rate of 2 ± 1 RPM. At the completion of this test the specimen shall be removed from the cold box and from the mandrel without straightening. The specimen shall be examined without magnification, for cracks in the insulation. For component wire, 1 inch of insulation shall be removed from each end of the specimen. For finished cable, 2 inches of the jacket shall be removed from each end of the specimen and, if applicable, the shield shall be pushed back and formed into a pigtail at each end. One inch of the insulation of each of the component wires then shall be removed from each end of the specimen. The specimens then shall be subjected to the voltage withstand test specified in 4.7.27.2 with the bent portion submerged.

4.7.20 Shield coverage. The percent coverage of the braid shall be determined by the following formula:

$$K = (2F - F^2) \times 100$$

Where:

K = percent coverage
F = $EPd_2/\sin\alpha$
P = picks per inch of cable length
α = angle of braid with axis of cable
E = number of strands per carrier
d_1 = diameter of one of the round shield strands or thickness of flattened strand
d_2 = diameter of one of the round shield strands or width of flattened strand

$$\tan\alpha = 2\pi(D + 2d_1)\,P/C$$

C = number of carriers
b = component wire diameter
B = geometry factor of Table IX
D = diameter of cable under shield; for 7 components or less:

$$D = Bb$$

for more than 7 components:

D = average measured diameter of cable under shield

TABLE IX. Cable geometry factor (B).

Number of Components	Factor (B)
1	1.0
2	1.8
3	2.1
4	2.4
5	2.7
6	3.0
7	3.0

4.7.21 Shrinkage. A 12-inch specimen of component wire shall be cut so that the insulation and conductor are flush at both ends. The specimen shall then be aged at the temperature specified in the applicable specification sheet for 6 hours in an air-circulating oven. At the end of this period, the specimen shall be removed from the oven and allowed to return to room temperature. Shrinkage of the insulation shall then be measured as the greatest distance which any layer of the insulation has receded from either end of the conductor; that is, the measurement obtained at the end showing the greater shrinkage shall be considered the shrinkage of the specimen.

