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MATERIAL SPECIFICATION

**CABLE, POWER, ELECTRICAL AND CABLE
SPECIAL PURPOSE, ELECTRICAL SHIELDED
AND UNSHIELDED, GENERAL SPECIFICATION FOR**

NUMBER

5PTM1T03-D

DATE

04/10/03

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CAGE CODE 98897

F/A-22 PROGRAM INFORMATION

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MATERIAL SPECIFICATION

1. SCOPE

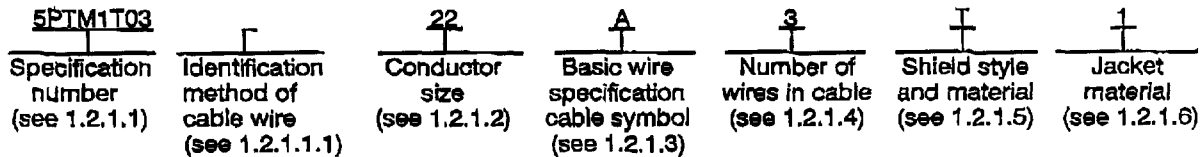
1.1 Scope – This specification covers the requirements for special purpose and power electrical cable. (See 6.1).

1.2 Classification – The cable shall be of the following types and shall be furnished in the basic wire size and basic wire type, number of wires, and shield and jacket styles, as specified.

Unshielded & Unjacketed – 2 to 8 color-coded wires, spirally laid without shield or jacket.

Shielded and jacketed – A single wire, or 2 to 5 color-coded wires spirally laid with a shield and a jacket.

1.2.1 Cable designation – Cable shall be identified by a combination of digits and letters (not to exceed 15), in accordance with the following (see 3.4.1).



Example: 5PTM1T03-22A3T1

1.2.1.1 Cable specification number – The finished cable shall be identified by the number of this specification.

1.2.1.1.1 Identification method of cable wire – If the preferred identification method (see 3.2.1.1.1) is required, specify a “-”; for optional identification method A (see 3.2.1.1.2), specify the letter “A”.

1.2.1.2 Conductor size – The basic wire size shall be identified. All wires used in the cable shall be of the same size.

1.2.1.3 Basic wire specification – A letter symbol shall be used to designate the specification, type, and class in accordance with Table I.

TABLE I

BASIC WIRE SPECIFICATION		CABLE SYMBOL
5PTM1T01	TYPE A	A
	TYPE B	B
	TYPE C	C
	TYPE D	D
	TYPE E	E
	TYPE F	F
	TYPE G	G
	TYPE H	H
5PTM1T05	TYPE A	K
	TYPE B	L
	TYPE C	M
	TYPE D	N
	TYPE E	P
	TYPE F	R
	TYPE G	S
	TYPE H	T

1.2.1.4 Number of wires per cable – The number of wires per cable shall be as designated and shall be 1 to 5 for shielded or shielded and jacketed cables and 2 to 8 for unshielded unjacketed cables.

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1.2.1.5 Shield style and material – The shield style and material of the overall shields shall be designated by a single letter as follows:

SYMBOL SINGLE SHIELD STYLE	SHIELD MATERIAL	MAXIMUM TEMPERATURE LIMIT FOR SHIELD MATERIAL (INFORMATION ONLY)
U	No shield	---
S	Silver-coated high strength copper alloy, flat	200°C (392°F)
T	Tin-coated copper, flat	150°C (302°F)

1.2.1.6 Jacket material and temperature rating – The single jacket symbol shall be used for cables with an outer jacket only. Unless otherwise specified, jacket colors shall be as specified under the jacket materials as follows:

SINGLE JACKET SYMBOL	JACKET MATERIAL	TEMPERATURE LIMIT FOR JACKET MATERIAL (INFORMATION ONLY)
0	No jacket	---
1	Tape of natural polyimide combined with clear fluorinated ethylene propylene (FEP) wrapped and heat sealed with white (PTFE) outer surface (see 3.8)	200°C (392°F)
2	White, crosslinked, extruded, modified, ethylene, tetrafluoroethylene copolymer (XLETPE)	200°C (392°F)

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and Standards – The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

Military

MIL-C-12000 Cable, Cord, and Wire, Electric; Packaging Of.

MIL-C-27500 Cable, Power, Electrical and Cable Special Purpose, Electrical Shielded and Unshielded, General Specification For.

MIL-DTL-81381 Wire, Electric, Polyimide-Insulated Copper or Copper Alloy

F/A-22 Program

5PTPPL02 Hazardous Materials Reduction

AC-580 Hazardous Materials Management

AC-1170 Hazardous Materials Procedures

PRO-2610 Hazardous Materials Management

STANDARDS

Federal

FED-STD-228 Cable And Wire, Insulated; Methods Of Testing.

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Military

MIL-STD-104	Limits For Electrical Insulation Color
MIL-STD-105	Sampling Procedures And Tables For Inspection By Attributes
MIL-STD-681	Identification Coding And Application Of Hookup and Lead Wire
MIL-STD-686	Cable And Cord, Electrical; Identification Marking And Color Coding Of

2.1.2 Other Government documents, drawings, and publications - The following other Government documents and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

NATIONAL BUREAU OF STANDARDS

H4 -1 Federal Supply Code for Manufacturers, United States and Canada, Name to Code.

H4 -2 Federal Supply Code for Manufacturers, United States and Canada, Code to Name.

NBS HDBK 100 - International Annealed Copper Standard (IACS)

2.2 Other publications - The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents - not listed in the DODISS shall be the issue of the non-Government documents which are current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ANSI/ASTM B3	Soft or Annealed Copper Wire.
ANSI/ASTM B33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
ASTM B170	Oxygen-Free Electrolyte Copper-Refinery Shapes.
ASTM B272	Copper Flat Products with Finished (Rolled or Dawn) Edges (Flat Wire and strip)
ANSI/ASTM B298	Silver-Coated Soft or Annealed Copper Wire
ANSI/ASTM B624	High-strength, High-conductivity Copper Alloy Wire for Electronic Application Standard Specification for
ASTM D3032	Hookup Wire Insulation, Standard Methods of Testing
ASTM D4066	Nylon Injection and Extrusion Materials (PA)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA-WC27500	Standard for Aerospace and Industrial Electrical Cable
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3. REQUIREMENTS

3.1 Materials

3.1.1 Copper or High-strength Copper Alloy Shield Round Strand Material - Before shielding, the copper strands used in shields shall be annealed or soft-drawn copper wire from commercial pure copper and shall conform to ASTM B3 or high strength copper alloy in accordance with ASTM B624 except that the minimum tensile strength shall be 56,000lb/in², the minimum elongation shall be 6 percent, and the conductivity shall be 80 percent (minimum) as stated in NBS Handbook 100. Wire shall be free from lumps, kinks, splints, abrasions, scraped or corroded surfaces and skin impurities.

3.2 Construction - Construction shall comply with the classification given in 1.2. Combinations of shield style and material, basic wire specification and jacket materials shall be specified herein.

3.2.1 Basic wire - Wire used in the construction of the cable shall be qualified to the basic wire specification (see Table I) before cabling. The producer of the finished cable shall be a qualified source under the

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applicable basic wire specification. Color added to the insulation (as helical stripe) for the purpose of wire number identification shall not degrade the wire insulation as evidenced by failure to meet the requirements herein. Unless otherwise specified, the manufacturer of the cable is responsible for assuring that the basic wire meets the wire specification requirements prior to being fabricated into cable.

3.2.1.1 Identification of cable wire – The basic wire insulation for single or multiconductor cables shall be colored to provide a method of determining the wire number. Unless otherwise specified, the preferred identification method (see 3.2.1.1.1) shall be used.

3.2.1.1.1 Preferred identification method – The insulation of wire used in the cable shall be white or (or basic color or natural color) with one colored spiral stripe in accordance with Table XII. The color stripe may be applied by an inking process or be incorporated in the textile braid when the braid is employed in the basic wire. When the inking process is used, the stripe shall be in accordance with MIL-STD-681 except stripe color and sequence shall be as specified herein. When the braid is used, colored fibers shall be used for two parallel and adjacent carriers of the braid. The color identification fibers shall be woven in the opposite direction of any identification marker. Except for the colored fibers and any identification marker, all carriers shall be white.

