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			CLASSIFICATION				UNRESTRICTED

1.0 GENERAL

This specification covers round multi-conductor solid (Type I) and stranded (Type II), flat flexible cable for use in low power applications, with insulation displacing connectors on 0.050 inch centers. The specification is composed of the following sections.

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2.0 APPLICABLE DOCUMENTS


The following documents of the issue in effect on the date of the latest revision of this specification, shall form a part of this specification to the extent specified herein.

Military Specifications

MIL-C-45662 Calibration System Requirements

Military Standards

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts

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Industry Specifications/Standards

ASTM B3	Soft or Annealed Copper Wire
ASTM B5	Electrolytic Copper wire Bars, Cakes, Slabs, Billets, Ingots, and Ingot Bars
ASTM B8	Concentric-Lay Stranded Copper Conductors, Hard, Medium-Hard, and Soft
ASTM B33	Tinned soft or Annealed Copper Wire
UL Subj 758	Outline of the Investigation of Thermoplastic-Insulated Appliance Hook-Up Wire
UL 2651	Factory Inspection Procedure

3.0 REQUIREMENTS

3.1 Qualification

Cable furnished under this specification shall be a product capable of meeting the qualification test requirements specified herein.

3.2 Material

The material used in the construction of the cable shall be as specified herein. Substitute materials shall meet the performance requirements of the specification.


3.2.1 Insulation. The insulation material shall be polyvinyl chloride (PVC) having a durometer of Shore C 80 to 90, a minimum tensile strength of 1500 PSI, and a minimum elongation of 100 percent. The material thickness shall be 0.007 minimum.

3.2.2 Conductors. The conductor material shall be electrolytic tough pitch (ETP) copper in accordance with ASTM B5.

3.2.2.1 **Solid Conductors (Type I)**. The conductors shall be annealed temper, 10.0 mil diameter wire in accordance with ASTM B3 and shall have a maximum tensile strength of 40 KSI and a minimum elongation of 15 percent in ten (10) inches.

3.2.2.2 **Stranded Conductors (Type II)**.

3.2.2.2.1 The individual strands shall be annealed temper, 5 mil diameter (AWG-36), tin-coated wire in accordance with ASTM B33 and shall have a maximum tensile strength of 40 KSI and a minimum elongation of 10 percent before stranding.

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3.2.2.2.2 The conductor shall be 7-strand concentric-lay wire equivalent to size AWG-28 and shall have a nominal area of 175 circular mils and a nominal overall diameter of 15 mils; the lay shall be a 0.35 inch maximum, left-hand twist (see ASTM B8).

3.3 Design and Construction

The cable shall conform to UL Style 2651 and shall consist of parallel, stranded or solid conductors laminated and/or extruded between two insulation layers. The insulation material shall be formed around the conductors so as to avoid air-spaces adjacent to the conductor.


- 3.3.1 Flammability. The cable shall be flame retardant when tested in accordance with UL Subject 758.
- 3.3.2 Cable Width. The first-to-last conductor spacing for the available cable widths shall be as specified on product drawing.
- 3.3.3 Cable Color. The insulation shall be as specified on the product drawing.
- 3.3.4 Cable Marking. The cable marking shall be as specified on the product drawing. The marking shall not flake or peel under any of the conditions described in this specification.
- 3.3.5 Conductor Splices. Splices may exist in the individual strands of stranded conductors, but shall not exist closer together than one (1) foot.

3.4 Transmission Line Characteristics

- 3.4.1 Characteristic Impedance. When measured in a ground-signal-ground (GSG) configuration, the unterminated cable shall exhibit a nominal characteristic impedance (Z_0) of 125 ohms for solid and 105 ohms for stranded.
- 3.4.2 Propagation Delay Time. When measured in a GSG configuration, the terminated cable shall exhibit a propagation delay time of 1.45 to 1.55 nano-seconds per foot of cable length.

3.5 Electrical Characteristics

- 3.5.1 Voltage Rating. The voltage rating of the cable shall be 300 volts RMS.

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3.5.2 Conductor Resistance

3.5.3 Type I. The resistance of individual conductors shall not exceed 108 ohms per 1000 feet at 20°C when measured with a Kelvin Bridge or other suitable direct current instrument in accordance with MIL-STD-202, Method 303.

3.5.4 Type II. The resistance of individual conductors shall not exceed 66 ohms per 1000 feet at 20°C when measured with a Kelvin Bridge or other suitable direct current instrument in accordance with MIL-STD-202, Method 303.