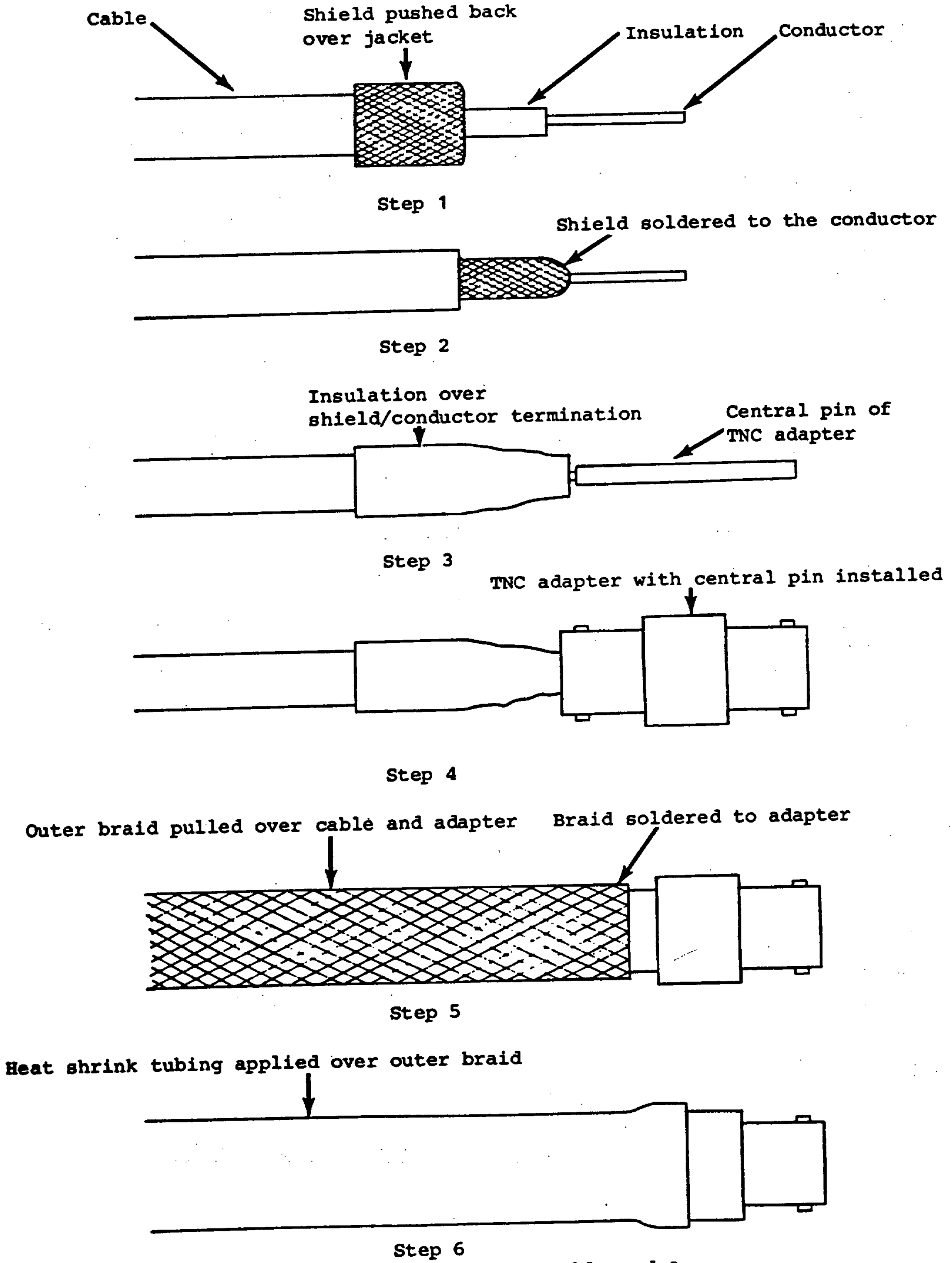
4.7.22 Smoke. This test shall be conducted in still air at an ambient temperature of 25 ± 5°C (77 ± 9°F). A specimen approximately 15 feet long of component wire shall be so suspended that at least the central 10-foot section is horizontal and unsupported. One end of the wire shall be suitably weighted 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 the temperature specified in the applicable specification sheet. This conductor temperature shall be thus maintained for 15 minutes during which time there shall be no indication of visible smoke. A flat-black background shall be used for this test.

4.7.23 Surface resistance. The surface resistance of the component wire shall be measured using the procedure of FED-STD-228, Method 6041, except that the required humidity shall be maintained per ASTM E104, Method A and without instrumentation of the chamber. All specimens, after attachment of the required electrodes, shall be cleaned by the procedure described in the test method. The specimens shall be positioned in the test chamber so that their ends are at least 1 inch from any wall of the chamber.

* 4.7.24 Surface transfer impedance, effective.

