INCH-POUND

MIL-DTL-27072C
8 December 2000
SUPERSEDING
MIL-C-27072B
24 September 1987

DETAIL SPECIFICATION

CABLE, POWER, ELECTRICAL AND CABLE, SPECIAL PURPOSE,
ELECTRICAL, MULTICONDUCTOR AND SINGLE SHIELDED,
GENERAL SPECIFICATION FOR

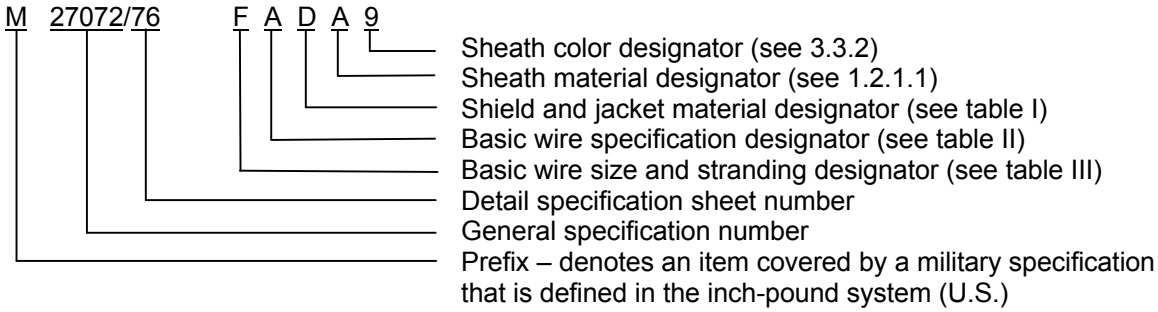
This specification is approved for use by all Departments
and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers special purpose electrical multi-conductor and single shielded cable for electronic circuits where the cable will be protected in racks, tunnels, or within buildings, trailers, or equipment. Cables constructed using polyvinyl chloride (PVC) on insulated wires or for fillers, tapes, or jackets are not to be used for aerospace applications.

1.2 Classification.

1.2.1 Part or identifying number. The PIN consists of the following form:



1.2.1.1 Cable sheath material designator. Cable sheath material designator using a single letter is as follows:

A	Polyvinyl chloride (PVC) 1/
B	Polyethylene (PE)
D	Fluorinated ethylene propylene (FEP)
E	Polytetrafluoroethylene (PTFE)

Notes: 1/ PVC is not to be used in aerospace applications.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Defense Logistics Agency, Defense Supply Center, Columbus (DSCC-VAI), P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6145

1.2.1.2 Shield and jacket undershield material designator. Cable shield and jacket undershield material designator using a single letter is in accordance with table I.

Table I. Shield and jacket undershield material designator.

Shield Material	Jacket undershield material		
	Unjacketed	Polyamide	PVC 1/
No shield	A	E	Z
Tinned copper round	C	G	K
Silver-coated copper round	D	H	L

Notes: 1/ PVC is not to be used in aerospace applications.

2. APPLICABLE DOCUMENTS

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

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document 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 and Copolymers (Low, Medium, and High Density)

DEPARTMENT OF DEFENSE

MIL-I-631 - Insulation, Electrical, Synthetic-Resin Composition, Non-rigid
MIL-DTL-16878/1 - Wire, Electrical, Type B, 105 ºC, 600 Volts (Insulated, High Temperature)
MIL-DTL-16878/17 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated, 105 ºC, 600 Volts, Polyamide Jacket
MIL-DTL-16878/18 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated, 105 ºC, 1000 Volts, Polyamide Jacket
MIL-W-22759/9 - Wire, Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 1000-Volt
MIL-W-22759/11 - Wire, Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 600-Volt

(See Supplement 1 for list of associated specification sheets.)

STANDARDS

FEDERAL

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

DEPARTMENT OF DEFENSE

MIL-STD-686 - Cable and Cord, Electrical, Identification Marking and Color Coding of

(Unless otherwise indicated, copies of the above specifications and standards are available from the Document Automation and Production Service, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents that 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).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B33 - Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes (DoD adopted)
ASTM B298 - Standard Specification for Silver-Coated Soft or Annealed Copper Wire (DoD adopted)
ASTM D2116 - Standard Specification for FEP-Fluorocarbon Molding and Extrusion Materials (DoD adopted)
ASTM D3369 - Standard Specification for Polytetrafluoroethylene (PTFE) Resin Cast Film (DoD adopted)
ASTM D4066 - Standard Classification System for Nylon Injection and Extrusion Materials (PA) (DoD adopted)
ASTM D4894 - Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

ANSI/NCSL Z540-1 - Calibration Laboratories and Measuring and Test Equipment, General Requirements (DoD adopted)

(Application for copies should be addressed to the National Conference of Standards Laboratories, 1800 - 30th Street, Suite 305B, Boulder, CO 80301-1032.)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA HP 3 - Electrical and Electronic PTFE (Polytetrafluoroethylene) Insulated High Temperature Hook-up Wire; Types ET (250 Volts), E (600 Volts), and EE (1000 Volts) (DoD adopted)

(Application for copies should be addressed to the National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1. Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet (see 6.2.1). In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern. For cables without specification sheets, see 6.2.2.