3.5.5 Dielectric Withstanding Voltage. There shall be no evidence of insulation breakdown when the cable is tested in accordance with MIL-STD-202, Method 301. The following details shall apply:


- a. Test Potential - 1000 volts, RMS, 60 Hz
- b. Test Duration - 60 seconds
- c. Special Preparation - cable (excluding 6 inches at both ends) to be immersed in a water bath, containing 0.5 to 1.0 percent of a suitable wetting agent, for a minimum period of 4 hours
- d. Points of Measurement - (1) Between all conductors commonly connected and the bath; (2) between all conductors alternately connected.

3.5.6 Insulation Resistance. The insulation resistance between adjacent conductors shall be not less than 25 megohms per foot (5 megohms per foot after exposure to the humidity environment described in 3.7.3) when measured in accordance with MIL-STD-202, Method 302. The following details shall apply:

- a. Test Condition - B (500 volts DC)
- b. Points of Measurement - between adjacent conductors

3.5.7 Capacitance. The capacitance shall be 14 \pm 2 picofarads per foot (12 \pm 2 picofarads per foot for Type I cable) when measuring in accordance with MIL-STD-202, Method 305, the following details shall apply:

- a. Test Frequency - 1 megahertz
- b. Points of Measurement - one conductor to two adjacent conductors connected in ground-signal-ground configuration

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3.6 Mechanical Characteristics

- 3.6.1 Folding. There shall be no evidence of cracking or delamination of the cable after two complete cycles of transverse folding; the conductors shall exhibit no loss of continuity; the dielectric withstanding voltage of the cable shall be not less than 1000 volts RMS (see 3.5.5). The following details shall apply:
- Fold Angle - 180°
 - Pressure Applied to fold - 30 \pm 1 PSI
 - Time of Application - 15 \pm 1 minute
 - Definition of Cycle - pressure applied to fold for 15 minutes and to the unfolded creased portion of the cable for an additional at minutes.
- 3.6.2 Flexing Endurance. (Type II only) The conductors shall exhibit no loss of continuity greater than 1 microsecond during 150 cycles of cable flexing. The following details shall apply:
- Tension on Cable - 2 pounds per-inch-of-cable-width
 - Flex Angle - 140° as shown in Figure 1
 - Mandrel Spacing - just touching cable
- 3.6.3 Slit Propagation. There shall be no exposure of conductors when strands are stripped from the composite cable. The following details shall apply:
- Two strands selected from the end of the cable width
 - Direction of Force - 180° to normal strand position (parallel to plane of cable) as shown in Figure 2
 - Sample Preparation - slit notch cut 1.5 inch (minimum)
 - Strip Length - 12 inches
 - Slit rate at least 1" per second



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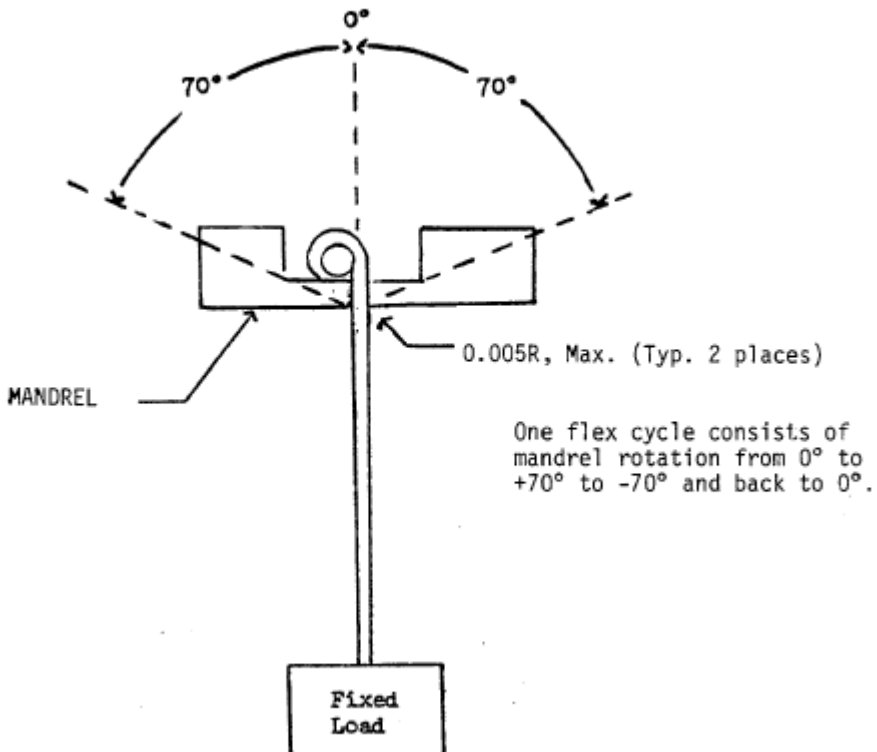