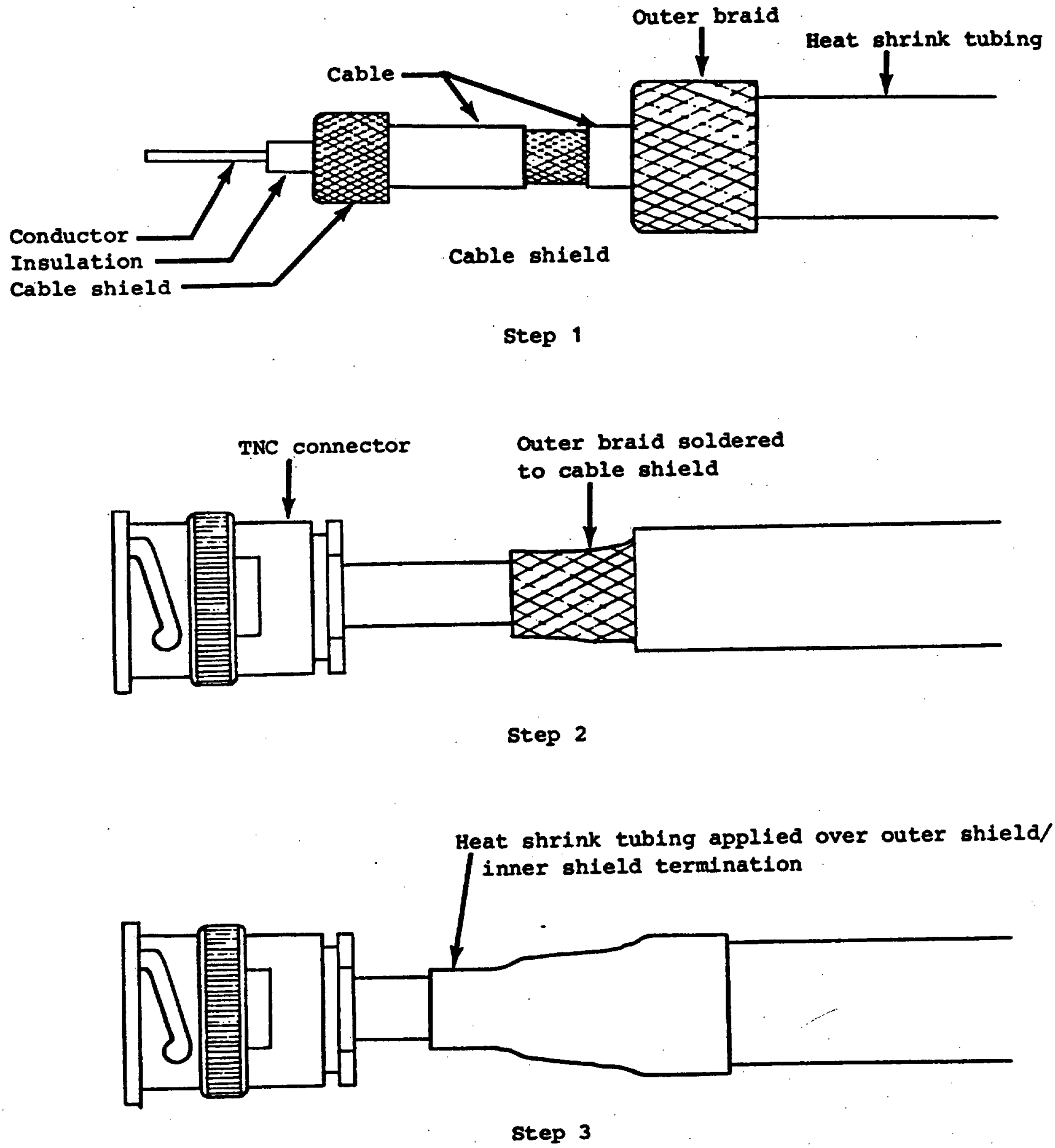
* 4.7.24.1 Scope. The method to be described is a modification of Method 1, Section 5, of IEC Standard 96-1A. The modifications are for experimental convenience, and to extend the usable frequency range. The effective surface transfer impedance is determined upon a 1 ± 0.01 m length of cable.