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

3.3 Materials.

3.3.1 Basic wire. The basic wires shall conform to the requirements of the specifications listed in table II. See table A-1 for a cross-reference of current basic wire designator to former basic wire designator.

TABLE II. Basic wire specification designator.

Basic wire specification designator	Basic wire specification
A 1/	MIL-DTL-16878/17
B 1/	MIL-DTL-16878/18
D 2/	MIL-W-22759/11, MIL-W-22759/9, or NEMA HP 3
E 2/	MIL-W-22759/9 or NEMA HP 3
P 1/	MIL-DTL-16878/1

Notes: 1/ PVC shall not be used in aerospace applications.
2/ See specification sheet for basic wire.

3.3.1.1 Basic wire gauge and stranding. The basic wires shall conform to the size and stranding specified in table III.

TABLE III. Basic wire size and stranding designator.

Size and stranding designator	Conductor Size AWG	Number of strands	Strand size AWG	Size and stranding designator	Conductor size AWG	Number of strands	Strand size AWG
D	12	19	25	K	20	7	28
F	16	19	29	L	22	19	34
G	18	19	30	M 1/	22	7	30
H 1/	18	7	26	S 1/, 2/	26	7	34
J	20	19	32	-	-	-	-

Notes: 1/ Inactive for new design – stranding.
2/ Inactive for new design – wire size.

3.3.1.2 Basic wire identification coding. Unless otherwise specified in individual specification sheets, the individual wires shall be coded for their entire length in accordance with MIL-STD-686, table II (a). The standard means of coding shall be solid-colored insulation (see 3.3.1.3), with colored stripe tracer (see 3.3.1.4).

3.3.1.3 Solid-colored insulation. Cables having six wires or less shall employ solid coloring and each wire shall be clearly distinguishable. The entire thickness of the insulation shall be solid-colored.

3.3.1.4 Helical stripe tracer. Cables having more than six wires shall employ solid coloring in the first six wires and shall utilize a colored helical stripe tracer on the seventh wire and above. Where extruded polyamide jackets are used over the primary insulation, the helical stripe tracer may be applied to the underlying insulation or to the surface of the polyamide jacket.

3.3.1.4.1 Ink. The colored helical stripe shall be obtained by using nonconductive, permanent inks having pigments or dyes that are least affected by light, by plasticizers incorporated in the insulation, and by the temperature allowed by the basic wire. The medium used shall provide good anchorage to the insulation.

3.3.1.4.2 Width and length of lay. The stripe width and length of lay shall be as specified in MIL-STD-686.

3.3.2 Sheath color and stripe or band. Unless otherwise specified in the solicitation or order (see 6.2), cable sheath and stripe or band color shall be in accordance with MIL-STD-686. The sheath stripe or band color designation shall be in accordance with table IV. Cable sheath material shall be of a contrasting color to the stripe or band.

3.3.3 Fillers. Where fillers are used, the fillers shall be either:

a. Foamed or solid polyethylene in accordance with L-P-390, type II, grade 4.

b. PVC in accordance with MIL-I-631, type F, grade C.

c. PTFE in accordance with ASTM D4894.

3.3.3.1 Fibrous fillers. Fibrous fillers shall not be used.

TABLE IV. Sheath color and stripe or band color designator.

Color designator	Sheath color	First stripe or band	Color Designator	Sheath color	First stripe or band
0	Black		G	Black	Violet
1	Brown		H	Black	Gray
2	Red		J	Brown	Red
3	Orange		K	Brown	Orange
4	Yellow		L	Brown	Yellow
5	Green		M	Brown	Green
6	Blue		N	Brown	Blue
7	Violet		P	Brown	Violet
8	Gray		R	Brown	Gray
9	White		S	Red	Orange
A	Black	Brown	T	Red	Yellow
B	Black	Red	U	Red	Green
C	Black	Orange	W	Red	Blue
D	Black	Yellow	Y	Red	Violet
E	Black	Green	X	Unstriped 1/	
F	Black	Blue	Z	Clear 2/	

Notes: 1/ Inactive for new design. For new design, use color designator 0 through 9 for unstriped solid color sheath.
2/ Applicable only to cable sheaths made of FEP.

3.3.4 Binder tape. Where binder tape is specified in the applicable specification sheet, the tape shall be one of the following materials:

a. Polyethylene terephthalate film conforming to MIL-I-631, type G, in thickness of .001 inch (minimum).

b. PVC film conforming to MIL-I-631, type F, grade A, in thickness of .005 to .010 inch.

c. PE film conforming to L-P-390, type II, grade 4, in thickness of .005 to .010 inch.

d. PTFE film conforming to ASTM D3369 in thickness of .001 inch (minimum).

e. Polyester

3.3.4.1 Optional use of binder tape. When binder tape is not specified on a specification sheet, binder tape may be applied at the manufacturer's option. If used, the binder tape shall be one of the materials specified in 3.3.4.

3.3.5 Overall shielding. Where tinned copper strands are specified (see table I), the strands shall conform to ASTM B33 before shielding. Where silver-coated copper strands are specified (see table I), the strands shall conform to ASTM B298 before shielding.