3.2.1.1.2 Optional identification method A – The insulation shall be solid color in accordance with Table XII. Solid coloring shall be done by the manufacturer of the wire and the coloring shall meet the requirements of the basic wire specification.

3.2.2 Cable Layup – The required number of wires for multiconductor construction determined by the cable designation shall be cabled with a left-hand lay. The lay of the individual wires shall be not less than 6 nor more than 16 times the outside major axis diameter of the unshielded, unjacketed cable. The basic wire shall not be spliced. When cables are cut, wires will maintain proper sequence and shall not splay more than twice the diameter of the cable for cables containing 5PTM1T05 type basic wires. Cables containing 5PTM1T01 type basic wires shall not untwist a maximum 5.0 inches.

3.2.2.1 Fillers and binder tapes – Fillers and binder tapes, if used shall be of a fungus resistant material with a temperature equivalent to the cable rating without fillers and tape. They shall also be easily removable from the finished cable without adherence to the underlying insulation. The use of filler and binder tapes shall not increase weight and diameter of the finished product above those herein.

3.2.3 Shield – When the cable designation specifies that a shield is to be incorporated in the cable construction, a closely woven braid of flat strand shall be applied over the basic wire or cable as per Section 1.2.1.5.

3.2.3.1 Braided flattened wire strands – Flat wire shields shall be braided from flat coated copper or high strength copper alloy. The flattened wire shall be 0.0015 inch \pm 0.0004 inch (0.040 \pm 0.010 mm) in thickness.

3.2.3.1.1 Copper wire, flattened – Copper flattened wire shall meet the requirements of ASTM B272 except the wire shall be made by flattening round wire.

3.2.3.1.2 Coating of flattened wire strands.

3.2.3.1.2.1 Tin-coated copper flattened wire – Tin coated copper strands before flattening shall conform to ASTM B33. Flattened wire strands shall meet the continuity of coating test of ASTM B33. The thickness of coating shall be 250 microinches maximum.

3.2.3.1.2.2 Silver-coated high strength copper alloy flattened wire – Silver-coated high-strength copper alloy strands shall conform to ASTM B298 after flattening. The flattened wire strands shall have a minimum coating thickness of 40 microinches and shall meet the continuity of coating requirements of ASTM B298 after flattening.

3.2.3.2 Braid angle – The shield braid shall be a push-back type. The angle of the carriers of the braid to the axis of the cable in woven wire shields shall be not less than 18° nor more than 40°. When the major diameter of the cable beneath the braid is greater than 0.31 inch (7.9 mm), the above braid angle restriction shall not apply. In this case, the shield shall be suitably applied to provide good push-back characteristic. For determination of braid, see 4.5.6.

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3.2.3.3 Shield coverage – The shield braid shall be applied in such a manner as to provide coverage of not less than 85 percent for each individual shield.

3.2.4 Jacket – When a jacket is applied over a shield, it shall meet the following requirements. The jacket shall be easily removable from the finished cable without adherence to the underlying shield. Stripping time (for jacketing style 1) shall be 5 seconds maximum when tested in accordance with 4.5.18 and shall not open more than .125 inch (3.18 mm). The wall thickness of the jacket shall be as specified in Table III or 3.2.4.1.2 as applicable.

3.2.4.1 Jacket material

3.2.4.1.1 Taped polyimide/fluorinated ethylene propylene – The jacket of polyimide/fluorinated ethylene propylene tapes shall consist of two tapes, as specified in Table II and III. The first tape shall be a 0.001 inch polyimide tape coated on both sides with 0.0001 inch FEP. Succeeding tapes shall be applied in alternating directions. The tapes shall be fused together to provide a jacket with a wall thickness in accordance with Table III.

TABLE II

TAPE MATERIAL FOR CABLE JACKET		
Tape Code	Thickness (inch)	Material
1	0.0012	FEP/Polyimide/FEP
2	0.002	PTFE

TABLE III

TAPE CODES FOR CABLE JACKET					
Diameter of the Cable before Jacketing	Wrap 1		Wrap 2		Nominal Wall Thickness of Jacket (inch)
	Tape Code	Minimum Overlap (percent)	Tape Code	Minimum Overlap (percent)	
0 – 0.200	1	50	2	50	0.007
0.201 and greater	1	50	2	67	0.009

3.2.4.1.2 Extruded, crosslinked, modified, ethylene-tetrafluoroethylene – Jackets of extruded and crosslinked modified ethylene-tetrafluoroethylene shall have a wall thickness of 0.006 inch to 0.011 inch depending on the cable o.d., minimum shall not be less than .005 inch and maximum shall not be more than 0.012 inch. The color shall be white. The tensile strength and elongation shall be 5000 lbf/in² minimum and 50 percent minimum, respectively, and shall be tested in accordance with 4.5.13.1.

3.2.4.2 Concentricity of extruded jackets – The concentricity of extruded jackets shall be not less than 70 percent when tested in accordance with 4.5.17.

3.3 Functional characteristics

3.3.1 Dielectric withstand – One hundred percent of all finished cable shall be tested in accordance with 4.5.3. Following this test, there shall be no evidence of electrical breakdown or arcing.

3.3.1.1 Impulse dielectric (for unshielded/unjacketed configuration) – One hundred percent of all finished unshielded and unjacketed, multiconductor cable, 2–8 conductors, sizes 14–26 AWG and 2–5 conductors, size 12 AWG, shall pass the impulse dielectric test in accordance with 4.5.4. There shall be no evidence of dielectric failure.

3.3.2 Jacket flaws (shielded and jacketed cables only) – One hundred percent of all finished cable shall be tested in accordance with 4.5.5. All flaws shall be removed or marked consistent with the requirements for packaging (see 5.1).

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3.3.3 Conductor continuity – All conductors in all lengths of finished cable shall withstand the conductor continuity test of 4.5.9.

3.3.4 Cold bend (shielded and jacketed cables only) – All finished shielded and jacketed types of cable shall withstand the cold bend test of 4.5.7 without evidence of cracking of jackets. Shielded and jacketed cable with jacket material listed in 4.5.7 shall then pass the voltage withstand test of 4.5.8 without electrical breakdown (see 4.3).

3.3.5 Thermal shock – All finished cable with jacket style 1 shall withstand the thermal shock test of 4.5.10 without cracking of the jacket (see 4.3).

3.3.5.1 Aging stability – All finished cable with jacket style 1 shall withstand the aging stability test of 4.5.11 without cracking of the jacket (see 4.3).

3.3.6 Blocking – Adjacent layers of cable with all jacket materials shall not stick together nor to the metal mandrel when subjected to the test for blocking in 4.5.16 at rated temperature of the jacket or basic wire, whichever is lower, for 6 hours.

3.3.7 Flammability – Cable specimens with all jacket materials loaded with sufficient weight to remain taut throughout test shall not burn for more than 30 seconds, and shall not propagate more than 3.0 inches (76.2 mm) along the wire/cable length when tested in accordance with 4.8.

3.3.8 Immersion – Cable specimens with jacket material 1 shall not increase in diameter more than 5 percent and shall not crack when tested in accordance with 4.5.14.

3.3.9 Lamination sealing – Cable specimens with taped wrapped jacket material 1, shall exhibit no separation of layers either along the insulation or at the ends when tested in accordance with 4.5.15.

3.3.10 Crosslinked verification – All finished cable with jacket material 2 shall withstand the test of 4.5.12 without cracking of the jacket, dielectric breakdown, or pitting of metallic coatings.

3.3.11 Temperature rating – The temperature rating of the cable shall be defined as the lowest rating of one basic specification wire, shield material, or jacket material as defined in 1.2.1.5 or 1.2.1.6.