* 4.7.24.2 Sample preparation. Approximately 4 feet of the cable shall be prepared in the following manner. Approximately 3 inches of the cable jacket shall be removed from one end of the cable and the shield pushed back to expose the insulated conductor. The insulation shall be removed from the conductor to within 1 inch of the pushed back shield as shown in Figure 2, step 1. For a multiconductor cable, all the conductors shall be connected together and these connected wires shall be referred to as "the conductor." The shield shall then be pulled forward over the remaining insulation and soldered to the conductor. The shield shall completely enclose the insulated conductor, shall be soldered around 360° of the conductor and all disturbed portions of the shield shall be well soldered. The conductor shall extend beyond the soldered joint and shall be formed and trimmed so as to be able to be soldered into the center pin of a TNC female-female adapter (see Figure 2, step 2). Excess shield, beyond the solder joint, shall be removed and the center pin of the adapter shall be attached to the conductor so that the pin is within 1/2 inch of the soldered joint. A piece of shrink tubing or other appropriate material shall be applied over the soldered joint to insulate the joint (see Figure 2, step 3). The adapter pin shall then be inserted into the TNC adapter as shown in Figure 2, step 4. A metallic outer braid shall be pulled over the entire length of the cable and shall extend halfway over the TNC adapter. The outer braid shall then be soldered to the TNC adapter, making sure that a 360° solder joint is formed (see Figure 2, step 5). Shrink tubing shall be applied over the entire length of the outer braid ensuring that the outer braid is pressed firmly and consistently to the jacket of the cable (see Figure 2, step 6). During the application of the joint insulating tubing, outer braid and overall shrink tubing, the exact location of the soldered joint between the shield and conductor shall be noted by marking each layer at that location in some suitable manner. The other end of the cable, with the outer braid and shrink tubing applied, shall be terminated in the following manner. At a distance of 38 inches from the mark on the tubing which indicates the location of the shield to conductor joint, the shrink tubing shall be cut circumferentially and all tubing futher than 38 inches from that mark shall be removed. The outer braid which has been exposed shall be cut back to within 2 inches of the shrink tubing and the severed braid removed. The remaining 2 inches of outer braid shall then be pushed back to expose the cable underneath. The cable jacket shall be window stripped to expose the shield for a distance of 1/2 inch. The center of this window cut in the cable jacket shall be 1.00 ± 0.01 meters from the mark on the outer shrink tubing which indicates the location of the joint between the shield and the conductor. The end of the cable shall then be cut and prepared for termination with a TNC male plug such that the distance from the installed plug to the window in the cable jacket is 1/4 to 1/2 inch. The prepared cable will appear as shown in Figure 3, step 1. The TNC male plug shall be installed and the outer braid pulled forward over the exposed cable shield and the shield and outer braid shall be soldered together for 360° around the cable as shown in



* Figure 2. Preparation of cable end A

*



* Figure 3. Preparation of cable end B.

Figure 3, step 2. Any excess outer braid between the solder joint and the TNC plug shall be removed. The joint between the outer braid and shield shall be insulated with shrink tubing or other appropriate material as shown in Figure 3, step 3. The end of the cable with the TNC female-female adapter shall be designated as end "A" and will be attached to the signal generator during the measurement. The end of the cable with the TNC male plug shall be designated as end "B" and will be attached to the detector during the measurement. Any other method of shield termination may be used provided that the method can be shown to produce results of equal accuracy to those obtained using the method described above.

* 4.7.24.3 Configuration.

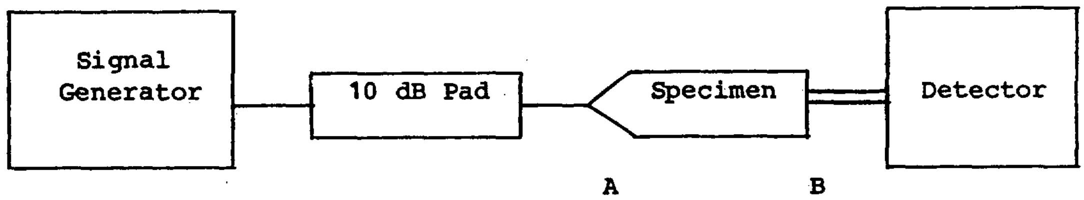


Figure 4. Configuration of the measurement system for determining surface transfer impedance, effective. The letters A and B refer to the A and B ends of the specimen, as described in paragraph 4.7.24.2.

The detector shall have a sensitivity of at least -100 dBm. A spectrum analyzer with a tracking generator is a suitable set of instruments for the detector and signal generator. Any other suitable instruments may be used as the detector or signal generator provided that they shall be shown to produce results of equal accuracy to those obtained using a spectrum analyzer and tracking generator when the measurement is performed as described below.