3.3.6 Component jackets. When construction includes jacketed components (see 3.5.3), the jackets shall be one of the following materials:

a. Polyamide in accordance with ASTM D4066, type PA622, grade E22.

b. PVC in accordance with sheath PVC requirements of 3.3.7.a.

3.3.7 Cable sheaths. Cable sheaths shall be one of the following materials:

a. PVC in accordance with table V and the cold bend requirements of 3.7.3.

b. PE in accordance with L-P-390, type III, grade 8.

c. FEP in accordance with ASTM D2116.

d. PTFE in accordance with ASTM D4894.

3.3.7.1 Physical properties. Physical properties of the sheath shall be in accordance with table V.

TABLE V. Sheath physical properties.

Inspection	Sheath material designator (see 1.2.1.1)			
	A	B	D	E
Original tensile strength (PSI) (min)	2100-2700	1800	2200	3000
Original ultimate elongation percent (min)	250-350	250	200	150
Tensile strength after aging 1/	75% of original	-	-	-
Ultimate elongation after aging 1/	75% of original	-	-	-

Notes: 1/ After accelerated aging (see 4.3.2.3).

3.3.8 Insulation. Insulation, if required, shall be as specified on the applicable specification sheet.

3.4 Components. The cable may include components such as:

a. Shielded single conductors, shielded twisted pairs, shielded twisted triplets, etc. Unless otherwise specified in the applicable specification sheet, all shielded components shall be insulated by a component jacket, applied over the shield, to prevent electrical noise and stray ground currents.

b. Nonshielded twisted pairs, twisted triplets, etc. When specified in the applicable specification sheet, a component jacket shall be applied over the twisted assembly.

3.5 Design and construction.

3.5.1 Component twisting (cable lay). Twisted components of the finished cable after being laid up shall have no residual twist on the individual wires. The length of lay shall be between 8 and 16 times the pitch diameter of the layer in the component. Fillers may be used, as needed, to permit compliance with the roundness requirements specified herein and to modify diameters to fit components to the finished cable. At the option of the manufacturer, binder tapes (see 3.3.4) may be applied over the components to assist in further cabling operations.

3.5.2 Component shielding (braid coverage). For the shielded components specified in 3.4.a, the shield shall consist of a woven braid using strand material specified in 3.3.5. The metallic coating on the copper strands of the shield shall be similar to the metallic coating of the conductor to which the shield is applied. Unless otherwise specified (see 6.2.1), metallic shielding shall provide coverage of not less than

90 percent. The angle of the braid with the axis of the cable shall lie between 20 degrees and 40 degrees for diameters up to .600 inch. For diameters larger than .600 inch, the braid angle may be greater than 40 degrees. Percent coverage, K, and angle of braid, a, shall be calculated as follows:

$$K = (2F - F^2) \times 100$$
$$F = NPd/\text{Sin } a$$
$$a = \text{Tan}^{-1} (2\pi(D + 2d) P/C)$$

Where:

F = Fill or space factor
K = Percent coverage
N = Number of wires per carrier
P = Picks per inch of cable length
d = Diameter of individual braid wire in inches
a = Angle of braid with axis of cable
D = Diameter of cable under the shield in inches
C = Number of carriers

3.5.2.1 Strand size. Braided shields using round copper and copper alloy wires shall be as specified in table VI.

TABLE VI. Braided shield strand size to covered diameter.

Strand size AWG	Diameter covered (inches)
38	to .060
36	.061 to .310
34	.311 to .750
32	.751 and larger

3.5.3 Component jacketing. The jacket shall be extruded directly over the shield or binder tape if present. The insulated wire may also include a jacket.

3.5.3.1 Jacket material applications for basic wires designated P or B . Jacket material used for a specific basic wire designated P or B (see table II) shall be as specified in table VII.

TABLE VII. Jacket material applications.

Basic wire designator	Jacket material	
	Shielded components (multi-conductor cable)	Unshielded components
P	Polyamide 1/, or PVC	-
B	-	PVC

Notes: 1/ Shall not be used if the diameter of the component exceeds .250 inch.

3.5.3.2 Other wire types. For components having basic wire designators not listed in table VII, the jacket material shall be limited to materials listed in 3.3.6.

3.5.3.3 Dimensions. Dimensions of component jackets shall be in accordance with table VIII. The average jacket thickness shall be not less than that shown in table VIII. The minimum wall thickness at any cross section shall be not less than 70 percent of the average wall thickness at that cross section.

TABLE VIII. Minimum average jacket wall thickness (inches).

Diameter of component under jacket (inches)	Jacket material	
	Polyamide	PVC
.000 through .100	.005	.012
.101 through .125	.007	.015
.126 through .200	.007	.015
.201 through .250	.008	.015
.251 through .500	-	.020
.501 through .750	-	.030
.751 through 1.000	-	.040

3.5.4 Final cabling. The cabling of wires, components, or combinations thereof, and fillers, if applicable, shall be accomplished such that there is no residual twist left in the individual wires or components. The length of lay shall be between 8 and 16 times the pitch diameter of the particular layer.

3.5.4.1 Binder tapes. Binder tapes may be used in the final cabling process. When binder tapes are used, the tapes shall be in accordance with 3.3.4 and shall be applied with a minimum overlap of 25 percent.