3.3.12 Hazardous Materials Control

3.3.12.1 Materials supplied to this specification shall be in compliance with 5PTPPL02 for LM Aero – Marietta operations, AC-580 or AC-1170 for LM Aero – Ft. Worth operations and PRO-2610 for BMA operations. Shipments in response to initial purchase orders or samples of materials submitted for evaluation to this specification must be in compliance with AC-580 or AC-1170 or PRO-2610 and be accompanied by a Material Safety Data Sheet (including proper disposal information). Failure to comply with these requirements is cause for rejection of the material.

3.3.12.2 Before submitting a material for qualification to this specification, the supplier shall provide a Material Safety Data Sheet (MSDS) and the chemical formulation. Agreements for non-disclosure and control of proprietary information shall be executed as appropriate. This information shall be submitted to the appropriate Environmental, Safety and Health Organization to determine if additional information is necessary, and to document appropriate precautions for the material's use.

3.3.12.3 Materials called out in this specification may be hazardous. Consult the appropriate Material Safety Data Sheets and/or Environmental, Safety and Health organization before using these materials.

3.4 Identification of product.

3.4.1 Cable product identification – The cable product identification shall consist of the cable designation as determined by 1.2.1, the cable manufacturer's code designation in accordance with publications H4-1 and H4-2, and the revision letter of current specification.

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3.4.1.1 Unshielded—unjacketed cable and shielded and jacketed singles – Cable product identification shall be imprinted on the insulation of wire number 1 (see 3.4.2), except on single shielded and jacketed constructions, having jacket style 2. Single shielded and jacketed constructions having jacket style 2 shall have the cable product identification marked on the surface of the jacket. The cable product identification shall conform to paragraph 3.4.3. The cable product identification shall not be required when the product identification is not required by the basic wire specification for that size wire.

3.4.1.2 Shielded and jacketed cable (2 to 5 wires) – The cable product identification shall be imprinted on the outer surface of jacket style 2. All other jacket styles shall have cable product identification imprinted on a marker tape placed beneath the shield or jacket.

TABLE IV

OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS B, E, F AND H MULTI CONDUCTOR CABLE (6 MIL, 5PTM1T01)



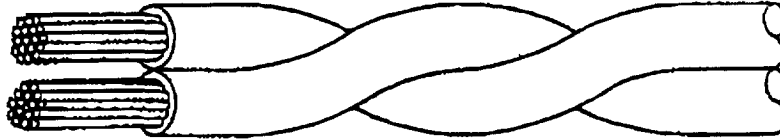
No. Of Cond.	Conductor size (AWG)	Outside Diameter Inch			Weight (lbs/1000 Feet)		
		Min.	Target	Max.	Min.	Target	Max.
2	26	0.057	0.061	0.065	2.55	2.75	2.95
	24	0.065	0.069	0.073	2.54	3.77	4.00
	22	0.077	0.081	0.085	5.31	5.61	5.91
	20	0.092	0.097	0.102	8.40	8.70	9.00
	18	0.109	0.115	0.121	12.40	12.85	13.30
	16	0.124	0.130	0.136	16.15	16.60	17.05
3	26	0.058	0.062	0.066	3.90	4.15	4.40
	24	0.066	0.070	0.074	5.35	5.65	5.95
	22	0.080	0.084	0.088	8.05	8.45	8.85
	20	0.096	0.101	0.106	12.65	13.05	13.45
	18	0.115	0.121	0.127	18.85	19.35	19.95
	16	0.128	0.135	0.142	24.35	25.05	25.55
4	26	0.064	0.071	0.078	5.15	5.50	5.85
	24	0.074	0.081	0.088	7.15	7.55	7.95
	22	0.088	0.095	0.102	10.60	11.20	11.80
	20	0.111	0.120	0.122	16.75	17.35	17.95
	18	0.131	0.142	0.143	25.00	25.80	26.60
	16	0.149	0.160	0.171	32.40	33.40	34.40
5	26	0.076	0.086	0.096	6.48	6.90	7.35
	24	0.087	0.097	0.107	9.00	9.50	10.00
	22	0.103	0.113	0.123	13.40	14.00	14.60
	20	0.122	0.135	0.148	21.00	21.70	22.40
	18	0.143	0.159	0.174	31.20	32.30	33.40
	16	0.174	0.180	0.195	40.40	41.70	43.00

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TABLE V
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS L, P, R, AND T MULTI CONDUCTOR CABLE (6 MIL, 5PTM1T05)

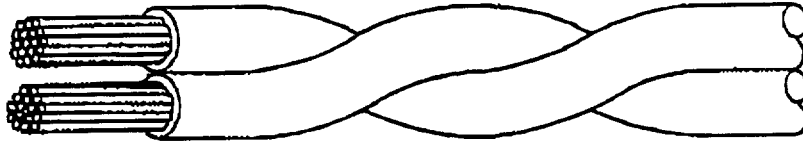


No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)		
	Conductor size (AWG)	Min.	Max.	Min.	Target	Max.
2	26	0.061	0.065	2.46	2.63	2.80
	24	0.068	0.074	3.44	3.65	3.85
	22	0.080	0.086	5.18	5.43	5.67
	20	0.096	0.102	8.07	8.44	8.81
	18	0.115	0.121	12.23	12.82	13.41
3	26	0.067	0.071	3.75	3.96	4.17
	24	0.073	0.080	5.17	5.46	5.74
	22	0.086	0.093	7.78	8.14	8.49
	20	0.103	0.110	12.18	12.72	13.25
	18	0.123	0.131	18.51	19.34	20.16
4	26	0.069	0.093	5.04	5.29	5.54
	24	0.078	0.104	6.90	7.30	7.69
	22	0.091	0.122	10.39	10.88	11.37
	20	0.108	0.148	16.32	17.03	17.73
	18	0.130	0.174	25.31	28.15	28.99
5	26	0.092	0.098	6.34	6.62	6.90
	24	0.104	0.110	8.64	9.14	9.63
	22	0.122	0.128	13.01	13.63	14.24
	20	0.146	0.152	20.45	21.34	22.22
	18	0.174	0.181	31.11	32.46	33.81
	16	0.197	0.204	39.87	41.52	43.16

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TABLE VI
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS K, M, N AND S MULTI CONDUCTOR CABLE (8 MIL, 5PTM1T05)



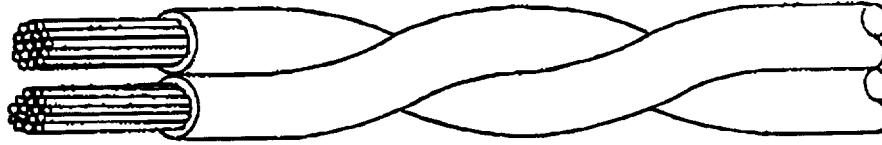
No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)		
	Conductor size (AWG)	Min.	Max.	Min.	Target	Max.
2	26	0.069	0.075	2.74	2.94	3.14
	24	0.076	0.082	3.75	3.99	4.23
	22	0.088	0.094	5.55	5.84	6.12
	20	0.105	0.111	8.53	8.98	9.42
	18	0.123	0.131	12.84	13.48	14.11
	16	0.138	0.146	16.42	17.16	17.89
	14	0.168	0.176	25.36	26.25	27.14
	12	0.205	0.215	37.94	39.40	40.85
3	26	0.075	0.081	4.17	4.41	4.65
	24	0.081	0.089	5.64	5.99	6.33
	22	0.094	0.102	8.33	8.76	9.18
	20	0.112	0.121	12.95	13.55	14.15
	18	0.132	0.142	19.41	20.31	21.21
	16	0.148	0.158	24.79	25.84	26.89
	14	0.180	0.191	38.27	39.53	40.79
	12	0.219	0.232	56.96	59.08	61.19
4	26	0.078	0.106	5.62	5.91	6.20
	24	0.087	0.117	7.53	8.01	8.48
	22	0.100	0.134	11.12	11.71	12.29
	20	0.119	0.159	17.34	18.15	18.95
	18	0.139	0.188	26.10	27.25	28.39
	16	0.155	0.209	33.23	34.61	35.89
	14	0.189	0.253	51.25	52.93	54.61
	12	0.231	0.309	76.05	79.02	81.99
5	26	0.105	0.111	7.04	7.38	7.72
	24	0.116	0.123	9.42	10.02	10.62
	22	0.134	0.141	13.92	14.66	15.40
	20	0.159	0.166	21.76	22.75	23.74
	18	0.188	0.195	32.70	34.14	35.57
	16	0.210	0.218	41.67	43.39	45.10
	14	0.255	0.263	64.15	66.29	68.42
	12	0.310	0.321	95.19	98.85	102.50
6	26	0.105	0.111	8.51	8.86	9.21
	24	0.116	0.124	11.32	12.04	12.76
	22	0.134	0.142	16.73	17.61	18.49
	20	0.160	0.167	26.10	27.31	28.51
	18	0.188	0.196	39.27	41.00	42.73
	16	0.210	0.219	50.01	52.09	54.17
	14	0.255	0.265	77.02	79.61	82.19
	12	0.311	0.322	114.36	118.56	122.76
7	26	0.105	0.111	9.84	10.34	10.74
	24	0.117	0.123	13.65	14.11	14.57
	22	0.131	0.142	19.51	20.55	21.58
	20	0.157	0.167	30.52	31.90	33.27