FIGURE 1 - CABLE FLEX RESISTANCE
TYPE II ONLY

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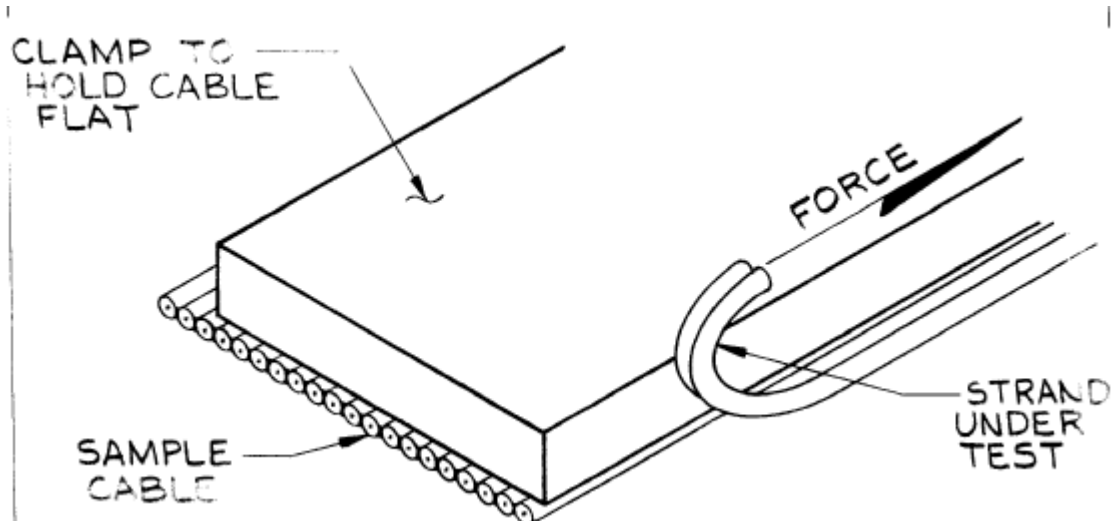



FIGURE 2 - SLIT PROPAGATION

3.7 Environmental Characteristics

3.7.1 Thermal Shock. After exposure of the cable to alternate periods of extreme high and low temperature, there shall be no evidence of cracking or delamination of the insulation. The dielectric withstanding voltage of the cable shall be not less than 1000 volts RMS (see 3.5.5). The test shall be in accordance with MIL-STD-202, Method 107; the following details shall apply:

- a. Test Condition - B (5 1-hour cycles)
- b. Temperature Range - -65°C to $+105^{\circ}\text{C}$

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3.7.2 High Temperature Aging. After exposure of the cable to a continuous high temperature environment, there shall be no evidence of cracking or delamination of the insulation; the dielectric withstanding voltage shall be not less than 1000 volts RMS (see 3.5.5) and the insulation resistance shall be not less than 25 megohms (see 3.5.6). The following details shall apply:

- a. Test Duration - 100 hours
- b. Test Temperature - +105°C

3.7.3 Moisture Resistance. After exposure of the cable to a high humidity environment, there shall be no evidence of delamination of the insulation. The test shall be in accordance with MIL-STD-202, Method 106 (omitting steps 7A and 7B); the following details shall apply:

- a. Test Duration - 240 hours (10 24-hour cycles)
- b. Relative Humidity - 90% minimum
- c. Temperature - +25°C to 65°C
- d. Final Measurement at High Humidity - Upon completion of step 6 of the final cycle and a temperature of 25°C +_ 2°C and a relative humidity of 90 to 98%, the insulation resistance shall be measured (see 3.5.6)

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Equipment Calibration

All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with MIL-C-45662.

4.2 Inspection Conditions


Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions.

- a. Temperature - 25°C +_ 5°C
- b. Relative Humidity - 30 to 80%
- c. Barometric Pressure - Local ambient

4.3 Qualification Inspection

Qualification inspection shall be performed on sample cable produced with equipment and procedures normally used in production.