3.5.4.2 Temperature equivalent. When an FEP sheath (see 1.2.1.1 and table V) is specified for use with basic wire designated D or E (see table II), the binder tape and filler material, if used in the construction, shall have a temperature rating equivalent to that of the basic wire.

3.5.4.3 Overall shielding. When specified (see applicable specification sheet), an overall shield shall be applied over the complete cable core prior to application of the cable sheath. Shielding construction shall be in accordance with 3.5.2 and 3.5.2.1.

3.5.5 Sheaths. Sheaths shall be centered over the cable core. Sheaths of materials designated A, B, and D (see table V) shall be extruded directly over the cabled components or overall shield or binder tape, if present. Sheath materials designated E (see table V) shall be either extruded or tape wrapped directly over the cable components or overall shield or binder tape, if present.

3.5.5.1 Sheath wall thickness. The average sheath wall thickness shall be not less than the values shown in table IX. The minimum wall thickness at any cross section shall be not less than 70 percent of the average wall thickness at that cross section.

TABLE IX. Minimum average sheath wall thickness (inches).

Cable diameter directly under sheath (inches)	Sheath material by designator	
	A and B	D and E
.000 through .080	.025	.010
.081 through .125	.025	.010
.126 through .250	.025	.010
.251 through .500	.040	.015
.501 through 1.000	.065	.021
1.001 through 1.500	.085	.025
1.501 through 2.000	.110	-
2.001 through 2.500	.125	-
2.501 through 3.000	.125	-

3.6 Cable identification. The following cable identification shall be placed on the outer surface of sheaths with material designators of A and B or on a suitable marking tape placed longitudinally under sheath materials designated D and E:

a. Manufacturer's name or CAGE code

b. Military part or identifying number (see 1.2.1)

c. Number of wires

d. Voltage rating of the component wire

e. AWG size for homogeneous cables

f. National stock number (if applicable)

3.6.1 Sheath marking. Inked or identification marking shall be used on sheath materials designated A and B. Indent marking is allowed only when sheath wall thickness is equal to or greater than .010 inch. Inked marking is required on all other sheath materials and those sheaths with wall thickness less that .010 inch. Marking shall repeat at intervals of not more than 24 inches. Continuous marking is acceptable. Marking (at the discretion of the manufacturer) may be on either one, two, or three lines.

3.6.2 Marking tape. Marking tape, if required, shall be specified on the applicable specification sheet.

3.6.3 Cable marking durability. Marking on cable sheath materials designated A and B shall remain legible after being repeatedly subjected to abrasion.

3.7 Finished cable.

3.7.1 Conductor resistance. The direct current resistance of each conductor in a cable shall not exceed the value specified in the applicable basic wire specification.

3.7.2 Dielectric strength. Insulated conductors in the finished cable shall be capable of withstanding the dielectric strength withstanding test voltage specified in the applicable specification sheet.

3.7.3 Cold bend. The cable shall show no evidence of cracked sheath, component jacket, or conductor insulation when exposed to cold bending conditions, as defined in 4.3.5.

3.8 Workmanship. The finished cable shall conform to the requirements specified herein and those of the applicable specification sheet . Unless otherwise specified in the applicable specification sheet, the cable shall be round, i.e., possessing a circular cross section. The cable shall also possess cylindrical uniformity and, in addition, shall be free from lumps and kinks. The cable outer surface shall be smooth and free from abrasions, scraped, pitted or pocked surfaces, skin impurities, and other deficiencies.

4. VERIFICATION

4.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection 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 [i.e., non-Government standard (NGS) or federal or military standard] shall be in accordance with ANSI/NCSL Z540-1 or equivalent.

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

a. Process control inspection (see 4.2.1).

b. Conformance inspection (see 4.2.2).

4.2.1 Process control inspection. Process control inspections are performed at the most appropriate stage of the manufacturing operation. The process control tests shall consist of the inspections listed in table X and shall be performed on all cable produced.

TABLE X. Process control inspections.

Inspection	Requirement paragraph	Test method paragraph
Basic wire	3.3.1	4.3.1
Gauge and stranding	3.3.1.1	4.3.1
Wire identification	3.3.1.2 through 3.3.1.5	4.3.1
Filler material	3.3.3, 3.5.4.2	4.3.1
Component twisting (length of lay)	3.5.1, 3.5.4	4.3.1.1
Binder tape		
Material and dimensions	3.3.4, 3.5.4.1, 3.5.4.2	4.3.1
Overlap	3.5.4.1	4.3.1
Insulation material	3.3.8	4.3.1
Shield		
Material and strand size	3.3.5	4.3.1
Coverage and braid angle	3.5.2, 3.5.4.3	4.3.1.2
Jacket Material	3.3.6, 3.5.3 through 3.5.3.3	4.3.1
Sheath Material	3.3.2, 3.3.7	4.3.1

4.2.2 Conformance inspection. Conformance inspections shall be those tests specified in table XI and shall be performed on specimens taken from the finished cable or material removed from finished cable of each lot of reels, spools, or coils to be delivered. Sampling inspection shall be accomplished for each lot in accordance with 4.2.2.2.

