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SUPERSEDING
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MILITARY SPECIFICATION

CABLES, (POWER AND SPECIAL PURPOSE) AND WIRE, ELECTRICAL
(300 AND 600 VOLTS)

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

1. SCOPE

1.1 Scope. This specification covers single and multiple conductor cables with and without shields for use in 300 and 600 volts root mean square (rms) applications (see 6.1).

1.2 Classification. Cables covered in this specification are furnished in accordance with the type designation specified and are classified by the elements thereof.

1.2.1 Type designation. The type designation is formed as follows:

CO-	08	HG	E	(2/16S-4/12)	SJ	1090
Component (1.2.1.1)	Total number of conductors (1.2.1.2)	Class (1.2.1.3)	Flexibility (1.2.1.4)	Conductor data (1.2.1.5)	Shielding under jacket (1.2.1.6)	Outside diameter (1.2.1.7)

1.2.1.1 Component. Cables covered by this specification are identified by the two-letter symbol "CO" followed by a hyphen.

1.2.1.2 Total number of conductors. The total number of conductors (see 6.3.1), in a cable exclusive of uninsulated ground wires (see 6.3.2 and 6.3.5), are identified by a two-digit number. For cables with less than 10 conductors, a "0" precedes the number of conductors (example - 04 = 4 conductors), in a multiple conductor power cable.

1.2.1.3 Class. The class of cables is identified by a two-letter symbol, the first letter of which designates the duty (see 6.1) in accordance with table I. The second letter indicates the application of the cables in accordance with table II.

TABLE I. Duty of cables.

(Class) designated letter	Duty	Voltage rating (max volts)
L	Light	300
M	Medium	600
H	Heavy	600

NOTE: See table V for insulation thickness. See table VIII for jacket thickness.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: US Army Communications Electronics Command, ATTN: AMSEL-ED-TM Fort Monmouth, NJ 07703-5023 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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TABLE II. Application of cable.

Class designating letter	Application
G	General purpose, medium low temperature, -40°C to +75°C
O	Medium low temperature, oil resistant, -40°C to + 75°C
L	Low Temperature, heat resistant, -55°C to +75°C
D	Low temperature, oil, and heat resistant, -55°C to +75°C
H	Low temperature, heat and weather resistant, -55°C to +90°C
B	Low Temperature, oil, and weather resistant, -55°C to +80°C
C	Low temperature, oil, and heat resistant, -55°C to +80°C
K	Low temperature, oil, heat , and weather resistant, -55°C to +80°C
N	Low temperature, oil and, heat resistant, -55°C to +90°C 1/
E	Low temperature, ozone, oil, weather, and heat resistant, -65°C to +90°C

1/ Synthetic polyisoprene may be blended with natural rubber.

TABLE III. Compounds in accordance with MIL-I-3930.

Class designation letter	Insulating compound designators in accordance with MIL-I-3930 applicable slash sheet in ()	Jacketing compound designator in accordance with MIL-I-3930 applicable slash sheet in ()
G	IS (2), IH (9), S (12), O (13) 1/2/	S (12), O (13), JN (18, 22) 1/2/
O	IS (2), IH (9), S (12), O (13) 1/2/	S (12), O (13), JN (18, 22) 1/2/
L	IS-L (3), IH (9), S (12), O (13) 1/2/	S (12), O (13), JS-L (16), JN-L (23) 1/2/
D	IS-L (3), IH (9), S (12), O (13) 1/2/	S (12), O (13), JN-L (19, 23) 1/2/
H	IH (9), S (12), O (13) 1/2/	S (12), O (13), JH (20) 1/2/
B	IH (9)	JN-L (19, 23)
C	IE (11)	JN-L (19, 23)
K	IE (11)	JU (21)
N	IR (4) IL (5) 2/	JR (17), JN (18, 22)
E	S (12), O (13) 1/2/	S (12), O (13) 1/2/

1/ For S and O insulating and jacketing designations; see the appendix herein for additional performance requirements.
2/ MIL-I-3930/2, /5, /12, /13, and /20 are not for CECOM use.

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1.2.1.4 Flexibility. Flexibility of a cable is based upon the flexibility of the conductors comprising the cable. All conductors and uninsulated ground wires within the same cable will be of the flexibility designated (see 3.2.1 and 3.2.2). The flexibility is identified as follows:

S - Semiflexible
F - Flexible
E - Extra-flexible

1.2.1.5 Conductor data.

1.2.1.5.1 Number and size of individual conductors. The number of individual conductors of the same wire size are designated by that number followed by a number indicating the conductor wire size. For example: "3/22" indicates 3 number 22 AWG conductors. When cables are made up of different wire sizes, each different wire size is individually represented, with a dash separating each different wire size. For example: "-6/14-1/8" indicates six No. 14 AWG conductors and a single No. 8 AWG conductor.

1.2.1.5.2 Unshielded grouped conductors. Conductors twisted together to form a group (such as pairs, triples, quads, etc.) are designated, immediately following the wire size, by "x", followed by the number of these conductor groups contained in the cable; for example, "2/20 x 1" indicates two No 20. AWG conductors twisted together to form a pair; "3/22 x 4" indicates 4 groups,each group consisting of three No. 22 AWG conductors twisted together to form a triple.

1.2.1.5.3 Shielding.

1.2.1.5.3.1 Grouped shielding. When one or more groups of copper conductors have a common shield over each conductor group, the designator "S x (no. of groups)" follows the wire size; for example, "2/22 S x 6" indicates six pairs of No. 22 AWG conductors, with a shield over each pair. When a single group has an overall shield, the designation "x 1" is to be omitted since conductors under a shield are twisted to form one group, for example; "2/20 S" indicates one twisted pair of No. 20 AWG conductors under a common shield.

1.2.1.5.3.2 Individual shielding. When each conductor of the same size is individually shielded, the letter "I" follows the letter "S". For example: "3/14 SI" indicates three No. 14 AWG conductors, each conductor individually shielded. A shielded single conductor is to be designated by the letter "S" instead of "SI". For example: "1/18 S" indicates a single No. 18 AWG conductor shielded.

1.2.1.5.4 Uninsulated ground drain wires. Uninsulated ground drain wires are designated in the same manner as conductors specified in 1.2.1.5 except the letter "R" is to follow the wire size. For example: "3/8 R" indicates three No. 8 AWG ground wires. Uninsulated ground wires are not counted in the total number of conductors.

1.2.1.5.5 Cabling. All conductors and groups that are cabled together beneath the jacket,and under the jacket shield, shall be enclosed in parentheses. For example: "(2/20 x 2-3/18)" indicates a cable made up of two twisted pairs No. 20 AWG conductors and three No. 18 AWG conductors.

1.2.1.5.6 Cable configuration. Cables composed of two conductors laid parallel are to be designated by the letter "F" which is to follow the conductor number. For example, "2F/8" indicates two No. 8 AWG conductors laid parallel.

1.2.1.6 Shielding under the jacket. When single shielding is over all conductors and beneath the jacket, the letters "SJ" follows the parentheses that enclose the conductor data. When double shielding beneath the jacket is specified, the letters "SSJ" will follow the parentheses that enclose the conductor data. No letters are used if an overall shield beneath the jacket is not present.

1.2.1.7 Outside diameter.

1.2.1.7.1 Cables (except parallel conductors). The outside diameter of the cable is indicated by four significant figures expressing the diameter in mils (thousandths of an inch) to the nearest figure divisible by five. If a tolerance other than that specified in 3.2.8.1 is required, it is indicated by placing the tolerance immediately after this element of type designation (see 1.2.1.8b and 1.2.8f).

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1.2.1.7.2 Parallel conductor cables. The outside diameter of the parallel conductor cable shall be designated by giving the major diameter followed by a slant an followed by the minor diameter. The diameter, either major or minor, shall be indicated in mils (thousandths of an inch) by four significant figures. If a tolerance other than that specified in 3.8.2 is required, it shall be indicated by placing the tolerance immediately after the major or minor diameter.