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TABLE VII
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS A, C, D, AND G MULTI CONDUCTOR CABLE (8 MIL, 5PTM1T01)



No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)			
	Conductor size (AWG)	Min.	Target	Max.	Min.	Target	Max.
2	26	0.063	0.067	0.071	2.82	3.02	3.22
	24	0.071	0.075	0.079	3.90	4.13	4.36
	22	0.083	0.087	0.091	5.55	5.85	6.15
	20	0.098	0.103	0.108	8.57	8.87	9.17
	18	0.125	0.131	0.137	14.18	14.63	15.08
	16	0.131	0.137	0.143	16.45	16.90	17.35
	14	0.156	0.163	0.170	24.65	25.70	26.75
	10	0.196	0.204	0.212	38.90	40.40	41.90
3	26	0.065	0.069	0.073	4.26	4.53	4.80
	24	0.076	0.080	0.084	5.90	6.20	6.50
	22	0.085	0.091	0.097	8.37	8.77	9.17
	20	0.102	0.108	0.114	12.90	13.30	13.70
	18	0.131	0.138	0.145	21.35	21.95	22.55
	16	0.140	0.148	0.156	24.80	25.40	26.00
	14	1.165	0.173	0.181	37.15	38.55	39.95
	10	0.205	0.214	0.223	58.60	60.60	62.60
4	26	0.071	0.078	0.085	5.70	6.04	6.38
	24	0.081	0.088	0.095	7.92	8.30	8.68
	22	0.096	0.103	0.110	11.20	11.70	12.20
	20	0.119	0.128	0.137	17.25	17.75	18.25
	18	0.149	0.160	0.171	28.50	29.25	30.00
	16	0.158	0.169	0.180	33.10	33.85	34.60
	14	0.190	0.201	0.212	49.65	51.40	53.15
	10	0.236	0.250	0.264	78.30	80.80	83.30
5	26	0.084	0.094	0.104	7.14	7.55	7.96
	24	0.095	0.105	0.115	10.55	10.95	11.40
	22	0.112	0.122	0.132	14.20	14.80	15.40
	20	0.130	0.143	0.156	21.80	22.40	23.00
	18	0.164	0.179	0.194	35.65	36.55	37.45
	16	0.174	0.189	0.204	41.40	42.30	43.20
	14	0.209	0.224	0.239	62.20	64.30	66.40
	10	0.259	0.279	0.299	98.00	101.00	104.00
		0.320	0.340	0.360	152.70	156.60	160.50

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MATERIAL SPECIFICATION

TABLE VII
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS A, C, D, AND G MULTI CONDUCTOR CABLE (8 MIL, 5PTM1T01)(CONT'D)

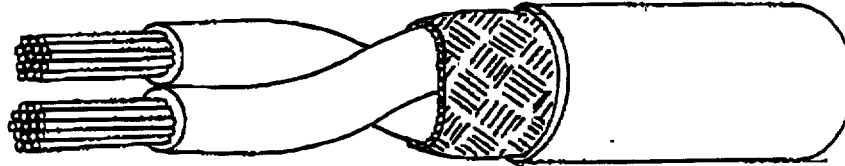
No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)			
	Conductor size (AWG)	Min.	Target	Max.	Min.	Target	Max.
6	26	0.098	0.105	0.112	8.62	9.06	9.50
	24	0.110	0.117	0.124	12.10	12.55	13.00
	22	0.128	0.135	0.142	17.10	17.70	18.30
	20	0.150	0.159	0.168	26.30	26.90	27.50
	18	0.189	0.200	0.211	42.90	43.85	44.80
	16	0.199	0.210	0.221	49.90	50.80	51.70
	14	0.238	0.249	0.260	75.00	77.10	79.20
	12	0.297	0.311	0.325	118.20	121.20	124.20
7	10	0.364	0.378	0.392	184.00	187.90	191.80
	26	0.098	0.105	0.112	10.12	10.57	11.02
	24	0.110	0.117	0.124	14.15	14.60	15.05
	22	0.128	0.135	0.142	20.10	20.70	21.30
	20	0.150	0.159	0.168	30.80	31.40	32.00
	18	0.189	0.200	0.211	50.20	51.20	52.20
	16	0.199	0.210	0.221	58.40	59.30	60.20
	14	0.238	0.249	0.260	87.90	90.00	92.10
8	12	0.297	0.311	0.325	138.40	141.40	144.40
	10	0.364	0.378	0.392	215.30	219.20	223.10
	26	0.101	0.115	0.121	11.63	12.08	12.53
	24	0.114	0.124	0.134	16.25	16.70	17.15
	22	0.134	0.144	0.154	23.10	23.70	24.30
	20	0.163	0.176	0.189	35.30	35.90	36.50
	18	0.202	0.217	0.232	57.50	58.50	59.50
	16	0.212	0.227	0.242	66.80	67.70	68.60
8	14	0.260	0.275	0.290	100.70	102.80	104.90
	12	0.318	0.338	0.358	158.60	161.60	164.60
	10	0.398	0.418	0.438	246.60	250.00	254.40

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TABLE VIII
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS L, P, R AND T FLAT BRAID SHIELDED AND JACKETED (6 MIL, 5PTM1T05)

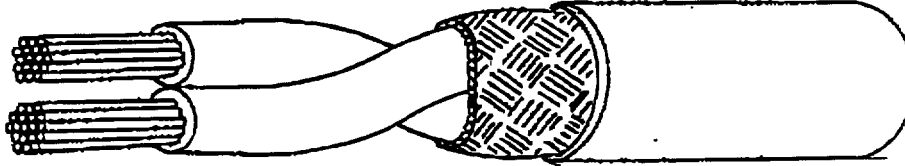


No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)		
	Conductor size (AWG)	Min.	Max.	Min.	Target	Max.
1	26	0.049	0.057	2.63	2.91	3.19
	24	0.052	0.060	3.39	3.51	3.82
	22	0.058	0.066	4.32	4.63	4.97
	20	0.066	0.074	5.97	6.36	6.75
	18	0.075	0.084	8.71	8.89	9.41
	16	0.083	0.092	10.72	10.93	11.48
	14	0.097	0.106	15.35	15.89	16.57
2	12	0.117	0.127	21.33	23.55	24.40
	26	0.080	0.090	4.85	5.28	5.71
	24	0.088	0.097	6.05	6.48	6.95
	22	0.100	0.109	8.11	8.68	9.20
	20	0.117	0.126	11.92	12.24	12.86
	18	0.136	0.145	16.83	17.29	18.09
	16	0.150	0.161	19.38	21.36	22.25
3	14	0.180	0.191	30.28	31.45	32.62
	12	0.218	0.231	45.29	46.80	48.31
	26	0.087	0.097	6.61	7.13	7.65
	24	0.095	0.105	7.64	8.89	9.45
	22	0.108	0.118	10.54	12.09	12.72
4	20	0.126	0.136	15.57	17.21	17.95
	18	0.146	0.157	22.26	24.62	25.60
	16	0.161	0.175	27.78	30.67	31.93
	26	0.093	0.119	8.37	8.98	9.59
	24	0.100	0.131	9.60	11.36	12.07
5	22	0.115	0.148	13.31	15.63	16.39
	20	0.133	0.172	19.53	22.25	23.18
	18	0.154	0.201	28.77	32.18	33.41
	16	0.172	0.222	36.17	40.08	41.50
	26	0.116	0.126	10.57	11.32	12.07
6	24	0.126	0.137	11.49	14.25	15.10
	22	0.144	0.155	16.01	19.52	20.45
	20	0.169	0.181	24.01	28.00	29.17
	18	0.198	0.209	35.51	40.27	41.77
	16	0.221	0.233	44.52	50.38	52.12