4.2.2.1 Lot. A lot shall consist of all cable of one type manufactured substantially under the same conditions and offered for inspection at one time.

4.2.2.2 Sampling . A random sample shall be selected from each lot in accordance with table XII.

4.2.2.3 Rejected lots. Failure of any sample to pass any inspection shall constitute a failure of the lot. If an inspection lot is rejected, the contractor may rework the lot to correct the defects, or screen out the defective units and resubmit the lot for re-inspection. Such lots shall be separated from new lots and shall be identified as re-inspected lots (see 4.2.2.4).

4.2.2.4 Noncompliance. If a sample fails to pass any inspection, the contractor shall notify the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted on all units of the product. Acceptance and shipment of the product shall be discontinued until corrective action has been taken. After the corrective action has been taken, the conformance inspection shall be repeated on replacement articles. This includes all tests and examinations, or only the test that the original sample failed at the cognizant inspection activity. Final acceptance and shipment will be withheld until inspection has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure should be provided to the cognizant inspection activity.

TABLE XI. Conformance inspections.

Inspection	Requirement paragraph	Inspection method paragraph
Cable diameter	3.5.5.1	4.3.1.3
Jacket thickness	3.5.3.3	4.3.1.4
Shield (overall)	3.3.5	4.3.1
Braid coverage	3.5.2	4.3.1.2
Sheath		
Thickness	3.5.5.1	4.3.1.4
Tensile strength	3.3.7.1	4.3.2.1
Ultimate elongation	3.3.7.1	4.3.2.2
Accelerated aging	3.3.7.1	4.3.2.3
Color and stripe band	3.3.2	4.3.1
Finished cable		
Cabling	3.5.4	4.3.1.1
Identification	3.6 through 3.6.2	4.3.1
Marking durability	3.6.3	4.3.6
Cold bend	3.7.3	4.3.5
Electrical		
Conductor resistance	3.7.1	4.3.3
Dielectric strength	3.7.2	4.3.4
Workmanship	3.8	4.3.1

TABLE XII. Inspection sample.

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

Notes: 1/ Lot size is based on number of reels, spools, or coils

4.3 Methods of inspection.

4.3.1 Visual and mechanical inspection. Cable, components, and wire shall be subjected to a thorough visual and mechanical inspection to ascertain that the material, construction, workmanship, marking, colors, diameters/thicknesses, and lengths are in accordance with the applicable requirements. In the event of dimensional discrepancy, 5 feet shall be cut from the end of the sample and the dimensions shall be re-measured beyond this 5-foot point.

4.3.1.1 Length of lay. The length of lay shall be determined in accordance with method 1521 of FED-STD-228.

4.3.1.2 Shield coverage. Shield coverage shall be determined by method 8121 of FED-STD-228, except that the formula specified in 3.5.2 shall be used for the calculation.

4.3.1.3 Outside diameter. The outside diameter of the cable shall be measured using method 1331 of FED-STD-228.

4.3.1.4 Wall thickness of jackets and sheaths. The wall thickness of jackets and sheaths shall be measured by method 1014 of FED-STD-228, with method 1018 of FED-STD-228 used as a referee.

4.3.2 Cable sheath tests.

4.3.2.1 Tensile strength. The tensile strength test shall be conducted in accordance with method 3021 of FED-STD-228.

4.3.2.2 Ultimate elongation. The ultimate elongation test shall be conducted in accordance with method 3031 of FED-STD-228. Benchmarks on test specimens shall be 2 inches apart before tensile loading is applied.

4.3.2.3 Accelerated aging. The aged tensile strength and ultimate elongation of sheath material A (see table V) shall be calculated using the accelerated aging test conducted in accordance with method 4031 of FED-STD-228.

4.3.3 Conductor resistance. Conductor resistance shall be measured by method 6021 of FED-STD-228. The added length of conductor, due to cabling, shall be determined by the length of lay of the conductor and the mean diameter of the layer.

4.3.4 Dielectric strength. The dielectric strength test shall be conducted in accordance with method 6111 of FED-STD-228, except that the shielded specimens shall be tested dry against the shield as a ground electrode.

4.3.5 Cold bend. Two specimens shall be subjected to the cold bend test at the temperature indicated in table XIII. The specimens shall be placed in a cold chamber in a non-flexed position and maintained at the required temperature for a minimum of 16 hours. Without removal from the cold chamber, each specimen shall be bent around a mandrel with a diameter in accordance with table XIII for one complete turn. Upon removal from the chamber, the specimen shall be examined for conformance with 3.7.3. The insulated conductors shall be removed from the cable and shall be subjected to the dielectric strength withstand test of the applicable basic wire specification (see table II).

TABLE XIII. Cable cold bend test temperature and mandrel size.