1.2.1.8 Use and examples of type designations. Use of type designations formed as indicated in 1.2.1 is not intended to limit the number of cable types procured under this specification. Representative examples of type designations are as follows:

a. CO-10LGF(6/22-2/20-2/18x1)0640 represents a 10 conductor light duty general purpose flexible cable with six No.22 AWG conductors, two No. 20 AWG conductors and one twisted pair No. 18 AWG conductors. The cable has an outside diameter of 0.640 inch.

b. CO-18HLF(3/20x4-3/18x1-3/16)1040±0.025 represents an 18 conductor heavy duty heat resistant flexible cable with four triples, each triple composed of three No. 20 AWG conductors twisted together; and one triple composed of three No.18 AWG conductors twisted together, and three No.16 AWG conductors. The cable has an outside diameter of 1.040 inches with a tolerance of ±0.025 inch specified.

c. CO-06MDE(3/22S-2/20SI-1/16S)SJ0430 represents a 6 conductor medium duty, oil resistant extra flexible cable with three No. 22 AWG conductors twisted together to form a triple, in a common shield; two No. 20 AWG conductors, each individually shielded and one 16 AWG conductor individually shielded. The cable has an overall shield with a jacket or sheath. The cable has an outside diameter of 0.0430 inch.

d. CO-15 MDF(2/22SX5-2/20S-2/18SI-1/16S)1620 represents a 15 conductor, medium duty, oil and heat resistant flexible cable with five pairs of No. 22 AWG conductors, each pair individually shielded; one shielded pair of No. 20 AWG conductors; two No. 18 AWG conductors, each individually shielded; one No. 16 AWG shielded conductor. The cable has an outside diameter of 1.620 inches.

e. CO-02HGF(2/4-2/8R)1080 represents a 2 conductor, heavy duty, general purpose flexible cable with two No. 4 AWG conductors, and two No. 8 AWG uninsulated ground wires. The cable has an outside diameter of 1.080 inches.

f. CO-02HGS(2F/8)0920±0050/0510 represents a 2 conductor, heavy duty, general purpose, semi-flexible parallel cable with two No. 8 AWG conductors having a major diameter of 0.920 inch with a tolerance 0.050 inch specified and a minor diameter of 0.510 inch.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks for a part of this document form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

L-P-390	-	Plastic, Molding and Extrusion material, Polyethylene Copolymers (Low, Medium, and High Density).
QQ-W-343	-	Wire, Electrical Copper (uninsulated).

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MIL-I-3930 - Insulating and Jacketing Compounds, Electrical (for Cables, Cords, and Wires).
MIL-C-12000 - Cables, Cords, and Wires, Electric Packaging of.
MIL-P-24216 - Polypropylene Cores, Strands Centers and Substrands Wire Rope.

STANDARDS

FEDERAL

FED-STD-228 - Federal Test Method Standard Cable and Wire, Insulated; Method of Testing.

MILITARY

MIL-STD-104 - Limits for Electrical Insulation Color.
MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-686 - Cable and Cord Electrical; Identification Marking and Color Coding of.
MIL-STD 810 - Environmental Test Methods and Engineering Guidelines.
MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise indicated, the issues of the documents which are DoD adopted are those listed in the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

ANSI/ASTM-D-4066 - Nylon Injection and Extrusion Materials.

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

UNDERWRITERS LABORATORIES INCORPORATED

UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords.

(Copies of the UL publication may be obtained from the Underwriters Laboratories, Inc., Publication Stock, 333 Pfingsten Road, Northbrook, IL 60062.)

NEMA WC 7/ICEA S-66-524 - Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

(Copies of the NEMA publication may be obtained from the National Electrical Manufacturers Association, 2101 L Street, N.W., Suite 300, Washington D.C. 20037.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Materials. Materials shall be specified herein. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the product. When definite material is not specified, a material shall be used which will enable the wire and cable to meet the requirements of this specification. All materials shall be fungus resistant in accordance with MIL-STD-810, method 508.

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3.1.1 Wire Strands.

3.1.1.1 Copper strands. The strands comprising the conductor, uninsulated ground wires (see 6.4.5), and braided shields, shall be soft, drawn, or annealed wire conforming to the applicable requirements of QQ-W-343.

3.1.2 Insulating and jacketing compounds. The insulating and jacketing compounds shall comply with the applicable types (see table III).

3.1.2.1 Polyethylene. Polyethylene shall be accordance with L-P-390.

3.1.2.2 Polyurethane. Polyurethane shall be of a polyetherurethane type.

3.1.2.3 Crosslink polyethylene. Crosslink polyethylene shall meet the requirements of ICEA S-66-524, insulation for cables rated 0 - 2,000 volts.

3.1.2.4 Polyamide (nylon). Polyamide shall be in accordance with ASTM-D-4066.

3.1.3 Recycled material. These cables and wires shall contain recycled material to the maximum extent possible provided such material dose not prevent the manufacturer from meeting the requirements of this specification. The recycled material shall be reprocessed in a manner which will restore it to the same chemical composition and physical properties as the material originally selected.

3.1.4 Fillers and binders. Materials used for fillers and binders shall be compatible with the requirements of the finished cable. Twisted polyethylene film or foam polypropylene is acceptable for use with thermoplastic materials only. The yarns shall be clean, dry, and substantially free from all foreign particles, knots, lumps, or any substance that would impair the insulation of the conductor. All materials shall be fungus resistant in accordance with MIL-STD-810, method 508.

3.1.5 Separators. Materials used for separators shall be one of the type specified in 3.1.5.1 and 3.1.5.2.

3.1.5.1 Polyester tapes. Where used, polyester tapes shall conform to MIL-I-631 type G, form T.F. Polyester tape may be polyethylene-coated for subsequent heat sealing.

3.1.5.2 Polypropylene tape. Where used, polypropylene shall be in accordance wit MIL-P-24216.

3.2 Design and construction. Cables shall be of the design, construction, and physical dimensions specified herein.

3.2.1 Conductors. Conductors shall be in accordance with QQ-W-343. For a particular size and flexibility, the conductors shall be of the type, class, and service listed in table IV (see 1.2.1.4).

3.2.2 Ground drain wires. Ground drain wires shall be in accordance with QQ-W-343 and table V. Each ground drain wire shall have a green cover of fibrous braid, extruded rubber, metallic, or plastic (see 3.2.6.2). When extruded rubber or plastic is used as a covering, it shall be marked "GND" (ground) in contrasting color with a maximum of 3 inches intervals in accordance with MIL-STD-686.

3.2.3 Insulated conductors. Insulated conductors shall be free stripping and extruded over the conductors. Insulated conductors shall be readily separated from each other. The minimum thickness, measured at a cross section of the insulation, for various cable duties and conductor sizes, shall be specified in table VI. The minimum insulation thickness; however, may be 80 percent of the nominal thickness at the area of contact between contiguous insulated conductors. There shall be no kinking of the insulated conductor within the sheath. Polyethylene insulated conductors of 24 through 12 AWG shall have 0.003 inch minimum thickness extruded jacket of polyamide.

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3.2.4 Shielding. Shielding shall be applied over the individual conductors, over two or more conductors, or over the entire group of conductors, as specified (see 1.2.1.5.3). The shield shall consist of a braid providing a minimum coverage of 85 percent (see 4.6.1). Irregularities, breaks, and discontinuities shall be avoided in the application. There shall be no strands protruding through the insulation or the jacket. For insulated conductors in the Kcmil and the AWG sizes 500 Kcmil to 10 AWG inclusive, the shielding shall consist of a single or double braid of strands, each strand having a nominal diameter of 0.0063 inch. For insulated conductors in AWG sizes No. 12 through 22 inclusive, the strand shall be of 0.0050 inch nominal diameter. For a shield applied over two or more conductors grouped together, or over the entire group of conductors, when the diameter covered is 0.625 inch or less, the shielding shall consist of a single or double braid of strands, each with a nominal diameter of 0.0050 or 0.0063 inch; when the diameter covered is more that 0.625 inch, strands with a nominal diameter greater than 0.063 may be used for the braid.

3.2.4.1 Shield cover. For a single conductor, or two or more conductors grouped together under one shield, there shall be a separator applied directly on the shield. When the diameter over the shield does not exceed 0.020 inch, 0.0050 to 0.0080 inch thick polyamide may be extruded instead of polyester tape over the shields that have polyethylene insulated components. For overall shield, there shall be an overlapping, helical wrap of polyester or polyproplene tape applied over the cable core prior to shielding. (see 3.2.6.4).

3.2.5 Identification coding. The individual conductors of all cables and single wires shall be coded for their entire length in accordance with MIL-STD 686.

a. The standard means of coating shall be as follows:

   (1) Solid-colored insulation with tracers, when required.

   (2) Color-coded 1/2 to 1 mil polyester tape, with or without 1/2 to 1 mil heat-sealable adhesion.

   (3) Color-coded 1 mil polyester tape with 1/2 to 1 mil heat-sealable adhesive in 8 AWG or larger, when tracers are required.

   (4) Color-coded, filled tapes in 8 AWG and larger, when tracers are not required.

   (5) Coding by marking.

   (6) Color code by green braid (ground wire only).

b. Color shall be in accordance with MIL-STD-104, class 1 for plastics and elastomers, and class 2 for thermosetting compounds. Where black, blue, brown, purple, or red (i.e., two or more of these colors) are used in the same cable, the colors (other than black) shall be light to nominal. Gray shall be dark (or slate) when in the same cable with white.

3.2.5.1 Solid-color insulation. The entire thickness of plastic or rubber insulation shall be solid-colored, when practicable. When the entire thickness is not a solid colored, insulation shall be applied over the inner core to form a integral part of the insulation wall. Cables having up to and including six conductors shall employ solid coloring, and each conductor shall be clearly distinguishable.

3.2.5.2 Stripe tracers. The tracer shall be in accordance with MIL-STD-686. All materials for stripping shall be nonconductive.

3.2.5.3 Coding by marking. Where prototype models or short runs of cables are specified for procurement (less than 10,000 feet) and the individual conductors of the cables have an outside diameter of 0.065 inch or larger, the contractor shall code the conductors by marking or coloring in accordance with MIL-STD-686.