* 4.7.24.4 Measurement procedure. This measurement procedure is suitable for use with a spectrum analyzer and tracking generator. The measurement procedure may be modified as needed if other instruments are used provided that the results obtained are shown to be of equal accuracy to those obtained when the measurement is performed as described below. With the measuring system configured as shown in Figure 4, adjust the output of the signal generator to produce a trace on the spectrum analyzer, which at its highest point is near the top graticule line on the screen. Remove the specimen and insert a calibrated variable attenuator in its place. Adjust the attenuator until a trace is obtained which approximates the top graticule line on the screen. The position of the trace shall be recorded, either by storage on the screen or in any other suitable manner. Designate this trace A_0, where A_0 is the setting of the attenuator in dB. Increase the attenuator setting by 20 dB, and record the position of this trace, designated A_{20}, where A_{20} is the setting of the attenuator in dB. Increase the attenuator by a further 20 dB, and record the position of a trace designated A_{40}. Continue in this manner until the calibration traces have covered the entire height of the screen. Remove the attenuator, and reconnect the specimen, as shown in Figure 4. Designate the resulting trace on the screen as S and record its position. The value of S at any frequency shall then be calculated using the equation:

$$S = A_u = 20 \frac{y}{h} \text{ dB/meter} \qquad (1)$$

Where: A_u = attenuator setting used to produce the calibration trace immediately above trace S

y = distance on the screen between the traces A_u and S

h = distance on the screen between trace A_u and the calibration trace immediately below trace S

The power of attenuation P of the shield is:

$$P = 10^{S/10} \qquad (2)$$

The surface transfer impedance Z_{te}, at the frequency chosen, is given by:

$$Z_{te} = \frac{Z_o}{2} \sqrt{P} \quad \text{ohms/meters,} \qquad (3)$$

Where: Z_o = characteristic impedance of the spectrum analyzer and tracking generator

Unless otherwise specified, 100 points uniformly spaced throughout a decade of frequency, and including the beginning and end of the decade, shall be taken for each decade of frequency range specified on the specification sheet.

* 4.7.24.5 Determination of compliance. The values of Z_{te} as determined from measurements made in accordance with 4.7.24.4 shall not exceed the maximum specified values of Z_{te} as shown on the applicable specification sheet in any of the following ways.

(a) A single maximum value of Z_{te} may be specified at a discrete frequency or over a range of frequencies.

(b) The maximum value of Z_{te} over a range of frequencies may be specified by a plot of the maximum value of Z_{te} versus frequency.

(c) The maximum value of Z_{te} over a range of frequencies may be specified by the equation:

Maximum specified $Z_{te} = A_z(f)^{B_z}$ milliohms/meter,

Where: f = frequency in MHz
A_z, B_z = Z_{te} calculation parameters given on the specification sheet

4.7.25 Thermal shock resistance.

* 4.7.25.1 Preparation of specimen. A specimen of component wire five feet long shall be prepared by carefully removing 1 inch of insulation from each end of the wire. A specimen of finished cable five feet long shall be prepared by cutting the component wires, shield and jacket flush at each end, then carefully removing one inch of jacket from each end of the cable. A razor blade or equivalent, held perpendicular to the axis of the wire, shall be used to cut the insulation or jacket for the removal operation. The distance between the end of the conductor and the insulation or jacket at each end of the specimen shall be measured to the nearest 0.01 inch. The specimen shall be formed into a loose coil not less than 1 foot in diameter and shall be laid on a wire screen for handling throughout the test.

* 4.7.25.2 Test procedure. The specimen shall be placed for 30 minutes in a preheated air-circulating oven at the temperature specified in the applicable specification sheet. The specimen shall then be removed from the oven and, within two minutes, placed in a chamber which has been precooled to -55 ± 2°C (-67 ± 3.6°F). It shall be exposed to this temperature for 30 minutes, after which it shall be removed and allowed a minimum of 30 minutes to return to room temperature, 20 to 25°C (68 to 77°F). At the conclusion of this cycle, the distance from the end of each layer of insulation, or jacket for finished cable specimens, to the end of the conductor shall be measured to the nearest 0.01 inch. This thermal shock cycle and the measurements shall be repeated for an additional three cycles (a total of four cycles). Any measurement varying from the original measurement by more than the amount specified in the applicable specification sheet shall constitute failure. Any flaring of any layer shall also constitute failure.