Cable outside diameter OD (inches)	Sheath material designator (see 1.2.1.1)		
	A	B	D and E
	Temperature		
	-40 °C	-55 °C	-55 °C
	Mandrel size		
.000 through .300	3 X OD	3 X OD	3 X OD
.301 through .350	3 X OD	3 X OD	3 X OD
.351 through .450	3 X OD	3 X OD	3 X OD
.451 through .550	4 X OD	4 X OD	4 X OD
.551 through .750	5 X OD	5 X OD	5 X OD
.751 through .850	6 X OD	6 X OD	6 X OD
.851 through .950	8 X OD	8 X OD	8 X OD
.951 through 1.500	10 X OD	10 X OD	-
1.501 through 2.000	15 X OD	15 X OD	-
2.001 and over	20 X OD	20 X OD	-

4.3.6 Cable stripe and marking durability. A short specimen of finished cable shall be firmly clamped in a horizontal position with its upper longitudinal surface area freely exposed. A steel mandrel (.025 diameter ±.001 inch) shall be repeatedly rubbed over the surface at the stripe or mark so that the longitudinal axis of the mandrel and specimen shall be at right angles to each other. A weight shall so be attached to the jig holding the rubbing mandrel such that the combined jig and weight exert a 500-gram thrust normal to the surface. A motor-driven reciprocating cam mechanism and counter shall be used to permit an accurately measured number of abrasion strokes. The length of the stroke in each direction shall be .375 inch, the frequency of the stroke shall be 100 strokes per minute, and the number of strokes shall be not less than 300 (150 cycles). The direction of the motion shall be along the axis of the specimen and perpendicular to the axis of the mandrel. The procedure shall be repeated on two additional specimens of wire or cable selected 50 feet apart on a sample. No letter or number shall be illegible when examined following the test. This testing shall not be performed on cables with sheaths using the indent marking method of identification.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. The cable covered in this specification is intended for use in extensive electrical and electronic applications in protected areas. The cables are not intended for use as portable cables to be laid in the open where they may be subjected to vehicular traffic, or for direct burial. The cables provide flexible single shielded and multi-conductor cable for use within tunnels, wire ways, instrument racks, and conduits within electronic equipment, trailers, or buildings, and in protected runways between buildings. The cable uses are for data transmission, synchronizing pulses, audio and video signals, control power, radio frequency signals, and operating power for electronic equipment. All cables constructed with any PVC materials are prohibited from aerospace use.

6.1.1 Selection of basic wire. Table XIV may be used as a guide to the selection of the basic wires. The values given are for engineering guidance only and are not intended to be specification requirements or firm limitations.

6.1.1.1 Wire designated A and B. These wire types have a tough mechanical outer coating over the conductor cable during manufacture and installation. This jacket is considered necessary because of the physical abuse presented to multiconductor cable during manufacture and installation. It is particularly necessary where the wires are to be shielded or in contact with other shielded wires to prevent small broken strands in the shield from penetrating through the relatively soft primary insulation and causing circuit failure. The polyamide specified is that which has been used for several years successfully in electronic and aircraft type wire for electrical purposes and has very low moisture absorption with desirable electrical properties.

TABLE XIV. Guide for selection of basic wire. 1/

Characteristic	Basic wire designator 1/ (primary wire insulation)		
	A and B (PVC)	D and E (PTFE)	P (PVC)
Approximate dielectric constant	3.7	2	3.7
Approximate power factor Change with frequency Change with temperature	 Varies Varies	<.0002 Constant Constant	 Varies Varies
Approximate insulation resistance 15 °C 85 °C	 1000 MΩ per 1000 feet 5 MΩ per 1000 feet	 $>10^6$ MΩ per 1000 feet $>10^6$ MΩ per 1000 feet	
Flammability	Will ignite but is self-extinguishing	Noncombustible	Will ignite but is self-extinguishing
Solderability	Good	Excellent, hot soldering iron may be laid against insulation with no damage	Silver-good Tin-fair
Operation temperatures for - Sheltered cables Stationary Flexing - Exposed single conductors Stationary Flexing	 -60 °C to +105 °C -25 °C to +105 °C -60 °C to +105 °C -10 °C to +105 °C	 -200 °C to +200 °C -200 °C to +200 °C -200 °C to +200 °C -200 °C to +200 °C	
Fluid resistance	Nylon jackets are insoluble in common solvents except alcohols. Unattacked by alkalis or dilute mineral acids. Unaffected by petroleum hydrocarbon. Dissolve in alcohols, phenols, and formal acid	Unaffected by all solvents and chemicals except molten alkali metals	

Notes: 1/ See table II for basic wire specification designators.

6.1.1.2 Wires designated D and E. Wires designated D and E should be used where reliability is of utmost importance. Maximum conductor temperatures up to 200 °C are permissible (consistent with proper component jackets, tape and filler material, and sheath material). Wires D and E may be bent and flexed as a single conductor at temperatures as low as –200 °C (liquid nitrogen or liquid oxygen spillage). The power factor is in the order of .0002 and the dielectric constant in the order of 2.0, thus giving improved performance where low capacitance and low loss are necessary.

6.1.1.3 Wire designated P. Wire designated P may be used with conductor temperatures of 105 °C and any combination of ambient temperature and current so that this conductor temperature is not exceeded. A life of approximately 3 months may be expected with conductor temperatures as high as 115 °C and a life of approximately 1 week may be expected with conductor temperatures as high as 135 °C. This type wire should not be used where it is expected that the exposed single conductor at cable ends will be bent or flexed at temperatures below -10 °C in service and installation.