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3.2.6 Grouping and cabling. When the cables are grouped (see 1.2.1.5.2 and 1.2.1.5.5), the conductors within the group shall be twisted together. All the conductors and groups of conductors, shall be cabled together in an arrangement that shall form an essentially round construction (except for parallel conductors). Where there are mixtures of different conductor sizes and element constructions (shielded singles, shielded pairs), the larger diameter conductors and shielded wires shall be toward the center.

3.2.6.1 Length of lay. The lay-up of cable layers shall be unidirectional. For cables employing semiflexible conductors and uninsulated ground wires, when present, the length of lay shall be not greater than 20 times the outer diameter of the layer. For cables employing flexible conductors and uninsulated ground drain wires, when present, the length of lay shall be not greater than 16 times the outer diameter of the layer. For cables employing extra-flexible conductors and uninsulated ground drain wires, when present, the length of lay shall be not greater than 12 times the outer diameter of the layer. (The outer diameter of the layers is the diameter over the separator or binder, if used (see 3.2.6.4).

TABLE IV. Constructional and direct-current resistance requirements of conductors.

Conductor Size AWG and Kcmil	Conductor dc resistance at 25°C max ohms/1000 ft	Semiflexible		Number of Strands	Flexible			Number of Strands	Extra flexible			Number of Strands
		Wire type QQ-W-343			Wire type QQ-W-343		Service		Wire type QQ-W-343		Service	
		Type	Class		Type	Class			Type	Class		
500	0.023	E	G	259	E	H	---	427	---	---	---	---
450	0.025	E	G	259	E	H	---	427	---	---	---	---
400	0.028	E	G	259	E	H	---	427	---	---	---	---
350	0.032	E	G	259	E	H	---	427	---	---	---	---
300	0.038	E	G	259	E	H	---	427	---	---	---	---
250	0.045	E	G	259	E	H	---	427	---	---	---	---
4/0	0.054	E	G	133	E	H	---	259	---	---	---	---
3/0	0.069	E	G	133	E	H	---	259	---	---	---	---
2/0	0.086	E	G	133	E	H	---	259	---	---	---	---
1/0	0.113	E	G	133	E	H	---	259	R	K	---	1064
1	0.142	E	G	133	E	H	---	259	R	K	---	836
2	0.180	E	G	49	E	1/	---	259	R	K	---	665
3	0.213	E	G	49	E	H	---	133	R	K	---	532
4	0.283	E	G	49	E	H	---	133	R	K	---	420
6	0.450	E	G	49	E	H	---	133	R	K	---	266
8	0.715	---	---	---	E	G	---	49	R	K	---	168
10	1.14	---	---	---	B	K	Severe	104	or E R	H M	---	133 259
12	1.81	B	J	41	B	K	Severe	65	B	M	Extra Severe	165
14	2.82	B	J	26	B	K	Severe	41	or R B	M M	--- Extra Severe	168 104
16	4.49	B	K	26	B	H	Severe	65	B	O	Extra Severe	104
18	7.15	B	K	16	B	H	Severe	41	B	O	Extra Severe	65
20	11.35	---	---	---	B	H	Severe	26	B	O	Extra Severe	41
22	18.09	---	---	---	B	H	Severe	19	B	O	Extra Severe	26
24	24.50	---	---	---	B	O	Severe	19	B	P	Extra Severe	26

1/ Number 2 AWG conductor shall be type RC, except it shall be composed of 259-16.0 mil strands.

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TABLE V. Constructional and direct-current-resistance requirements of uninsulated ground drain wires.

Ground wire size	Ground wire resistance at 25°C max	Semiflexible				Flexible				Extra flexible				Length of lay max 1/
		No. of strands	Dia. of strands	QQ-W-343		No. of strands	Dia. of strands	QQ-W-343		No. of strands	Dia. of strands	QQ-W-343		
				Type	Class			Type	Class			Type	Class	
AWG	Ohms/1000 ft		Mils				Mils				Mils			Inches
4/0	.054	133	39.9	E	G	259	28.6	E	H	---	---	---	---	---
3/0	.069	133	35.5	E	G	259	25.5	E	H	---	---	---	---	---
2/0	.086	133	31.6	E	G	259	22.7	E	H	---	---	---	---	---
1/0	.113	133	28.2	E	G	259	20.2	E	H	---	---	---	---	---
1	.142	133	25.1	E	G	259	18.0	E	H	---	---	---	---	---
2	.173	49	36.8	E	G	133	22.3	E	H	---	---	---	---	---
3	.218	49	32.8	E	G	133	19.9	E	H	---	10.0	---	---	---
4	.283	49	29.2	E	G	133	17.7	E	H	420	10.0	R	K	---
5	.350	49	26.0	E	G	133	15.8	E	H	336	10.0	R	K	---
6	.450	49	23.1	E	G	133	14.0	E	H	266	10.0	R	K	---
7	.556	19	33.1	C	G	49	20.6	E	H	210	10.0	R	K	---
8	.715	19	29.5	C	G	49	18.4	E	H	168	10.0	R	K	---
9	.884	19	26.2	C	G	49	16.4	E	H	133	10.0	R	K	---
10	1.11	7	38.5	C	B	19	23.4	C	C	104	10.0	B	K	2.00
11	1.41	7	34.3	C	B 2/	19	20.8	C	C 2/	82	10.0	B	K 2/	1.50
12	1.77	7	30.5	C	B	19	18.5	C	C	65	10.0	B	K	1.25

1/ Since many of these sizes are not listed in QQ-W-343, the maximum length of lay is specified herein, instead of the service. This is the equivalent of extra severe service.

2/ Since these sizes are not listed in QQ-W-343, the applicable class is listed for information only.

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TABLE VI. Insulation thickness.

Duty (see table I)	Rubber, TPE, and crosslink polyethylene			Polyethylene		
	Conductor size inclusive AWG and Kcmil	Insulation thickness in inches		Conductor size inclusive AWG and Kcmil	Insulation thickness in inches	
		Nominal 1/	Minimum		Nominal 1/	Minimum
Light	24 to 18	0.016	0.013	25 to 18	0.010	0.008
	16 to 14	0.018	0.015	16 to 14	0.012	0.010
	12 to 10	0.021	0.018	12 to 10	0.015	0.012
Medium	24 to 20	0.030	0.025	24 to 20	0.012	0.010
	18 to 16	0.033	0.028	18 to 16	0.014	0.012
	14 to 12	0.036	0.031	14 to 12	0.016	0.014
	10 to 8	0.038	0.033	10 to 8	0.020	0.018
	6 to 2	0.047	0.042			
	1 to 2/0	0.063	0.056			
Heavy	24 to 20	0.030	0.025	24 to 16	0.015	0.012
	18 to 16	0.033	0.028	14 to 12	0.020	0.017
	14 to 10	0.047	0.042	10	0.030	0.025
	8 to 6	0.055	0.050	8 to 4	0.035	0.032
	4 to 2	0.063	0.057	2	0.042	0.038
	1	0.070	0.063	1	0.046	0.041
	1/0 to 4/0	0.078	0.070	1/0 to 2/0	0.056	0.052
	250 to 500 Kcmil	0.094	0.084	3/0 to 4/0	0.064	0.060
				250 to 500 Kcmil	0.075	0.070

1/ Nominal dimensions are included for information only.

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3.2.6.2 Ground drain wires. When specified (see 1.2.1.5.4), ground drain wires shall be included in two, three, four, and five conductor, heavy duty unshielded cables in which all conductors are of the same size, and shall be cabled together with the conductors and fillers, if used. The number of ground drain wires shall be the same as the number of conductors. The minimum size of the uninsulated ground drain wires shall be as specified in table VII and is dependent upon the size and number of conductors. Ground drain wires shall not be furnished in conductor sizes less than 8 AWG.

TABLE VII. Size of ground drain wires.

Power conductor sizes Kcmil and AWG	Minimum ground drain wire sizes (AWG)			
	Number of power conductors			
	Two	Three	Four	Five
500	4/0	2/0	1/0	2
400	3/0	1/0	1	3
350	2/0	1	2	4
250	1/0	2	3	5
4/0	1	3	4	6
3/0	2	4	5	7
2/0	3	5	6	8
1/0	4	6	7	9
1	5	7	8	9
2	6	8	9	10
3	7	9	9	10
4	8	10	10	12
6	10	10	12	12
8	10	12	12	12

3.2.6.3 Fillers. Fillers shall be used when required to effect a circular cross section (see 3.1.4).

3.2.6.4 Binders and separators. A binder applied over the cabled conductors to hold them in place is optional. A separator shall be applied over the cabled conductor prior to the application of the shield or jacket. The use of a separator for unshielded conductors of 8 AWG and larger shall be optional with the manufacturer. A separator shall be applied over the shield, if present, prior to the application of the jacket. For single conductor cable where no shield is present, a separator shall not be applied. Separators shall be applied as a heat barrier over the cabled conductors with polyethylene insulation, prior to extrusion of the jacket. The binders and separators shall be of the types specified in table VIII.

TABLE VIII. Binders and separators.