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MATERIAL SPECIFICATION

TABLE IX
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS B, E, F AND H FLAT BRAID SHIELDED AND JACKETED (6 MIL, 5PTM1T01)



No. Of Cond.	Conductor size (AWG)	Outside Diameter Inch			Weight (lbs/1000 Feet)		
		Min.	Target	Max.	Min.	Target	Max.
1	26	0.046	0.049	0.052	2.60	2.85	3.20
	24	0.050	0.053	0.055	3.38	3.63	3.88
	22	0.055	0.059	0.063	4.30	4.60	4.90
	20	0.063	0.067	0.071	6.16	6.46	6.76
	18	0.070	0.075	0.080	8.38	8.83	9.28
	16	0.077	0.083	0.089	10.32	10.87	11.42
	14	0.090	0.096	0.102	14.78	15.78	16.78
	12	0.109	0.116	0.123	21.78	23.28	24.78
2	26	0.072	0.077	0.082	4.64	5.04	5.44
	24	0.076	0.081	0.086	5.74	6.34	6.94
	22	0.086	0.093	0.100	7.75	8.45	9.15
	20	0.101	0.109	0.117	11.44	12.14	12.84
	18	0.122	0.130	0.138	15.78	16.83	17.88
	16	0.134	0.144	0.154	20.87	20.92	21.97
	14	0.161	0.173	0.185	28.50	30.30	32.10
	12	0.199	0.214	0.229	43.80	46.20	48.60
3	26	0.075	0.080	0.085	6.27	6.77	7.27
	24	0.083	0.090	0.097	7.95	8.60	9.27
	22	0.092	0.099	0.106	11.08	11.88	12.68
	20	0.108	0.116	0.124	16.14	16.94	17.74
	18	0.125	0.134	0.143	22.80	24.00	25.20
	16	0.140	0.150	0.160	28.65	29.85	31.05
	14	0.167	0.181	0.195	41.60	43.90	46.20
	12	0.209	0.225	0.241	63.60	67.10	70.60
4	26	0.082	0.088	0.094	7.95	8.55	9.15
	24	0.092	0.099	0.106	10.35	11.00	11.65
	22	0.105	0.112	0.119	14.50	15.30	16.10
	20	0.122	0.130	0.138	21.10	21.90	22.70
	18	0.141	0.150	0.159	29.85	31.15	31.45
	16	0.147	0.167	0.187	37.60	38.90	40.20
	14	0.188	0.203	0.218	54.90	57.90	60.90
	12	0.237	0.255	0.273	84.70	86.60	92.90

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CAGE Code 90997

GA Form GD 745A-5

TABLE IX
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS B, E, F AND H FLAT BRAID SHIELDED AND JACKETED (6 MIL, 5PTM1T01) (CONT'D)

No. Of Cond.	Conductor size (AWG)	Outside Diameter Inch			Weight (lbs/1000 Feet)		
		Min.	Target	Max.	Min.	Target	Max.
5	26	0.100	0.106	0.112	9.70	10.40	11.10
	24	0.108	0.115	0.122	12.45	13.25	14.05
	22	0.124	0.132	0.140	17.50	18.60	19.70
	20	0.145	0.154	0.163	25.30	26.80	28.30
	18	0.168	0.178	0.190	36.60	38.40	40.20
	16	0.182	0.195	0.208	45.90	48.00	50.10
	14	0.214	0.230	0.246	68.80	72.40	76.00
	12	0.265	0.284	0.303	105.40	109.90	114.40

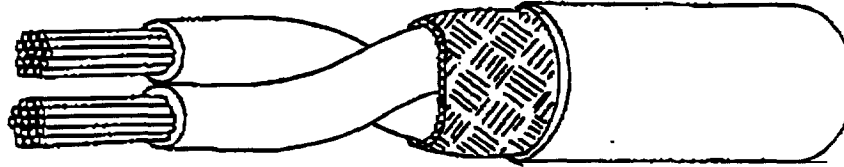
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CAGE Code 99897

MATERIAL SPECIFICATION

TABLE X
OUTSIDE DIAMETERS AND WEIGHTS OF WIRE
SYMBOLS K, M, N AND S FLAT BRAID SHIELDED AND JACKETED (8 MIL, 5PTM1T05)



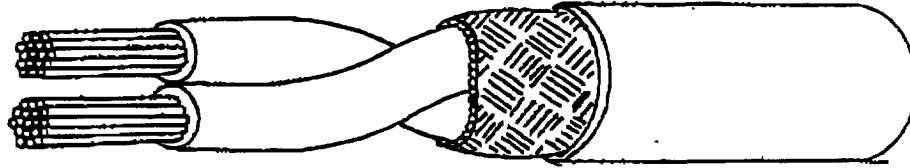
No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)		
	Conductor size (AWG)	Min.	Max.	Min.	Target	Max.
1	26	.052	.060	2.84	3.16	3.48
	24	.056	.064	3.74	3.84	4.18
	22	.062	.070	4.84	4.89	5.36
	20	.070	.079	6.69	6.81	7.24
	18	.080	.088	9.19	9.39	9.92
	16	.087	.096	11.15	11.46	12.04
	12	.102	.111	16.20	16.58	17.29
2	26	.122	.132	23.08	24.31	25.19
	26	.088	.098	5.29	5.77	6.25
	24	.096	.105	6.51	7.10	7.62
	22	.108	.118	8.63	9.39	9.97
	20	.126	.136	12.61	13.11	13.76
3	18	.144	.155	16.56	18.28	19.12
	16	.159	.170	20.25	22.41	23.37
	26	.095	.106	7.25	7.84	8.42
	24	.103	.114	8.35	9.76	10.42
4	22	.117	.128	11.24	13.20	13.92
	20	.135	.146	16.31	18.44	19.25
	18	.155	.167	23.52	26.00	27.05
	16	.173	.184	29.01	32.26	33.46
5	26	.100	.132	9.21	9.93	10.65
	24	.110	.142	10.40	12.53	13.26
	22	.124	.160	14.22	16.92	17.78
	20	.142	.186	21.08	23.85	24.90
	18	.164	.214	30.18	33.98	35.28
5	16	.182	.236	37.83	42.02	43.50
	26	.128	.138	11.65	12.47	13.29
	24	.138	.150	14.72	15.65	16.58
	22	.156	.168	20.12	21.14	22.16
	20	.183	.195	28.75	29.98	31.21
5	18	.211	.223	40.84	42.47	44.10
	16	.235	.247	51.01	52.81	54.61

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CAGE Code 98997

GA Form GD 74GA-E

TABLE XI
OUTSIDE DIAMETERS AND WEIGHTS OF CABLE
SYMBOLS A, C, D AND G FLAT BRAID SHIELDED AND JACKETED (8 MIL, 5PTM1T01)