4.7.26 Thermal stability. A 10-foot sample of cable shall be formed into a loose coil approximately 1 foot in diameter and aged in a circulating air oven for the time and temperature specified in the applicable specification sheet. The velocity of air past the sample (measured at room temperature) shall be between 100 and 200 feet per minute. After aging, the sample shall be allowed to cool to room temperature and shall then be subjected to the voltage withstand test of 4.7.27.1. A 6-inch specimen shall then be cut from the center of the 10-foot sample. This 6-inch specimen shall be used to determine the stop band attenuation of the aged cable in accordance with 4.7.2.

4.7.27 Voltage withstand.

4.7.27.1 Voltage withstand (dielectric). Voltage withstand (dielectric) tests shall be performed upon 100 percent of all finished cable by applying the specified voltage between each conductor or shield in turn and all the other conductors and shields which shall be tied together and grounded. The test voltage shall be as specified in the applicable specification sheet and the time of electrification shall be not less than 15 seconds nor more than 30 seconds.

4.7.27.2 Voltage withstand (post-environmental). The specimen shall be immersed in a 5 percent, by weight, solution of sodium chloride in water at 20 to 25°C (68 to 77°F), except that the uninsulated ends and 1.5

inches of insulated wire or cable at each end of the specimen shall protrude above the surface of the solution. After immersion for 5 hours, the voltage specified in the applicable specification sheet shall be applied between the conductor, or the shield as applicable, and an electrode in contact with the liquid. The voltage shall be gradually increased at a uniform rate from zero to the specified voltage in 0.5 minute, maintained at that voltage for a period of 5 minutes for component wire specimens and 1 minute for finished cable specimens, and gradually reduced to zero in 0.5 minute.

4.7.28 Weight. The weight of each lot of component wire or finished cable shall be determined by Procedure I (4.7.28.1). Lots failing to meet the weight requirement of the applicable specification sheet when tested in accordance with Procedure I shall be subjected to Procedure II. All reels or spools failing to meet the requirements of the applicable specification sheet when tested by Procedure II shall be rejected. The sampling plans of 4.4.1 are not applicable in Procedure II.

4.7.28.1 Procedure I. The length and weight of a specimen at least 10 feet long shall be accurately measured and the resultant measurements converted to pounds per 1000 feet.

4.7.28.2 Procedure II. The net weight of the component wire or finished cable 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 component wire or finished cable. The net weight of component wire or finished cable on each reel or spool shall be divided by the accurately determined length of component wire or finished cable on that reel or spool and the resultant figure converted to pounds per 1000 feet. When wood or other moisture absorbent materials are used for reel or spool construction, weight determinations shall be made under substantially uniform conditions of relative humidity.

* 4.7.29 Wrap test. A 12-inch specimen of component wire shall be bent back on itself at the mid-portion, on a radius not less than the radius of the wire, and one end of the specimen shall be wrapped tightly around the other end as a mandrel for a total of four close turns. The specimen shall then be placed in an air-circulating oven and conditioned for the time and at the temperature specified in the applicable specification sheet. After conditioning, the specimen shall be removed from the oven and examined visually without the aid of magnification for cracks.

*

5. PREPARATION FOR DELIVERY

* 5.1 Packaging. Packaging shall be Level A or C in accordance with MIL-C-12000. Unless otherwise specified in the order (6.2), Level A shall be applicable.

* 5.1.1 Level A. Packaging shall be in accordance with the Level A requirements of MIL-C-12000 and as follows:

* 5.1.1.1 Reels and spools. Component wire and finished cable shall be delivered wound on reels and spools of a nonreturnable type. Each reel or spool shall have an appropriate diameter for the respective product size. In no case shall the barrel of the reel or spool have a diameter less than that specified in Table X or less than 3 inches, whichever is greater. Reels and spools shall be suitably finished to prevent corrosion under typical storage and handling conditions. The method of attachment of flanges to barrels on metal reels or spools shall be structurally equivalent to a full circumferential crimp.

* TABLE X. Barrel diameters of spools and reels.