Binder types (optional)	Separator types		
	For unshielded cable	For shielded cable	
		Under shield	Over shield
Open wrap, open braid	Closed wrap, closed braid, compound - filled tape, polyester or polypropylene tape.	polyester or polypropylene tape.	Closed wrap, closed braid, compound-filled tape, polyester or polypropylene tape.

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3.2.7 Jacket. The jacket shall be extruded and then vulcanized (except for thermoplastics) over the cabled conductors or shielding, when used, and shall be well centered, single or double-layer jacket. Double-layer jackets shall be used on cables whose minimum jacket thickness is 0.098 inch or over as specified in table IX. Double-layer jackets shall be applied in two concentric layers that are strongly bonded together; the outer layer shall be at least 50 percent of the total thickness. A reinforcement consisting of an open braid or two layers of seine twine or cabled cotton, or the equivalent, applied in reverse directions, shall be provided between the layers of the jacket (see 6.1.4). For single conductor cables where no shield is present, the jacket shall be applied directly over the insulation and adhere to the insulation. The jacket shall be as specified in table IX, unless special outside diameters are specified.

TABLE IX. Jacket thickness.

Calculated core diameter inches, inclusive	Jacket Thickness					
	Duty L		Duty M		Duty H	
	Nominal	Minimum	Nominal	Minimum	Nominal	Minimum
0.125 and under	0.020	0.018	0.027	0.024	0.035	0.032
.126 to 0.155	.022	.019	.031	.028	.040	.036
.156 to .219	.024	.022	.039	.035	.045	.041
.220 to .234	.026	.023	.039	.035	.078	.070
.235 to .290	.031	.028	.047	.042	.078	.070
.291 to .300	.031	.028	.047	.042	.094	.085
.301 to .430	.050	.045	.063	.057	.094	.085
.431 to .540			.070	.063	.094	.085
.541 to .640			.078	.070	.109	.098
.641 to .740			.094	.085	.125	.113
.741 to .850			.109	.098	.141	.127
.851 to 1.100			.125	.113	.156	.140
1.101 to 1.320			.156	.140	.172	.155
1.321 to 1.550			.172	.155	.188	.169
1.551 to 1.820					.203	.183
1.821 to 2.050					.220	.198
2.051 to 2.300					.235	.212
2.301 to 2.550					.250	.225
2.551 to 2.800					.265	.239
2.801 to 3.100					.280	.252
3.101 to 3.500					.295	.266
3.501 to 3.950					.310	.279
3.951 to 4.450					.330	.297
4.451 to 5.000					.345	.311

3.2.7.1 Polyurethane jacket. For medium and heavy duty cables, the jacket shall be reinforced with polyester or glass fiber strands treated, (if necessary) to bond to polyurethane. The fibers shall be applied over the cable core and bonded to jacket.

3.2.7.2 Jacket color. The jacket color shall be black in accordance with MIL-STD-104.

3.2.8 Diameter tolerance.

3.2.8.1 Cable diameter tolerance (except parallel conductors). The outside diameter of cables having a specified diameter of less than 0.500 inch, shall have a tolerance of ± 0.015 inch. The outside diameter for cables having a specified diameter from 0.500 to 0.700 inch, inclusive shall have a tolerance of ± 0.020 inch. The outside diameter for cables having a specified diameter of more than 0.700 inch shall have a tolerance of ± 3 percent. The diameter of a cable at any cross section (except for parallel conductor cable) shall be considered the average of the major and minor diameters at that cross section. If a special tolerance is required on the outside diameter, such tolerances shall be indicated at the end of the type designation (see 1.2.1.8).

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3.2.8.2 Parallel conductors. The outside diameter of a parallel conductor cable shall have a tolerance of ±0.040 inch for a major diameter and a tolerance of ±0.030 inch for the minor diameter.

3.3 Spark. When a cable is tested as specified in 4.6.2, the insulated conductor shall withstand the applicable voltage specified in table XV. A certification to the effect that the spark test has been performed shall accompany the cable when it is submitted for acceptance.

3.4 Voltage withstand. When tested as specified in 4.6.3, the insulated conductor in the finished cable shall withstand the specified voltage in table XV.

3.5 Insulation resistance. When measured as specified in 4.6.4, the insulation resistance shall be not less than the figures obtained from the following formula:

$$R = K \log_{10} \frac{d + 2c}{d}$$

Where:
R - Insulation resistance in megohms - 1000 feet.
K - 2,000 for SBR, and 50,000 for polyethylene; 10,000 for EPDM, TPE and crosslink polyethylene.
d - Average diameter under the insulation.
c - Specified nominal insulation thickness.

NOTE: d and c shall be expressed in the same units.

3.6 Direct current resistance. When the cable is tested as specified in 4.6.5, resistance shall not exceed the values shown in tables IV and V.

3.7 Surface resistance. Black jacket, black insulation, and black striped jackets and insulation shall have a surface resistance of 10 megohms per inch minimum when tested as specified in 4.6.6 or 100 megohms minimum when tested in accordance with method 1340 of UL 1581.

3.9 Hot creep, (crosslink polyethylene only). When tested as specified in 4.6.11 the elongation and set shall not exceed the specified values in NEMA/ICEA S-66-524.

3.9 Cold bend. When the cable is tested as specified in 4.6.8, the insulation, jacket, and inked markings shall not crack.

3.10 Polyethylene shrink-back. When the cable is tested as specified in 4.6.9, it shall not shrink back a maximum 0.0625 inch and shall not split or crack.

3.11 Polyamide heat stability. When the cable is tested as specified in 4.6.10, there shall be no tears or cracks in the polyamide materials. Wrinkles or softening and flowing of the polyamide shall not be cause for rejection.

3.12 Marking. The cable jacket or marker tape shall be marked in accordance with MIL-STD-686. In addition, the manufacturer's name or trademark and the year of manufacture shall be included. The outer surface of the cables shall be smooth and free from raised markings. All letters and numbers in the marking shall be of the same height. There shall be no spacing between letters and numbers in the type designation, for example, CO-06HOF(6/18)0525.

3.12.1 Marking durability (polyethylene and polyamide insulation jackets only). When the cable is tested as specified in 4.6.8, there shall not be a continuous line evident through any letter or numeral of the ink marking nor through any striping applied to the outer surface of polyethylene or polyamide material when subjected to 250 cycles (500 strokes) of abrasive action.

3.13 Workmanship. Cables shall be constructed and finished in a thoroughly workmanlike manner in accordance with accepted high grade production techniques. The cables shall be a uniform and consistent product and shall be free from any defects which will adversely affect the serviceability of the product, such as lumps, kinks, splits, abrasions, scrapes, corroded surface, skin impurities, and faulty extruded surface.

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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 (examinations and date) 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 the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspection are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The insection 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspections shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

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

a. Materials inspection (see 4.3).

b. Quality conformance inspection (see 4.5).

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table X used in fabricating the cables, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

TABLE X. Material inspection.

Material	Requirement paragraph	Applicable specification
Copper	3.1.1.1	QQ-W-343
Insulating and jacketing compounds	3.1.2	MIL-I-3930, appendix herein, or ASTM-D-4066
Fillers and binders	3.1.4	MIL-STD-810
Polyester tape	3.1.5.1	MIL-I-631
Polypropylene tape	3.1.5.2	MIL-P-24216
Polyethylene	3.1.2.1	L-P-390
Crosslink polyethylene	3.8	ICEA S-66-524

4.3.1 Reinspection. If the cable is supplied on spools, reels, or coils or in precut lengths and is more than 12 months or 4 quarters of a year old from the date of last inspection to the date of shipment, the cable shall be reinspected to meet the applicable aging test of MIL-I-3930, the appendix or this specification, or ASTM-D-4066 for the insulation and jacket compounds used.

4.4 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of FED-STD-228.

4.5 Quality conformance inspection.

4.5.1 Inspection of the product for delivery. Inspection of the product for delivery shall consist of groups A, B, and C inspection.

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4.5.1.1 Inspection lot. An inspection lot shall consist of all cables of the same type designation (see 1.2.1) produced under essentially the same conditions, and offered for inspection at the same time.

4.5.1.2 Unit of product. The unit of product shall be taken as a continuous length of cable contained on a spool, reel, or coil. The unit of product shall not exceed 5,000 feet on each spool, reel, or coil.

4.5.1.3 Sample. The sample shall consist of that number of randomly selected units of product required by the applicable sampling plan for the presented lot.

4.5.1.4 Selection of sample units. Sample units for inspection shall be taken from each unit of product which forms a part of the sample. A sample unit is defined as a length of cable drawn from a unit of product, (see 4.6.1).

4.5.1.5 Test specimen. A test specimen may be the entire sample unit (length of finished cable) or any portion of the sample unit that is to be tested.

4.5.1.6 Group A inspection. Group A inspection shall consist of the inspections specified in table XII, in the order shown.

4.5.1.6.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table XII.

4.5.1.6.2 Major and minor defects. Major and minor defects shall be as defined in MIL-STD-105 as classified in table XI below. Any sample unit that has one or more major or minor defects shall be a defective.

TABLE XI. Major and minor defects.