No. Of Cond.	Outside Diameter Inch			Weight (lbs/1000 Feet)			
	Conductor size (AWG)	Min.	Target	Max.	Min.	Target	Max.
1	26	0.050	0.053	0.058	3.02	3.24	3.46
	24	0.054	0.057	0.060	3.67	3.88	4.13
	22	0.059	0.063	0.067	4.52	4.87	5.22
	20	0.067	0.071	0.075	6.47	6.75	7.03
	18	0.079	0.084	0.089	9.50	9.90	10.30
	16	0.082	0.088	0.094	10.83	11.33	11.83
	14	0.095	0.101	0.107	15.25	16.25	17.25
2	12	0.114	0.121	0.128	23.10	24.10	25.10
	26	0.075	0.080	0.084	5.06	5.56	6.06
	24	0.083	0.088	0.093	6.28	6.95	7.58
	22	0.094	0.100	0.106	8.27	8.97	9.67
	20	0.109	0.116	0.123	11.94	12.64	13.34
3	18	0.138	0.147	0.156	17.90	18.90	19.90
	16	0.144	0.154	0.164	20.70	21.75	22.80
	26	0.083	0.088	0.093	6.90	7.40	7.90
	24	0.090	0.096	0.102	8.80	9.40	10.0
	22	0.099	0.106	0.113	11.67	12.47	13.27
4	20	0.115	0.123	0.131	17.15	17.95	18.75
	18	0.145	0.154	0.169	25.85	26.95	28.05
	16	0.150	0.160	0.170	29.80	31.00	32.20
	26	0.091	0.097	0.103	8.72	9.32	9.92
	24	0.100	0.107	0.114	11.35	12.00	12.65
5	22	0.112	0.119	0.126	15.15	15.95	16.75
	20	0.130	0.138	0.146	22.15	22.95	23.75
	18	0.162	0.172	0.182	33.95	35.05	36.10
	16	0.168	0.179	0.190	39.25	40.45	41.65
	26	0.108	0.114	0.120	10.55	11.45	12.35
5	24	0.116	0.123	0.130	13.85	14.75	15.65
	22	0.132	0.140	0.148	18.70	19.70	20.70
	20	0.153	0.162	0.171	27.35	28.45	29.55
	18	0.189	0.200	0.211	42.15	43.45	44.75
	16	0.195	0.208	0.221	48.75	50.25	51.75

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MATERIAL SPECIFICATION

3.4.2 Wire product identification – The wire product identification shall appear on all individual basic wires when required by the basic specification. The wire product identification may be omitted on wire number 1 when this wire carries the cable product identification (see 3.4.1.1).

3.4.3 Printed marking – The printed marking shall be durable, legible, and shall be black in color, except where black is the color of the insulation in which case the color of the printing shall be white (see 3.2.1.1 and 3.4.1.1). The size of the printed characters shall be consistent with the magnitude of the surface upon which it is printed. The distance between the end of one mark and the beginning of next shall be:

- a. Six to 18 inches if printed on the jacket (3.4.1.1 and 3.4.1.2)
- b. A maximum of 3 inches if on a marker tape (3.4.1.2)
- c. A maximum of 12 inches if on wire number 1 (3.4.1.1)

The printed marking shall be applied with the vertical axes of the printed characters lengthwise on cable (or wire) whose nominal diameter is 0.050 inch (1.27 mm) or smaller. The vertical axes of the printed characters may be crosswise or lengthwise on cable (or wire) whose nominal diameter is 0.051 inch (1.30 mm), or larger, or whenever tape is used (see 3.4.4).

3.4.4 Identification tape – When tape is used for carrying the imprinted cable product identification, the tape shall be one continuous length of electrically nonadhesive type material with a temperature rating equivalent to the cable rating without the tape. The tape shall be .062 inch (1.57 mm) nominal or larger. The color of the tape shall be white, in accordance with MIL-STD-104, class 1, except when polyimide tape is used, in which case the natural color of the polyimide is acceptable.

3.4.5 Jacket color – Unless otherwise specified in the contract or purchase order (see 6.2), the cable jacket color shall be in accordance with the jacket material descriptions of 1.2.1.6. When a color or color tracer is specified, it shall conform to MIL-STD-104.

3.5 Workmanship – The cable shall be constructed and finished in a thoroughly workmanlike manner and shall exhibit uniform quality throughout.

3.6 Cable diameter – The major diameter of the cable shall be as specified in Tables IV through XI.

3.7 Cable weight – The maximum weight of the cable shall be as specified in Tables IV through XI. The acceptable values for the Cpk for the finished wire weight shall be 1.3, using a normal (Gaussian) distribution to obtain the Cpk value.

3.8 Contrast Ratio (PTFE) – The PTFE tape material shall be formulated in such a manner to achieve a minimum 62 percent contrast level when marked by a laser source. This requirement can be satisfied by certification from PTFE tape supplier.

4. QUALITY ASSURANCE PROVISIONS

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

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CAGE Code 96697

GA Form GD 745A-5

TABLE XII— CIRCUIT IDENTIFICATION COLORS FOR BASIC WIRES

Number of wires in cable	Identification solid/stripe colors for basic wires							
	Wire number							
	1	2	3	4	5	6	7	8
1	Basic (white)							
2	White	Blue						
3	White	Blue	Orange					
4	White	Blue	Orange	Green				
5	White	Blue	Orange	Green	Red			
6	White	Blue	Orange	Green	Red	Black		
7	White	Blue	Orange	Green	Red	Black	Yellow	
8	White	Blue	Orange	Green	Red	Black	Yellow	Violet

4.1.1 Responsibility for compliance – All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspection – The inspection requirement specified herein are classified as follows:

- a. Quality conformance inspection (see 4.3.1).
- b. Process control tests (see 4.3.2).

4.3 Inspection conditions – Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions in FED-STD-228.

4.3.1 Quality conformance inspection sampling – Sampling tests shall consist of the tests listed in Table XIII.

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MATERIAL SPECIFICATION

TABLE XIII - QUALITY CONFORMANCE INSPECTION

GROUP	TEST	REQUIREMENT	TEST METHOD
I	Shield coverage	3.2.3.3	4.5.6
	Braid angle	3.2.3.2	4.5.6
	Identification of product	3.4	4.5.1
	Jacket wall thickness	3.2.4	4.5.13
	Cable jacket removability	3.2.4	4.5.18
	Cable diameter	3.6	4.6
	Cable weight	3.7	4.7
II	Cold bend	3.3.4	4.5.7
	Thermal shock	3.3.5	4.5.10
	Aging stability	3.3.5.1	4.5.11
	Jacket, tensile strength elongation	3.2.4.1	4.5.13.1
	Blocking	3.3.6	4.5.16
	Flammability	3.3.7	4.8
	Impulse dielectric	3.3.1.1	4.5.4
	Crosslinked verification	3.3.10	4.5.12

4.3.1.1 **Lot** - A lot shall consist of all cable of a single cable designation offered for inspection at one time except that the lot shall not exceed 1,000,000 feet or one week's production, whichever is less. The lot shall be expressed in units of thousands of feet (total footage in lot divided by 1,000).

4.3.1.2 **Sample** - A sample shall consist of individual lengths of cable chosen at random from any one lot for the purpose of inspection or test. The sample size or number of lengths to be chosen from each lot shall be determined by the sampling plan.

4.3.1.3 **Sample unit** - A sample unit shall consist of one of the individual lengths of the sample. Each sample unit shall be of sufficient length to permit the performance of all applicable inspections or tests.

4.3.1.4 **Specimen** - A specimen shall consist of a piece of one sample unit upon which a particular inspection or test is to be made.

4.3.1.5 **Sampling for groups I and II tests** - For each group of tests, a random sample of the size specified shall first be selected from the lot. A specimen of sufficient length shall then be selected from each sample unit for the specified tests.

4.3.1.5.1 **Group I tests** - Sampling inspection for group I tests shall be in accordance with MIL-STD-105, inspection level S-4, AQL 6.5 (single sampling plan), (defects per hundred units).

4.3.1.5.2 **Group II tests** - Sampling inspection for group II tests shall be in accordance with MIL-STD-105, inspection level S-4, acceptance number 0 (single sampling plan).