PRODUCT TYPE	MINIMUM DIAMETER OF BARREL (AS TIMES NOMINAL DIAMETER OF FINISHED WIRE, EXCEPT SEE 5.1.1.1)
Component Wire	50X
Finished Cable	20X

* 5.1.1.2 Winding requirements. Unless otherwise specified in the purchase order (6.2), there shall be no restriction on the number of wire lengths per reel or spool, provided the wire length requirements of 3.6.6 are met by the inspection lot.

* 5.1.2 Level C. Packaging shall be in accordance with the requirements of MIL-C-12000 for Level C packaging.

5.2 Packing. Packing shall be Level A, B, or C in accordance with MIL-C-12000. Unless otherwise specified in the order (6.2), Level C shall be applicable.

* 5.3 Marking. Unless otherwise specified in the contract or order, each reel or spool shall be marked with the footage of the individual continuous lengths wound thereon as specified in 3.6.6. In addition, interior packages and exterior shipping containers shall be marked in accordance with MIL-C-12000 and MIL-STD-129. The identification shall be composed of the following information listed in the order shown:

CABLE, ELECTRIC, FILTER LINE, RADIO FREQUENCY ABSORPTIVE
Specification sheet part no.
Specification MIL-C-85485A
Length ______________ feet
Size
Date of manufacture
Name of manufacturer

6. NOTES

6.1 Intended use. The electric cables covered by this specification are intended for use in any application where their performance characteristics are required. The cables are suitable for installation on aerospace electrical systems within the limitations of applicable performance requirements.

6.1.1 Temperature rating. Temperature ratings as specified in specification sheets pertaining to this specification represent the maximum permissible continuous operating temperature of the conductor. The maximum ambient temperature should be the rated maximum conductor temperature of the wire diminished by the operating rise in temperature of the conductor.

6.1.2 Size designations. The conductor sizes and the corresponding size designations of this specification are in accordance with established usage for stranded copper conductors for hookup wire in the electronic and aircraft industries. These sizes and size designations are not identical with American Wire Gage (AWG) sizes for solid wire and strands. The diameters and cross-sectional areas of the stranded conductors of this specification are, in most sizes, only roughly approximate to those of AWG solid conductors of the same numerical size designation.

* 6.1.3 Installation. Installation technique is critical to performance of this product for its intended use. Refer to procuring activity for proper installation instructions.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Applicable specification sheet number, title, and date.

(c) Applicable specification sheet part number.

(d) Color required (3.6.3).

(e) Quantity required.

(f) Levels of packaging and packing required.

(g) Exceptions, if any, to the optional provisions of this specification including:

   (1) Applicable product identification requirements, if other than specified in 3.6.7.

   (2) Applicable minimum length requirements.

   (3) Responsibility for inspection, if other than specified in 4.1.

(4) Marking of dielectric test failures by stripping of insulation or by other method specified in the contract in lieu of cutting of the component wire or finished cable, if applicable (4.7.17.2).

(5) Special preparation for delivery requirements, if applicable (Section 5).

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 (QPL) 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 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 Naval Air Systems Command, Washington, DC 20360; however, application for qualification of products should be made to the Commanding Officer, Naval Avionics Center (Code D/714), 6000 East 21st Street, Indianapolis, Indiana 46218, who has been designated Naval Air Systems Command agent for establishing this Qualified Products List.

6.3.1 Conformity to qualified sample. It is understood that component wire or finished cable supplied under contract shall be identical in every respect to the qualification sample tested and found satisfactory, except for changes previously approved by the Government. Any unapproved changes from the qualification sample shall constitute cause for rejection.

* 6.4 Patent notice. The Government has a royalty-free license under Patent No. 4,347,487 for the benefit of manufacturers of radio frequency absorptive, filter line cable having a conductive jacket either for the Government or for use in equipment to be delivered to the Government.

* 6.5 Changes from previous issue. The paragraphs of this specification are marked with an asterisk to indicate where changes from the previous issue were made. 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 and relationship to the previous issue.

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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)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: ________
b. ADDRESS *(Street, City, State, ZIP Code)*	

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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