Major defect	Minor defect
Shrink-back of polyethylene insulation	Missing strands in conductor
Wrong color code	Poor stranding tension
All electrical defects	Poor free stripping
Broken strands in conductor	Rough surface of insulation
Insulation thickness	Color range of insulation incorrect
Nicked or torn insulation	Wrong footage
Occlusions in insulation	Stripe width and lay incorrect
Jacket thickness not within requirements	
Outside diameter incorrect	
Poor conductor coating	
Incomplete coverage of separator	
Incorrect concentricity of insulation	
Fails stripping durability (polyamide and polyethylene only)	
Hot creep (crosslinked polyethylene only)	

4.5.1.6.3 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

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TABLE XII. Group A inspection.

Examination	Requirement paragraph	Test method paragraph	AQL (percent defective)	
			Major	Minor
Visual and dimensional				
Conductors	3.2.1	4.6.1	1.0	4.0
Uninsulated ground wires	3.2.2	"		
Insulated conductors	3.2.3	"		
Shielding	3.2.4	"		
Identification coding	3.2.5	"		
Grouping and cabling	3.2.6	"		
Jacket and jacket color	3.2.7 & 3.2.7.2	"		
Diameter tolerance	3.2.8	"		
Marking	3.12	"		
Workmanship	3.13	"		
Electrical (in the order shown)				
Spark test	3.3	4.6.2	100	
Voltage withstand	3.4	4.6.3	100	
Insulation resistance	3.5	4.6.4		
Direct current resistance	3.6	4.6.5	1.0	
Surface resistance	3.7	4.6.6		
Hot creep (crosslink polyethylene only)	3.8	4.6.7		

4.5.1.7 Group B inspection. Group B inspection shall consist of the inspections specified in table XIII and shall be made on sample units which have been subjected to and which have passed group A inspection.

TABLE XIII. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph
Cold bend	3.9	4.6.8
Marking durability (polyethylene and polyamide insulation jackets only)	3.12.1	4.6.11

4.5.1.7.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-2. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 6.5 percent defective.

4.5.1.7.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. The resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.7.3 Disposition of sample units. Sample units which have passed all the group B inspection shall not be delivered on the contract.

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4.5.2 Periodic inspection. Periodic inspection shall consist of group C. Where the results of this inspection show noncompliance with the applicable requirements, delivery of products which have passed groups A and B shall not be delayed pending the results of these periodic inspections

4.5.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in table XIV. Group C inspection shall be made on sample units selected from inspection lots which have passed groups A and B inspection.

TABLE XIV. Group C inspection.

Inspection	Requirement paragraph	Test method paragraph
Polyethylene shrink-back	3.10	4.6.9
Polyamide heat stability	3.11	4.6.10
Hot creep (crosslink polyethylene only)	3.8	4.6.7

4.5.2.1.1 Sampling plan. One sample shall be selected per each 5,000 feet of cable or fraction thereof, not to exceed the total of five samples per order. Samples shall be selected periodically through the life of the contract to assure representative results.

4.5.2.1.2 Failures. If any sample unit fails to pass group C inspection, the sample shall be considered to have failed.

4.5.2.1.3 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the procuring activity and the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same materials and processes, and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the procuring activity). Group A inspection shall be reinstated; however, final acceptance and shipment shall be withheld until the group C inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity.

4.5.3 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.

4.6 Methods of inspection.

4.6.1 Visual and mechanical inspection. Cable shall be inspected to verify that the design, construction of conductors, uninsulated ground drain wires, insulated conductors, shielding, identification coding, grouping and cabling, jacket, diameter tolerances, marking, and workmanship are in accordance with the applicable requirements (see 3.2.1 through 3.2.8, 3.12, and 3.13). The inspections shall be made on a specimen not less than 2 feet in length and cut no closer than 5 feet from the end of the sample.

4.6.2 Spark test (see 3.3). All insulated conductors shall be subjected to the spark test in accordance with method 6211 of FED-STD-228 or method 900 or UL 1581 with the following exceptions:

a. It shall be performed on all insulated conductors prior to cabling, or shielding.

b. For conductors larger than 6 AWG, an adaption of method 6211 satisfactory to the Government inspector shall be used.

c. Speed shall be adjusted to insure that contact is maintained for at least .25 seconds between the electrode and any point on the insulation or according to formula in method 900 or UL 1581.

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d. The frequency of the voltage shall be 60 or 400 Hz or as listed on table 900.2 of UL 1581.

e. Use of voltmeter-equipped spark testers is optional.

f. Spark test voltage shall be in accordance with table XV.

TABLE XV. Spark and dielectric withstanding test voltage.

All insulation materials			
Specified nominal thickness inclusive (inch/mm)	Spark test voltage (volts) (rms)	Specified nominal thickness inclusive (inch/mm)	Dielectric withstanding voltage (volts)
0 to 0.029 (0 to .736)	3,000	0 to 0.020 (0 to .508)	1,000
0.030 to 0.044 (.762 to 1.12)	6,000	0.021 to 0.031 (.533 to .787)	1,500
0.045 to 0.059 (1.14 to 1.50)	7,000	0.032 to 0.047 (.813 to 1.20)	3,000
0.060 and up (1.52 and up)	10,000	0.048 to 0.063 (1.22 to 1.60)	3,500
		0.064 to 0.077 (1.63 to 1.96)	4,000
		0.078 to 0.094 (1.98 to 2.39)	5,000

4.6.3 Voltage withstand (see 3.4). Cables shall be tested as specified in method 6111 of FED-STD-228. The following exceptions shall apply:

a. The test shall be performed on finished cables only.

b. The source of power shall not be less than 5 kilovolt-amperes.

c. The crest factor of the test voltage shall not differ by more than ±10 percent from that of a sinusoidal wave when the transformer is loaded with the test specimen.

d. The immersion period shall be at least 6 hours for unshielded cables. Cables with an overall shield shall not be immersed in water, and shall be tested dry.

e. For unshielded cables, an alternating potential, as specified in table XV, shall be applied between two terminals; one shall be each conductor in turn, and the other shall be all remaining conductors and the uninsulated ground wires, if present, the shield tied together in electrical contact with the water.

f. For shielded cables. an alternating potential, as specified in table XV, shall be applied between two terminals; one shall be each conductor in turn, and the other shall be all the remaining conductors, the uninsulated ground wires, if present, and the shield tied together. The test voltage shall be maintained for 60 seconds +5, - 0 from the time it is reached.

4.6.3.1 Alternate voltage withstand. The following alternations in procedure may be used when tested as specified in 4.6.4. Specimens are to be tested dry.

a. Arrange the conductors in a rectangle containing rows and columns; for example, a 20 conductor cable would have 5 columns of 4 rows; a 33 conductor cable would have 5 columns of seven rows, with two unused spaces.

b. Connect all the conductors in columns together. Do this for each column.

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c. Apply the specified test voltage, for the specified time, between each column of the rectangle in turn, and the remaining columns connected together.

d. Disconnect all the conductors in a column. Do this for each column.

e. Connect all conductors in a row together. Do this for each row.

f. Apply the specified test voltage for 60 seconds +5, - 0, between each row the rectangle in turn, and the remaining rows connected together.

g. Connect all the conductors together.

h. If shields are present, apply the specified voltage from table XV between all the conductors connected together and the shields connected together.

4.6.4 Insulation resistance (see 3.5). Insulation resistance of the cables shall be determines as specified in method 6031 of FED-STD-228 except that:

a. The test shall be performed on finished cables only.

b. The insulation resistance shall be measured immediately after the voltage withstand test, and optionally after cable has been immersed at least six hours. The cable may be tested dry.

c. The test voltage shall be not less than 200 volts nor more than 500 volts dc.

d. The polarity of the conductor shall be maintained negative with respect to the water.

e. For unshielded cables, the potential shall be applied between two terminals, one being each conductor in turn, and the other being all the remaining conductors and uninsulated ground drain wires, if present, tied together in electrical contact with the water.

f. For shielded cables, the potential shall be applied between two terminals, one being each conductor in turn, and the other being all the remaining conductors the uninsulated ground drain wires, if present, and the shields tied together, in electrical contact with the water. Cables with an overall shield shall not be immersed in water, and shall be tested dry.

g. If the measurement is made at a temperature other than 15.6°C, the manufacturer shall correct the measured value of insulation resistance to the resistance at 15.6°C. If the insulation resistance is equal to or greater than that required by 3.5, when the measurement is made at temperature greater than 15.6°C, no correction factor need be used. The manufacture shall demonstrate that the correction factor is accurate for his compound.

h. Insulation resistance may be determined in less than 1 minute, if the galvanometer has ceased fluctuating and the reading indicates that a steady insulation resistance value has been obtained.

4.6.5 Direct current resistance (see 3.6). The direct current resistance of each conductor and uninsulated ground drain wire, if present, shall be measured on the finished cables as specified in FED-STD-228, method 6021.

4.6.6 Surface resistance test (see 3.7). The uninsulated conductors and jacketed cables shall be tested in accordance with method 6041 of FED-STD 228 or method 1340 of UL 1581. All specimens, after having been provided with the required electrodes but prior to testing, shall be cleaned by the procedure described in the test method. In positioning the specimens in the test chamber, the specimens shall be placed so that their ends are a minimum of 1 inch from any wall of the chamber unless otherwise specified in the test procedure.