4.3.1.6 **Resubmitted inspection lots** - MIL-STD-105 shall apply except that a resubmitted lot shall be inspected by the contractor using tightened inspection. Before resubmitting, full particulars concerning the cause of previous rejection and the action taken to correct the defects found in the lot shall be furnished by the contractor to the acquiring activity.

4.3.2 **Process control tests** - The process control tests are either of such nature that they cannot be performed on finished cable submitted for inspection and therefore must be conducted at the most appropriate stage of manufacturing operations, or they are tests conducted on 100 percent of the finished cable. The process control tests shall consist of the tests listed in Table XIV.

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TABLE XIV – PROCESS CONTROL TESTS

TEST	REQUIREMENT	TEST
Copper shield	3.2.3	4.5.2
Thickness of coating	3.2.3.1.2	4.5.2.2.1
Continuity of coating	3.2.3.1.2	4.5.2.2.2
Strand elongation	3.2.3.1.1	4.5.2.1
Jacket flaws	3.3.2	4.5.5
Dielectric withstrand	3.3.1	4.5.3 (if applicable)
Conductor continuity	3.3.3	4.5.9
Basic wire acceptance	3.2.1	Basic wire specification

4.3.2.1 Sampling for process control tests.

4.3.2.1.1 Shield strand material – From each week's production of individual shield strands or from every 100 pounds of individual shield strand, whichever is less, three 10-foot lengths of each style of shield strand representative of the material to be used in the finished cable shall be selected.

4.3.2.1.2 Coating – A sample shall consist of at least 3.5 feet of strand, before braiding, that is representative of the strand to be used in each lot of finished cable (see 4.3.1.1).

4.3.2.1.3 Coated copper strand elongation – A sample shall consist of at least 3.5 feet of strand, before braiding, that is representative of the strand to be used in each lot of finished cable (see 4.3.1.1).

4.3.2.1.4 Basic wire – Sampling of the basic wire shall be in accordance with the sampling plan of the basic wire specification. Additional impulse dielectric testing in accordance with the basic wire specification shall be performed when potentially degrading operations, either thermal, mechanical, or chemical have been performed subsequent to the original test.

4.3.3 Rejection and retest – When the 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 failure have been determined. After investigation, the contractor shall advise the acquiring activity of the action taken and after corrections have been made, all process control tests shall be repeated.

4.3.3.1 Tests may continue – For production reasons, testing may be continued pending the investigation of the process control sample failure, but final acceptance of the material shall not be made until it is determined that the lot meets all the requirements of the specification.

4.4 Inspection of packaging – The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-C-12000.

4.5 Methods of inspection

4.5.1 Inspection of product – All samples of cable shall be carefully inspected for packaging and all other requirements of this specification not covered by tests to ascertain conformance to this specification.

4.5.2 Shield strands

4.5.2.1 Elongation – Elongation tests on the coated copper strand shall be conducted in accordance with FED-STD-228, method 3211, using a 12-inch specimen, 10-inch bench marks, and a 10-inch initial jaw separation. A clamping-jaw grip may be used as an alternate to a spool type grip. Soft annealed copper shall be pulled at a rate between 5 and 10 inches per minute.

4.5.2.2 Coating

4.5.2.2.1 Thickness – The thickness of the coating shall be determined by the electronic determination method of ASTM B298.

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4.5.2.2.2 Continuity of silver – Continuity of silver coating tests shall be conducted in accordance with ASTM B298. There shall be no evidence of exposed copper.

4.5.2.2.3 Continuity of tin coating – The continuity of coating test shall be conducted in accordance with the test procedure in ASTM B33. There shall be no evidence of exposed copper.

4.5.3 Dielectric withstand – component wires – The finished cable shall be tested in accordance with method 6111 of FED – STD – 228, except that immersion is not required. Each conductor, in turn, shall be tested against all others tied together with the (inner) shield (if any). The test voltage shall be 1,500 V rms – for 600-volt rated basic wire. The time of electrification shall be not less than 15 nor more than 30 seconds.

4.5.4 Impulse dielectric test (for unshielded/unjacketed cable configuration) – The electrode head through which the cable is passed in the impulse dielectric test shall be of a suitable bead chain construction such that the electrode will give intimate metallic contact with practically all of the cable insulation surface. The characteristics of the impulse test and of the equipment auxiliary to the electrode head shall be as specified in the basic wire specification with test voltage at 6 kV (peak).

4.5.5 Jacket flaws – One-hundred percent of all finished shielded and jacketed cable shall pass through a suitable spark test device that will give intimate metallic contact with practically all of the jacket surface and impress a potential of 1,500 volt ac at commercial frequency between the electrode of the spark test device and the cable shield. Electrode length and speed of cable through the electrode shall be such that the jacket will be subjected to the test potential for a minimum of 0.2 second.

4.5.6 Braid angle and shield coverage – The braid angle and the percent coverage of the braid shall be determined by the following formula. Reference cable and geometry derivation factors in NEMA – WC27500.

$$\tan \alpha = 2 \pi (D+2d_1) P/C$$
$$K = 100 (2F - F^2)$$

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 strands
- D = diameter of cable under shield
- D = Gb (for cables with no fillers)
- D = Ab (for cables with fillers to round)
- C = number of carriers
- n = number of basic wires
- b = basic wire diameter

4.5.7 Cold bend – The ends of previously untested samples of finished cable shall be secured to a mandrel in a cold chamber. The other end of each specimen shall be secured to separate load weights sufficient to keep the cable vertical and tangent to the mandrel during the bending operation. The mandrel size shall be as specified in Table XV. The temperature of the chamber shall be lowered to $-55^\circ\text{C} \pm 5^\circ\text{C}$ at a rate not to exceed 50°C per minute. The specimens and the mandrel shall be conditioned at this temperature for 4 hours. At the end of this period, and while both mandrel and specimen are still at this low temperature, the cable shall be wrapped around the mandrel for 180° without opening the chamber. The time required for bending around 180° of the mandrel shall be one-half minute at a uniform rate of speed. A revolving mandrel operated externally from the chamber shall be used. The specimens shall then be removed from the mandrel and visually inspected, without magnification, for cracks. Specimens of shielded and jacketed types of cable with jacket mate-

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rial 1 and 2 shall be subjected to the voltage withstand test specified in 4.5.8. After being subjected to the cold bend test or voltage withstand test of the jacket, all specimens shall be dissected. The individual wires shall then be immersed within 3 inches of their ends for 1 hour in a 5 percent salt solution. At the end of this period, a potential of 1000 V rms at commercial frequency shall be applied for 1 minute from each conductor in the salt solution.

TABLE XV – TEST MANDREL DIAMETERS

FINISHED CABLE DIAMETER (INCHES)	COLD BEND (4.5.7); CROSSLINKED VERIFICATION (4.5.12); BLOCKING (4.5.13); IMMERSION (4.5.14) (INCHES)	FINISHED CABLE DIAMETER (INCHES)	THERMAL SHOCK (4.5.10); AGING STABILITY (4.5.11) (INCHES)
0 to 0.125	3	0 to 0.083	.75
0.126 to 0.250	6	0.084 to 0.111	1.0
0.251 to 0.380	10	0.112 to 0.139	1.25
0.381 to 0.750	18	0.140 to 0.184	1.74
0.751 to 1.200	30	0.195 to 0.250	2.25
1.201 to 2.000	48	0.251 to 0.334	3.0
		0.335 to 0.444	4.0
		0.445 to 0.556	5.0
		0.557 to 0.667	6.0
		0.668 to 0.889	8.0
		0.890 to 1.111	10.0
		1.112 to 1.556	14.0
		1.557 to 2.000	18.0

4.5.8 Voltage withstand, jacket – Specimens shall be formed into the shape of a U. All conductors shall be electrically connected together with the shields (if any) on both ends of the specimen. The specimens shall be tested in accordance with method 6111 of FED-STD-228, except the time of immersion shall be 1 hour minimum. The test voltage shall be 1,000 V rms, and the time of electrification shall be 1 minute. The test voltage shall be applied between the conductors (plus shield) and the immersion liquid.