6.1.2 Selection of component jackets. Table XV may be used as a guide in the selection of component jackets. The values listed are for engineering guidance only and are not intended to be specification requirements or firm limitations.

TABLE XV. Guide for selection of component jacket. 1/

Characteristic	Polyamide	PVC
Continuous operating temperature Stationary Flexing	 -60 °C to +105 °C -40 °C to +105 °C	 -85 °C to +90 °C -10 °C to +90 °C
Insulating value	Fair	Good
Softening due to soldering shield	Good	Good
Abrasion resistance	Excellent	Good
Fluid resistance	Good	Fair
Statements apply to continual soaking and occasional spillage of reactive solvents that will not affect cable usefulness.	Unaffected by petroleum hydrocarbons and most solvents except alcohol and phenol.	Swells or dissolves in hydrocarbons present in fuels and lubricants. Resists alcohols and paraffin-based oils. Dissolves in ketones and esters.

Notes: 1/ See 3.3.6 and table VII.

6.1.2.1 Polyamide jackets. Polyamide jackets are intended to provide shield isolation where shields are carried at ground potential for small components. Polyamide jackets are not permitted for use except over shields because the polyamide component jacket would adhere to the polyamide jackets over the individually twisted pairs or triples, and make it impossible to separate and properly strip the twisted component group. Further, this type of jacket is not allowed on diameters over .25 inch because of the tendency of polyamide when applied over large diameters to stretch when bent and to wrinkle when straightened again. With repeated working, these wrinkles may easily become cracks.

6.1.2.2 PVC jacket. PVC jackets are generally recommended for PVC insulated wires to be used in applications where ambient temperatures do not exceed 90 °C and maximum conductor temperatures do not exceed 105 °C for continuous use. PVC jackets are suitable for short time use with PVC insulated wire (designator P) with conductor temperatures as defined in 6.1.1.3.

6.1.3 Selection of sheath. Table XVI may be used as guide to the selection of a sheath. The values given are for engineering guidance only and are not intended to be specification requirements or firm limitations.

TABLE XVI. Guide for selection of sheath material. 1/

Sheath Material (designator)	Continuous operating temperature	Abrasion resistance	Ability to take impact loading	Flexibility degrees 2/			Fluid resistance 3/
				-30 °C	0 °C	+40 °C	
PVC (A)	-55 °C to +90 °C (stationary) -10 °C to +90 °C (flexing)	Good	Fair	G	F	P	Swells or dissolves in hydrocarbons present in fuel and lubricants. Resists alcohol and paraffin-based oils. Dissolves in ketones and esters.
Polyethylene (B)	-55 °C to +75 °C (stationary) -55 °C to +75 °C (flexing)	Excellent	Fair	G	G	G	Swells in some hydrocarbons present in fuels above 60 °C. Resists alcohols, mineral acids, alkalis.
FEP (D)	-200 °C to +200 °C (stationary) -55 °C to +200 °C (flexing)	Fair	Poor	G	G	G	Not measurably attacked by any known fluid within usage temperature range.
PTFE (E)	-200 °C to +200 °C (stationary) -65 °C to +200 °C (flexing)	Fair	Poor	G	G	G	Not measurably attacked by any known fluid within usage temperature range

Notes: 1/ See table V for sheath physical properties.
2/ E – Excellent, G – Good, F – Fair, P - Poor
3/ Applies to continual soaking; occasional spillage of reactive solvents will generally not affect cable usefulness.

6.1.3.1 PVC sheath (designator A). PVC is suitable for ambient temperatures up to 90 °C for continuous service and is suitable as a jacket for PVC insulated wires within the high conductor temperature limits set forth in 6.1.1.3 for short time use. If the cable is to be bent or flexed at low temperatures, extreme caution should be used with this type of sheath. It is not recommended that PVC sheath be used when the cable is to be handled at temperatures below -10 °C . Even though a cold bend test at -40 °C is provided in the specification, this test is only a comparison for quality control purposes between various types of PVC that might be used and an assurance of proper extrusion techniques; the test does not represent the physical use that the cable in the field may get by manual handling. PVC sheath provides a tough abrasion-resistant outer covering for the cable.

6.1.3.2 Polyethylene sheath (designator B). Polyethylene is suitable for operation over the temperature range indicated in table XVI. Polyethylene gives a tough highly abrasion-resistant outer coating and retains flexibility at low temperatures.

6.1.3.3 FEP (designator D) and PTFE (designator E) sheath. FEP and PTFE sheaths are intended for the outer covering of cable to be operated at temperatures above those permissible with PVC and PE sheaths.

6.2 Ordering data.

6.2.1 Cables with military specification sheets. Acquisition documents should specify the following:

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

b. Military specification part number (see 1.2.1).

c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

d. Title, number, and date of the applicable military specification sheet, length of cable, and sheath and stripe or band color, if other than specified (see 3.3.2), required.

e. Required non-technical constructional changes such as the addition of binder tapes (see 3.3.4) or other minor deviations that do not affect the performance requirements.

f. The percent shield coverage, if other than specified (see 3.5.2).

g. Packaging requirements (see 5.1).