4.6.7 Hot creep (crosslink polyethylene, see 3.8). The crosslink polyethylene insulation shall be tested in accordance with NEMA WC 7.

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4.6.8 Cold bend (see 3.9).

4.6.8.1 Specimens. One length of cable from each sample unit shall be prepared for test. The length shall be divided into two parts. Provide one specimens for checking inked markings and jacketed cable as a whole, and duplicate specimens for checking insulated conductors apart from the finished cable. The set shall be tested aged. If failure occurs to any one specimen, two additional specimens shall be prepared from the same sample unit and tested. If either of the additional specimens fail, the sample unit represented thereby shall be considered defective.

4.6.8.2 Procedure. The jacketed cable specimens and the insulated conductor specimen shall be conditioned in an air oven for 48 +1/2 hours at 71°C ±2°C (160°F ±2°F), allowed to cool at room temperature. Aged specimens selected for checking inked markings and cables as a whole shall be attached to the proper size mandrel as determined in 4.6.8.2.1. The specimens selected for checking insulation apart from the cable shall have the jacket removed and one of each differently colored insulated conductor shall be attached to the proper size mandrel as determined in 4.6.8.2.1. The specimens shall be suspended vertically with lower ends weighted sufficiently to keep specimens taut and to permit bending them without handling. The mandrel and specimens shall be placed in the cold chamber at the lower temperature ±2°C specified in table IIa, 4 hours minimum. While at this temperature, the jacketed cable specimens shall be bent for six close turns, one turn for polyethylene insulation, around the mandrel at the rate of approximately 15 turns + 3 per minute; the insulated conductor specimens (shielding or non-adhering color coding removed) shall be bent at the rate of one turn per second. If six turns cannot be obtained from a specimen because its length is restricted by space limitations in the cold chamber, the amount of turns obtainable from a 5 foot specimen shall be permitted. After the test has been completed, the jacket on the specimens of cable shall be examined through a magnifying glass of at least 3 diameter magnification and then removed. The conductor insulation on all specimens shall be examined for cracks with the magnifying glass.

4.6.8.2.1 Mandrels. The mandrel shall be of a standard size in one of the diameters (in inches) specified in table XIV. The standard size selected shall be the largest size that does not exceed the value computed in accordance with table XVI, except the 0.062 inch mandrel shall be used when a smaller size is indicated by the computation.

TABLE XVI. Mandrel diameters.

Inches	Inches	Inches	Inches
0.062	0.500	1.90	5.56
0.094	0.680	2.38	6.63
0.125	0.840	2.88	8.63
0.188	1.050	3.50	10.75
0.250	1.310	4.00	
0.375	1.660	4.50	

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TABLE XVII. Computed mandrel size.

Nominal outside diameter of insulated conductor or cable, inclusive 1/	Mandrel size, maximum		
	Unshielded cable	Shielded cable	Individual insulated conductors
Inch	Inch	Inch	Inch
up to 0.150	1.0 x OD	3.0 x OD	1.0 X OD
0.151 to 0.250	1.0 x OD	3.0 x OD	1.5 X OD
0.251 to 0.300	1.0 x OD	3.0 x OD	2.0 X OD
0.301 to 0.350	2.0 x OD	3.0 x OD	2.0 X OD
0.351 to 0.450	2.5 x OD	3.0 x OD	2.5 X OD
0.451 to 0.550	3.0 x OD	3.0 x OD	3.0 X OD
0.551 to 0.750	4.0 x OD	4.0 x OD	
0.751 to 0.950	5.0 x OD	5.0 x OD	
0.951 to 1.500	6.0 x OD	6.0 x OD	
1.501 to 2.000	8.0 x OD	8.0 x OD	
2.001 and over	10.0 x OD	10.0 x OD	

1/ For the nominal outside diameter cable (see 1.2.1.7). The nominal outside diameter of the insulated conductor shall be determined from the nominal outside diameter of the conductor and the nominal insulation thickness (see table VI). For parallel cables, the nominal outside diameter shall be the major axis.

4.6.11 Marking Durability (see 3.12.1). A short specimen of finished wire or sheath shall be firmly clamped in a horizontal position with its upper longitudinal surface area freely exposed. A small steel mandrel (0.025 diameter ±0.001) shall be repeatedly rubbed over the insulation surface at the stripe so that the longitudinal axis of the mandrel and specimen will be at right angles to each other. A weight shall be affixed to the jig holding the rubbing mandrel so that the combined jig and weight exerts a 500-gram thrust normal to the insulation surface. A motor-driven reciprocating cam mechanism and counter shall be used to permit an accurately measured number of abrasion strokes. The length of stroke in one direction shall be 0.375 inch and the frequency of strokes shall be 120 strokes per minute (each stroke consisting of a 180° rotation of the eccentric drive mechanism). The direction of motion shall be along the axis of the wire or cable jacket and perpendicular to the axis of the mandrel. This procedure shall be repeated on one additional specimen selected from at least 50 feet apart.

4.6.9 Polyethylene shrink-back (see 3.10). A 7-inch long specimen shall be cut from the insulated conductor. Shield and color coding braid, tape, or jacket shall be removed. The specimen shall then be cut to 6 inches with conductor flush with the insulation. The specimen shall then be air oven aged at 85° ±1°C for 24 hours ±1/2 hour. Specimen shall then be removed and allowed to cool to room temperature. The amount the conductor extends beyond the insulation shall be measured at each end and the insulation shall be examined for splitting or cracking.

4.6.10 Polyamide heat stability (see 3.11).

4.6.10.1 Polyamide coating over the primary insulation. A 1-foot specimen shall be bent around a metal mandrel six times the outside diameter of the specimen for two turns and taped down on its ends. The specimen and the mandrel shall be placed in a gravity convection type oven at a temperature of 200°F ±5° for 24 hours. Remove specimen and mandrel from oven and cool in a silica gel desiccator or equal until it returns to room temperature (1 hour minimum). Remove from desiccator and straighten the specimen.

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4.6.10.2 Polyamide coating under or over component shield. A sufficient length of specimen shall be used to insure at least six close turns when bent on a metal mandrel, six times the outside diameter of the specimen. Each turn shall be in contact with the next. The ends of the specimen shall be taped together so that the turns are held in place on the mandrel. The mandrel and specimen shall be suspended in a gravity convection oven at the temperature of 300°F ±5° for 15 minutes. The specimen and mandrel shall be removed from the oven and cooled in a silica gel desiccator or equal until the specimen is at room temperature (1 hour minimum). Remove from the desiccator and unwrap the coils.

5. PACKAGING

5.1 Packaging requirements. Except as specified herein, the requirement for packaging shall be in accordance with MIL-C-12000. The type designation (see 2.1) shall be included in the identification marking of all interior and exterior containers.

6. NOTES

6.1 Intended use. The cables covered by this specification are intended for use by the Armed Services in extensive electrical and electronic application. The cables may be used to transmit power, synch pulses, data transmission voltages, broadband, audio, or control power. The shielded cables are suitable for radio-frequency use in limited applications. A tough and flexible jacket is essential because the cables will be subjected to extreme mechanical abuse and extreme humidity and temperature conditions. Cables designated for light, medium, and heavy-duty are for use as indicated in 6.1.1. through 6.1.3.

6.1.1 Light-duty (L) cables. Light-duty cables are intended for use in test equipment in short lengths, or for interconnection of major components. They are intended to withstand severe flexing and frequent manipulation. Light-duty cables should not be used where they will be stepped on, run over by vehicles, beaten, or subjected to severe impacts. Light-duty cables are suitable for lightweight portable tools or small motor and generator leads where flexibility rather than long life is essential.

6.1.2 Medium-duty (M) cables. Medium-duty cables are intended to withstand the same usage as heavy duty cables except they should not be used where they will be run over by vehicles or subjected to severe impacts. They are intended to be a substitute for all uses of heavy-duty cables when the reduction in weight would be advantageous to the equipment they are used in. Medium-duty cables are suitable for small portable tools, sound equipment, radio receivers, and motor leads which do not require the heavier, sturdier, heavy-duty cables.

6.1.3 Heavy-duty (H) cables. Heavy-duty cables are intended for use where they will be subjected to extreme service impacts or will be run over buy heavy vehicles, such as trucks, tanks, or the like. They are designed to withstand severe flexing and mechanical abuse over long periods of time without deterioration. Heavy-duty cables are suitable for portable tools, extension lamps, charging cables, and control cables.

6.1.4 Reinforcement. Nylon yarn, 840/1 denier, suitably treated (phenol-latex coated) for bonding to rubber during cure is recommended (see 3.2.7).

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of the specification.

b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).

c. Complete type designation (see 1.2.1).

d. Lengths required.

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6.3 Definitions.

6.3.1 Insulated conductor. A conductor consists of a stranded wire, with insulating covering, suitable for carrying an electric current.

6.3.2 Equipment ground wire. An insulated conductor (green) intended for grounding non-current carrying metal parts of equipment.