4.5.9 Conductor continuity – Each basic wire in 100 percent of all finished cable in shipment reels or coils shall be tested for conductor continuity with an ohmmeter or other suitable testing device. There shall be no indication of discontinuity.

4.5.10 Thermal shock – Specimens of finished cable with jacket style 1 shall be wrapped around a mandrel for at least six close turns with the ends of the specimens tied to the mandrel. The mandrel diameter shall be as specified in Table XV. The specimens on the mandrel shall be subjected to 230°C within ± 5°C for 4 hours. At the end of this period, the specimen shall be inspected visually for cracks.

4.5.11 Aging stability – Specimens of finished cable with jacket style 1 shall be aged for 96 hours at 230°C within ± 5° C in a forced draft air oven. These specimens shall then be removed from the oven, allowed to cool at room temperature for 30 minutes and wrapped at a uniform rate of 15 ± 3 rpm at room temperature around a mandrel as specified in Table XV. At the end of this period, the specimens shall be removed from the mandrel as a helical coil and be inspected visually for cracks, without the aid of magnification (see 3.3.5.1).

4.5.12 Crosslinked verification – Twenty-four inch specimens of finished cable with crosslinked jackets (jacket symbol 2) shall have 1 inch of insulation removed from each end of each conductor. The conductors at each set of ends shall be tied together and loaded with weights equal to one-half the test load weight specified on the basic wire specification sheet times the number of conductors. This shall be done at each end of the specimen. The central portion of the specimen shall then be bent over a horizontally positioned smooth stainless steel mandrel of the diameter specified in Table XV. To prevent sticking of the wire to the mandrel, the mandrel may be coated with polytetrafluoroethylene in the form of either enamel or wrapped tape, provided that the diameter of the mandrel after coating is still in conformity with Table XV. This specimen so prepared on the mandrel shall be placed in an air circulating oven at 300 ± 5°C and maintained for 6 hours. The velocity of air past the

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specimen location in the oven shall be between 100 and 200 feet per minute as determined at room temperature. After completion of the air oven exposure, the specimen shall be allowed to cool to between 20°C and 25°C (68°F to 77°F). When cooled, the wire shall be freed from tension, removed from the mandrel, and straightened. The specimen shall then be subjected to the bend test (4.5.12.1), followed by voltage withstand test procedure of 4.5.8. After the voltage withstand test, the insulation shall be removed from the specimen and the conductor shall be inspected for pitting. Darkening of the copper coating caused by normal oxidation shall not be cause for rejection.

4.5.12.1 Bend test -- In a temperature maintained between 20 °C and 25 °C (68°F to 77°F), one end of the specimen shall be secured to the mandrel and the other end to the load weight specified in 4.5.12. The mandrel shall be rotated until the full length of the specimen is wrapped around the mandrel and is under the specified tension with adjoining coils in contact. The mandrel shall then be rotated in reverse direction until the full length of the wire which was outside during the first wrapping is now next to the mandrel. This procedure shall be repeated until two bends in each direction have been formed in the same section of the wire. The outer surface of the wire shall then be observed for cracking of the insulation.

4.5.13 Jacket wall thickness -- Specimens of finished cable shall be measured for wall thickness of jacket in accordance with method 1013 of FED-STD-228 except for tape wrapped jacket constructions use method 1018 or FED-STD-228.

4.5.13.1 Jacket tensile strength and elongation -- Jacket materials requiring tensile strength and elongation testing (see 3.2.4.1) shall be tested in accordance with ASTM D3032, using 1-inch bench marks, a 1-inch initial jaw separation, and a jaw separation speed of 2-inch per minute.

4.5.14 Immersion of polyimide/fluorinated ethylene propylene jackets -- Jacket style 1 specimens shall be tested in accordance with MIL-DTL-81381 using the voltage withstand test procedure of 4.5.8.

4.5.15 Lamination sealing (polyimide/fluorinated ethylene propylene jackets only, material 1) -- Specimens shall be tested for 6 hours at 230°C ± 5°C in accordance with MIL-DTL-81381. The jacket shall be visually inspected for delamination. Any separation of layers either along the insulation or at the ends shall constitute failure.

4.5.16 Jacket blocking -- One end of the continuous length of finished cable shall be fixed to a mandrel. The cable shall then be spirally wound around the mandrel so that at least three turns are in close contact with one another. The winding shall be continued until there are three layers of turns with each layer in close contact with one another. One end of previously untested samples of finished cable shall be secured to a mandrel. The other end of each specimen shall be secured to separate load weights sufficient to keep the cable vertical and tangent to the mandrel during the bending operation. The mandrel size shall be as specified in Table XV. The mandrel and cable shall then be placed within an air oven at the specified temperature for the specified time period (see 3.3.6). After removal from the oven, the mandrel and cable shall be cooled to room temperature and the cable shall be unwound. There shall be no adhesion or sticking of adjacent turns or layers during the unwinding process.

4.5.17 Concentricity -- The minimum wall thickness in a cross section of the extruded jacket shall be located and recorded. The maximum wall thickness of the jacket in this same cross section shall be measured and recorded. The ratio of the minimum wall thickness to the maximum wall thickness times 100 shall define the percent concentricity.

4.5.18 Cable jacket removability (see 3.2.4) -- The cable jacket shall be severed circumferentially 4 inches from the cable end. The cable shall be flexed at the point of severance to ensure that the jacket is parted completely. The 4-inch slug of jacket material shall be removed by pulling or working off the cable with the fingers. Finger gripping aids may be used. For jacket style 1 only, stripping time shall start when the jacket slug is gripped for removal after severance and shall end when the jacket slug has been completely removed from the cable.

4.6 Cable diameter -- Finished cable diameter as measured in a. through c. below shall not exceed the maximum cable diameter shown in Table IV through XI;

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- a. For all constructions except three-conductor cables, the measured diameter of the finished cable shall be directly determined with a micrometer caliper or dial micrometer as the greatest straight-line dimension of a cross-section of the cable.
- b. For three-conductor unshielded-unjacketed cable only, increase the caliper or dial micrometer reading by 7.7 percent to obtain finished cabled diameter.
- c. For three-conductor shielded and jacketed cable only, increase the caliper or dial micrometer reading by 15 percent of the specified nominal or median diameter of the basic wire as given in the applicable wire specification, to obtain finished cable diameter.

4.7 Cable weight

4.7.1 Measured - The finished-cable shall be weighed in accordance with method 8311 of FED-STD-228.

4.8 Flammability - Finished cable shall be tested in accordance with ASTM D3032. The period of flame application shall be 30 seconds for cables having components of size 10 AWG or smaller. Cables with larger components shall not be tested.

5. PACKAGING

5.1 Packaging - The requirements for packaging shall be in accordance with MIL-C-12000. Level C packaging shall be used unless otherwise specified. The ends of each length of cable shall be sealed against moisture intrusion. In addition, when a cable is wound on a reel or spool, the reel or spool shall have the following information marked on it in the order shown:

- a. Cable, power, electrical and cable special purpose,
- b. Cable designation number (see 1.2.1),
- c. Length feet (total and continuous),
- d. Date of manufacture, and
- e. Name of manufacturer or CAGE.

6. NOTES

6.1 Intended use - The cable covered by this specification is intended for use in aerospace and ground system applications requiring wires in a cable configuration for additional versatility and protection.

6.2 Ordering data

6.2.1 Acquisition requirements - Acquisition documents should specify the following:

- a. Title, number and date of this specification,
- b. Cable designation (see 1.2.1),
- c. Applicable specification date and issue for basic wires,
- d. Wire number identification color code (see 3.2.1.1) if, other than preferred,
- e. Minimum length shall be 100 feet, nominal must be specified.
- f. Applicable levels of preservation, packaging, and packing (see 5.1), and
- g. Jacket color (if other than specified in 1.2.1.6).

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