6.2.2 Cables for which military specification sheets have not been established. In addition to the information listed in 6.2.1, acquisition documents should also specify the following:

a. That prior to cable fabrication, the contractor should furnish a copy of the design data, as required, to the acquiring activity and custodian of this specification for configuration, documentation, approval, and assignment of a specification sheet number.

b. Basic wire specification, number of wires, AWG and stranding of conductors, shield and jacket undershield and sheath material designators (see 3.3, 1.2.1.1, and 1.2.1.2).

c. Colors for basic wire and sheath (see 3.3.1.2 and 3.3.2).

d. Insulation, if required (see 3.3.8).

e. Whether component should have a component jacket and, if so, the jacket material and wall thickness (see 3.5.3).

f. Overall shield, if required (see 3.5.4.3).

6.3 Subject term (key word) listing

Conductor, stranded
Fluorinated ethylene propylene (FEP)
Polyamide
Polyethylene (PE)
Polytetrafluoroethylene (PTFE)
Polyvinyl chloride (PVC)
Shielded cable

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

CONCLUDING MATERIAL

Custodians:
Army - CR
Navy - SH
Air Force - 11
DLA - CC

Review activity:
Army - MI

Preparing activity:
DLA - CC

(Project 6145-2262)

APPENDIX A.

A.1 Appendix A provides a cross-reference of former basic wire, jacket material, and sheath designators to current basic wire, jacket material, and sheath designators.

A.2 Basic wire designator cross-reference. Cross-reference of former basic wire types and designator to current basic wire designator (see table II) is shown in table A-I.

TABLE A-I. Cross-reference of former basic wire types and designators to current basic wire designators.

Basic wire specification	Former basic wire designator	MIL-C-27072B designator	MIL-DTL-27072C designator
MIL-W-16878/17	Type I	A	A
MIL-W-16878/18	Type II	B	B
-	Type III superseded by Type VIII	C superseded by H	Deleted
MIL-W-16878/4 1/ MIL-W-16878/21 1/	Type IV	D	D
MIL-W-16878/5 1/ MIL-W-16878/22 1/	Type V	E	E
MIL-C-17	Type VI	F	Deleted
MIL-W-5845 MIL-W-5846 MIL-W-5908	Type VII	G	Deleted
MIL-W-16878/10	Type VIII	H	Deleted
MIL-W-16878/19	Type IX	J	Deleted
MIL-W-16878/6 MIL-W-16878/20	Type X	K	Deleted
MIL-W-16878/13	Type XI	L	Deleted
MIL-W-16878/2	Type XII	M	Deleted
MIL-W-16878/3	Type XIII	N	Deleted
MIL-W-16878/1	Type XIV	P	P

Notes: 1/ Superseded by NEMA HP 3.

A.3 Jacket material designator cross-reference. Cross-reference of former component jacket material class and designator to current component jacket material designator (see table I) is shown in table A-II.

TABLE A-II. Cross-reference of former component jacket material class and designator to current component jacket material designator.

Jacket material	Former class	MIL-C-27072B designator	MIL-DTL-27072C designator
Polyamide	A	E, F, G, H	E, G, H (F deleted)
PVC	B	Z, J, K, L	Z, K, L (J deleted)
Polyethylene	C	M, N, O, P	Deleted
FEP	D	R, S, T, U	Deleted
Glass braid yarn	E	V, W, X, Y	Deleted

A.3.1 Shield and jacket undershield material cross-reference. Copper braid round shield material was specified in MIL-C-27072B but is not specified in MIL-DTL-27072C. Shield and jacket undershield designations B, F, and J (unjacketed) associated with copper braid round shield material used in MIL-C-27072B were deleted from MIL-DTL-27072C.

A.4 Sheath material cross-reference. Cross-reference of former style and sheath material designators to current sheath material designator (see 1.2.1.1) is shown in table A-III.

TABLE A-III. Cross-reference of former style and sheath material designators to current sheath material designators.

Sheath material	Former style	MIL-C-27072B designator	MIL-DTL-27072C designator
PVC	1	A	A
Polyethylene	2	B	B
Polychloroprene	3	C	Deleted
FEP	4	D	D
PTFE	5	E	E
Polyamide	6	F	Deleted
Glass braid yarn	7	G	Deleted
Polyurethane	8	H	Deleted
No sheath	-	K	Deleted

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, and send to preparing activity.
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-DTL-27072C	2. DOCUMENT DATE *(YYYYMMDD)* 20001208

3. DOCUMENT TITLE

Cable, Power, Electrical, and Cable, Special Purpose, Electrical, Multiconductor and Single Shielded, General Specification for

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) DSN *(if applicable)*	7. DATE SUBMITTED *(YYYYMMDD)*

8. PREPARING ACTIVITY

a. NAME Defense Logistics Agency Defense Supply Center, Columbus	b. TELEPHONE *(Include Area Code)* (1) Commercial 614-692-0538 (2) DSN 850-0538
c. ADDRESS *(Include Zip Code)* DSCC-VAI P.O. Box 3990 Columbus, Ohio 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** **Defense Standardization Program Office (DLSC-LM)** **8725 John J. Kingman Road, Suite 2533** **Fort Belvoir, Virginia 22060-6621** **Telephone 703 767-6888 DSN 427-6888**