6.3.3 Wire. A single metallic conductor of stranded construction designed to carry current in an electrical circuit.

6.3.4 Uninsulated ground drain wires. Uninsulated ground drain wires are wires bare or covered with green covering to identify them as ground wires and should not be confused with the insulated green conductor used in portable power cable which is used as the equipment ground conductor (see 6.3.2). These uninsulated ground drain wires are used in heavy duty outdoor and mine cables.

6.4 Disposal. Caution should be taken during handling and disposal of all insulating and jacketing materials in accordance with ASTM C930 and FED-STD-313.

6.5 Subject term (key word) listing.

Extra flexible
Fillers and binders
Ground drain wires
Heavy duty
Hot creep
Light duty
Medium duty
Semiflexible
Separators

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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APPENDIX

PROCEDURE FOR TESTING INSULATING AND JACKETING COMPOUNDS
TYPE TPE-O AND TPE-S (LOW TEMPERATURE)

10. SCOPE

10.1 Scope. This appendix details the procedure for testing of samples of insulating and jacketing compounds for both low temperature, heat and ozone resistant, olefinic thermoplastic elastomer (TPE-O) and low temperature, heat and ozone resistant, styrenic thermoplastic elastomer (TPE-S). This appendix is a mandatory part of the specification. The information contained herein is intended for compliance to the latest issue of MIL-I-3930.

20. APPLICABLE DOCUMENTS

20.1 Non-Government publications. The following document (s) form a part of this document to the extent specified herein. Unless Otherwise indicated, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

UNDERWRITERS LABORATORIES INCORPORATED

UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords.

(Copies of the UL publication may be obtained from the Underwriters Laboratories, Inc., Publication Stock, 333 Pfingsten Road, Northbrook, Illinois 60062.)

30. PHYSICAL PROPERTY REQUIREMENTS

	TPE-O	TPE-S
Unaged:		
Tensile strength, minimum psi	1000	1000
Elongation, minimum percent	250	250
Tear strength, minimum lb/in	150	150
Tensile strength at 100 percent modulus, minimum psi	200	200
* Air oven aging, 168 hours ± 1 hour at 136°C ± 1°C:		
Tensile strength retention, minimum percent	80	80
Elongation, minimum percent of original	65	65
* Oil immersion (ASTM # 2 oil), 18 hours ± one-half hour at 121°C ± 1°C (jacket only):		
Tensile strength retention, minimum percent	75	75
Elongation, minimum percent of original	75	75
Ozone resistance (after air-oven conditioning) and 168 hours ± 1 hour in ozone (jacket only):		
At 50°C (120°F)	No cracking	No cracking
Brittleness temperature:		
Unaged, maximum °C	-55	-55
Aged, maximum °C	-55	-55
Maximum torsional stiffness ratio:	10	10
Cold tension recovery (minimum percent at -55°C):	TBD	TBD

* In lieu of doing performance tests, supplier may also provide certificate of compliance in accordance with UL-1581 may be provided if it conforms to the values specified in this appendix.

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CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - YD
Air Force - 85

Review activities:
Army - AR, MI
Navy - AS, SH
Air Force - 17, 99
NSA
DLA - IS

User Activities:
Navy - MC
Air Force - 11, 15

Preparing activity:
Army - CR

Agent:
DLA - FS

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-3432F	2. DOCUMENT DATE (YYMMDD) 2 November 1992

3. DOCUMENT TITLE: CABLES, (POWER AND SPECIAL PURPOSE) AND WIRE, ELECTRICAL (300 AND ç)) VOLTS)

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME U.S. ARMY COMMUNICATIONS-ELECTRONICS COMMAND	b. TELEPHONE *(Include Area Code)* (1) Commercial 908-532-5851	(2) AUTOVON 992-5851
c. ADDRESS *(Include Zip Code)* ATTN: AMSEL-ED-TM FORT MONMOUTH, NJ 07703-5023	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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d. The frequency of the voltage shall be 60 or 400 Hz or as listed on table 900.2 of UL 1581.

e. Use of voltmeter-equipped spark testers is optional.

f. Spark test voltage shall be in accordance with table XV.

TABLE XV. Spark and dielectric withstanding test voltage.

All insulation materials			
Specified nominal thickness inclusive (inch/mm)	Spark test voltage (volts) (rms)	Specified nominal thickness inclusive (inch/mm)	Dielectric withstanding voltage (volts)
0 to 0.029 (0 to .736)	3,000	0 to 0.020 (0 to .508)	1,000
0.030 to 0.044 (.762 to 1.12)	6,000	0.021 to 0.031 (.533 to .787)	1,500
0.045 to 0.059 (1.14 to 1.50)	7,000	0.032 to 0.047 (.813 to 1.20)	3,000
0.060 and up (1.52 and up)	10,000	0.048 to 0.063 (1.22 to 1.60)	3,500
		0.064 to 0.077 (1.63 to 1.96)	4,000
		0.078 to 0.094 (1.98 to 2.39)	5,000

4.6.3 Voltage withstand (see 3.4). Cables shall be tested as specified in method 6111 of FED-STD-228. The following exceptions shall apply:

a. The test shall be performed on finished cables only.

b. The source of power shall not be less than 5 kilovolt-amperes.

c. The crest factor of the test voltage shall not differ by more than ±10 percent from that of a sinusoidal wave when the transformer is loaded with the test specimen.

d. The immersion period shall be at least 6 hours for unshielded cables. Cables with an overall shield shall not be immersed in water, and shall be tested dry.

e. For unshielded cables, an alternating potential, as specified in table XV, shall be applied between two terminals; one shall be each conductor in turn, and the other shall be all remaining conductors and the uninsulated ground wires, if present, the shield tied together in electrical contact with the water.

f. For shielded cables. an alternating potential, as specified in table XV, shall be applied between two terminals; one shall be each conductor in turn, and the other shall be all the remaining conductors, the uninsulated ground wires, if present, and the shield tied together. The test voltage shall be maintained for 60 seconds +5, - 0 from the time it is reached.

4.6.3.1 Alternate voltage withstand. The following alternations in procedure may be used when tested as specified in 4.6.4. Specimens are to be tested dry.

a. Arrange the conductors in a rectangle containing rows and columns; for example, a 20 conductor cable would have 5 columns of 4 rows; a 33 conductor cable would have 5 columns of seven rows, with two unused spaces.

b. Connect all the conductors in columns together. Do this for each column.

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c. Apply the specified test voltage, for the specified time, between each column of the rectangle in turn, and the remaining columns connected together.

d. Disconnect all the conductors in a column. Do this for each column.

e. Connect all conductors in a row together. Do this for each row.

f. Apply the specified test voltage for 60 seconds +5, - 0, between each row the rectangle in turn, and the remaining rows connected together.

g. Connect all the conductors together.

h. If shields are present, apply the specified voltage from table XV between all the conductors connected together and the shields connected together.

4.6.4 Insulation resistance (see 3.5). Insulation resistance of the cables shall be determines as specified in method 6031 of FED-STD-228 except that:

a. The test shall be performed on finished cables only.

b. The insulation resistance shall be measured immediately after the voltage withstand test, and optionally after cable has been immersed at least six hours. The cable may be tested dry.

c. The test voltage shall be not less than 200 volts nor more than 500 volts dc.

d. The polarity of the conductor shall be maintained negative with respect to the water.

e. For unshielded cables, the potential shall be applied between two terminals, one being each conductor in turn, and the other being all the remaining conductors and uninsulated ground drain wires, if present, tied together in electrical contact with the water.

f. For shielded cables, the potential shall be applied between two terminals, one being each conductor in turn, and the other being all the remaining conductors the uninsulated ground drain wires, if present, and the shields tied together, in electrical contact with the water. Cables with an overall shield shall not be immersed in water, and shall be tested dry.

g. If the measurement is made at a temperature other than 15.6°C, the manufacturer shall correct the measured value of insulation resistance to the resistance at 15.6°C. If the insulation resistance is equal to or greater than that required by 3.5, when the measurement is made at temperature greater than 15.6°C, no correction factor need be used. The manufacture shall demonstrate that the correction factor is accurate for his compound.

h. Insulation resistance may be determined in less than 1 minute, if the galvanometer has ceased fluctuating and the reading indicates that a steady insulation resistance value has been obtained.

4.6.5 Direct current resistance (see 3.6). The direct current resistance of each conductor and uninsulated ground drain wire, if present, shall be measured on the finished cables as specified in FED-STD-228, method 6021.

4.6.6 Surface resistance test (see 3.7). The uninsulated conductors and jacketed cables shall be tested in accordance with method 6041 of FED-STD 228 or method 1340 of UL 1581. All specimens, after having been provided with the required electrodes but prior to testing, shall be cleaned by the procedure described in the test method. In positioning the specimens in the test chamber, the specimens shall be placed so that their ends are a minimum of 1 inch from any wall of the chamber unless otherwise specified in the test procedure.

4.6.7 Hot creep (crosslink polyethylene, see 3.8). The crosslink polyethylene insulation shall be tested in accordance with NEMA WC 7.

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4.6.8 Cold bend (see 3.9).

4.6.8.1 Specimens. One length of cable from each sample unit shall be prepared for test. The length shall be divided into two parts. Provide one specimens for checking inked markings and jacketed cable as a whole, and duplicate specimens for checking insulated conductors apart from the finished cable. The set shall be tested aged. If failure occurs to any one specimen, two additional specimens shall be prepared from the same sample unit and tested. If either of the additional specimens fail, the sample unit represented thereby shall be considered defective.

4.6.8.2 Procedure. The jacketed cable specimens and the insulated conductor specimen shall be conditioned in an air oven for 48 +1/2 hours at 71°C ±2°C (160°F ±2°F), allowed to cool at room temperature. Aged specimens selected for checking inked markings and cables as a whole shall be attached to the proper size mandrel as determined in 4.6.8.2.1. The specimens selected for checking insulation apart from the cable shall have the jacket removed and one of each differently colored insulated conductor shall be attached to the proper size mandrel as determined in 4.6.8.2.1. The specimens shall be suspended vertically with lower ends weighted sufficiently to keep specimens taut and to permit bending them without handling. The mandrel and specimens shall be placed in the cold chamber at the lower temperature ±2°C specified in table IIa, 4 hours minimum. While at this temperature, the jacketed cable specimens shall be bent for six close turns, one turn for polyethylene insulation, around the mandrel at the rate of approximately 15 turns + 3 per minute; the insulated conductor specimens (shielding or non-adhering color coding removed) shall be bent at the rate of one turn per second. If six turns cannot be obtained from a specimen because its length is restricted by space limitations in the cold chamber, the amount of turns obtainable from a 5 foot specimen shall be permitted. After the test has been completed, the jacket on the specimens of cable shall be examined through a magnifying glass of at least 3 diameter magnification and then removed. The conductor insulation on all specimens shall be examined for cracks with the magnifying glass.

4.6.8.2.1 Mandrels. The mandrel shall be of a standard size in one of the diameters (in inches) specified in table XIV. The standard size selected shall be the largest size that does not exceed the value computed in accordance with table XVI, except the 0.062 inch mandrel shall be used when a smaller size is indicated by the computation.

TABLE XVI. Mandrel diameters.

Inches	Inches	Inches	Inches
0.062	0.500	1.90	5.56
0.094	0.680	2.38	6.63
0.125	0.840	2.88	8.63
0.188	1.050	3.50	10.75
0.250	1.310	4.00	
0.375	1.660	4.50	

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TABLE XVII. Computed mandrel size.

Nominal outside diameter of insulated conductor or cable, inclusive 1/	Mandrel size, maximum		
	Unshielded cable	Shielded cable	Individual insulated conductors
Inch	Inch	Inch	Inch
up to 0.150	1.0 x OD	3.0 x OD	1.0 X OD
0.151 to 0.250	1.0 x OD	3.0 x OD	1.5 X OD
0.251 to 0.300	1.0 x OD	3.0 x OD	2.0 X OD
0.301 to 0.350	2.0 x OD	3.0 x OD	2.0 X OD
0.351 to 0.450	2.5 x OD	3.0 x OD	2.5 X OD
0.451 to 0.550	3.0 x OD	3.0 x OD	3.0 X OD
0.551 to 0.750	4.0 x OD	4.0 x OD	
0.751 to 0.950	5.0 x OD	5.0 x OD	
0.951 to 1.500	6.0 x OD	6.0 x OD	
1.501 to 2.000	8.0 x OD	8.0 x OD	
2.001 and over	10.0 x OD	10.0 x OD	

1/ For the nominal outside diameter cable (see 1.2.1.7). The nominal outside diameter of the insulated conductor shall be determined from the nominal outside diameter of the conductor and the nominal insulation thickness (see table VI). For parallel cables, the nominal outside diameter shall be the major axis.

4.6.11 Marking Durability (see 3.12.1). A short specimen of finished wire or sheath shall be firmly clamped in a horizontal position with its upper longitudinal surface area freely exposed. A small steel mandrel (0.025 diameter ±0.001) shall be repeatedly rubbed over the insulation surface at the stripe so that the longitudinal axis of the mandrel and specimen will be at right angles to each other. A weight shall be affixed to the jig holding the rubbing mandrel so that the combined jig and weight exerts a 500-gram thrust normal to the insulation surface. A motor-driven reciprocating cam mechanism and counter shall be used to permit an accurately measured number of abrasion strokes. The length of stroke in one direction shall be 0.375 inch and the frequency of strokes shall be 120 strokes per minute (each stroke consisting of a 180° rotation of the eccentric drive mechanism). The direction of motion shall be along the axis of the wire or cable jacket and perpendicular to the axis of the mandrel. This procedure shall be repeated on one additional specimen selected from at least 50 feet apart.

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4.6.10.2 Polyamide coating under or over component shield. A sufficient length of specimen shall be used to insure at least six close turns when bent on a metal mandrel, six times the outside diameter of the specimen. Each turn shall be in contact with the next. The ends of the specimen shall be taped together so that the turns are held in place on the mandrel. The mandrel and specimen shall be suspended in a gravity convection oven at the temperature of 300°F ±5° for 15 minutes. The specimen and mandrel shall be removed from the oven and cooled in a silica gel desiccator or equal until the specimen is at room temperature (1 hour minimum). Remove from the desiccator and unwrap the coils.

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b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).

c. Complete type designation (see 1.2.1).

d. Lengths required.

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6.3.3 Wire. A single metallic conductor of stranded construction designed to carry current in an electrical circuit.

6.3.4 Uninsulated ground drain wires. Uninsulated ground drain wires are wires bare or covered with green covering to identify them as ground wires and should not be confused with the insulated green conductor used in portable power cable which is used as the equipment ground conductor (see 6.3.2). These uninsulated ground drain wires are used in heavy duty outdoor and mine cables.

6.4 Disposal. Caution should be taken during handling and disposal of all insulating and jacketing materials in accordance with ASTM C930 and FED-STD-313.

6.5 Subject term (key word) listing.

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Hot creep
Light duty
Medium duty
Semiflexible
Separators

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

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APPENDIX

PROCEDURE FOR TESTING INSULATING AND JACKETING COMPOUNDS
TYPE TPE-O AND TPE-S (LOW TEMPERATURE)

10. SCOPE

10.1 Scope. This appendix details the procedure for testing of samples of insulating and jacketing compounds for both low temperature, heat and ozone resistant, olefinic thermoplastic elastomer (TPE-O) and low temperature, heat and ozone resistant, styrenic thermoplastic elastomer (TPE-S). This appendix is a mandatory part of the specification. The information contained herein is intended for compliance to the latest issue of MIL-I-3930.

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UNDERWRITERS LABORATORIES INCORPORATED

UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords.

(Copies of the UL publication may be obtained from the Underwriters Laboratories, Inc., Publication Stock, 333 Pfingsten Road, Northbrook, Illinois 60062.)

30. PHYSICAL PROPERTY REQUIREMENTS

	TPE-O	TPE-S
Unaged:		
Tensile strength, minimum psi	1000	1000
Elongation, minimum percent	250	250
Tear strength, minimum lb/in	150	150
Tensile strength at 100 percent modulus, minimum psi	200	200
* Air oven aging, 168 hours ± 1 hour at 136°C ± 1°C:		
Tensile strength retention, minimum percent	80	80
Elongation, minimum percent of original	65	65
* Oil immersion (ASTM # 2 oil), 18 hours ± one-half hour at 121°C ± 1°C (jacket only):		
Tensile strength retention, minimum percent	75	75
Elongation, minimum percent of original	75	75
Ozone resistance (after air-oven conditioning) and 168 hours ± 1 hour in ozone (jacket only):		
At 50°C (120°F)	No cracking	No cracking
Brittleness temperature:		
Unaged, maximum °C	-55	-55
Aged, maximum °C	-55	-55
Maximum torsional stiffness ratio:	10	10
Cold tension recovery (minimum percent at -55°C):	TBD	TBD

* In lieu of doing performance tests, supplier may also provide certificate of compliance in accordance with UL-1581 may be provided if it conforms to the values specified in this appendix.

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CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - YD
Air Force - 85

Review activities:
Army - AR, MI
Navy - AS, SH
Air Force - 17, 99
NSA
DLA - IS

User Activities:
Navy - MC
Air Force - 11, 15

Preparing activity:
Army - CR

Agent:
DLA - FS

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-3432F	2. DOCUMENT DATE (YYMMDD) 2 November 1992

3. DOCUMENT TITLE CABLES, (POWER AND SPECIAL PURPOSE) AND WIRE, ELECTRICAL (300 AND ç)) VOLTS)

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*	b. ORGANIZATION	
c. ADDRESS *(Include Zip Code)*	d. TELEPHONE *(Include Area Code)* (1) Commercial (2) AUTOVON *(If applicable)*	7. DATE SUBMITTED *(YYMMDD)*

8. PREPARING ACTIVITY

a. NAME U.S. ARMY COMMUNICATIONS-ELECTRONICS COMMAND	b. TELEPHONE *(Include Area Code)* (1) Commercial 908-532-5851 (2) AUTOVON 992-5851
c. ADDRESS *(Include Zip Code)* ATTN: AMSEL-ED-TM FORT MONMOUTH, NJ 07703-5023	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340