4.3.1 Sample. Six (6) for Type II 38- to 40-inch lengths of the widest available cable shall be subjected to the qualification inspection.

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4.3.2 Test Sequence. The sample cables shall be subjected to the inspections specified in Table II, in the order shown.

4.4 Quality Conformance Inspection

Manufacturer will perform this inspection on production run of cable.

4.4.1 Sample. Five (5) Type I, Six (6) Type II 38- to 40-inch lengths of the widest available cable shall be subjected to the qualification inspection.

4.4.2 Test Sequence. The sample cables shall be subjected to the inspections specified in Table III in the order shown.

4.4.3 Disposition of Sample Units. Sample cable that has been subjected to the quality conformance inspection shall not be considered deliverable on the contract or purchase order.

4.5 Acceptance Inspection

Acceptance inspection shall consist of the examinations and inspections specified in Table IV.

4.5.1 Inspection Lot. An inspection lot shall consist of all cable produced under essentially the same conditions and offered for inspection at one time.


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TABLE II - QUALIFICATION INSPECTION

Examination or Test	Paragraph	Sample Number					
		1	2	3	4	5	6
Dielectric Withstanding Voltage	3.5.5	X	-	-	-	-	-
Insulation Resistance	3.5.6	X	-	-	-	-	-
Conductor Resistance	3.5.2	X	-	-	-	-	-
Capacitance	3.5.7	-	X	-	-	-	-
Thermal Shock	3.7.1	-	X	-	-	-	-
Folding	3.6.1	-	-	X	-	-	-
High Temperature Aging	3.7.2	-	-	-	X	-	-
Slit Propagation	3.6.3	-	-	-	X	-	-
Flexing Endurance (Type II Only)	3.6.2	-	-	-	-	X	-
Moisture Resistance	3.7.3	-	-	-	-	-	X

TABLE III - QUALITY CONFORMANCE INSPECTION

Examination or Test	Paragraph	Sample Number			
		1	2	3	4
Dielectric Withstanding Voltage	3.5.5	X	-	-	-
Insulation Resistance	3.5.6	X	-	-	-
Conductor Resistance	3.5.2	X	-	-	-
Capacitance	3.5.7	-	X	-	-
High Temperature Aging	3.7.2	-	X	-	-
Slit Propagation	3.6.3	-	X	-	-
Flexing Endurance (Type II Only)	3.6.2	-	-	X	-
Moisture Resistance	3.7.3	-	-	-	X

- 4.5.2 Sampling Plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for General Inspection Level II. The acceptance quality level (AQL) shall be as specified in Table IV. Major and minor defects shall be as defined in MIL-STD-105.
- 4.5.3 Rejected Lots. Rejected lots may be screened by vendor to remove defective cable.
- 4.5.4 Disposition of Sample Cable. Sample cable that has been subjected to the acceptance inspection shall be considered deliverable on the contract or purchase order.

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5.0 PREPARATION FOR DELIVERY

5.1 Packaging

The cable shall be packaged with 100 feet on individual cardboard reels. One (1) splice per reel shall be permitted, with the shorter cable length a minimum of 25 feet.

TABLE IV - ACCEPTANCE INSPECTION


<u>Examination or Test</u>	AQL	
	<u>Major</u>	<u>Minor</u>
Visual & Mechanical	1.0%	4.0%
Electrical	2.5%	*

* All electrical defects considered major.

5.2 Marking

At a minimum, the flange of the reel shall provide the following information.

- FCI name and part number
- Date of Manufacture
- Conductor AWG Size
- Appliance Wiring Material
- Maximum Temperature Rating - 105°C
- Maximum Voltage Rating - 300 volts
- Style - 2651
- UL Label

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REVISION RECORD

REV	PAGE	DESCRIPTION	EC #	DATE
A		Change maximum temperature rating from 150°C to 105°C	6383	10/06/80
B				
C	2 3 7	Delete MIL-STD-105 Add extruded cable to Section 3.3 Revise Section 3.6.3 and Figure 2	6877	02/13/81
D	2	Change durometer from "75 to 85" to "80 to 90"	8252	02/25/82
E	3 11	Changes to 3.3.3 and 3.3.4 Polyethylene bags removed from vendor requirement	8414 8404	04/07/82
F	All		V11791	06/27/91
G	All	Revised format to be consistent with GS-01-001, and change BERG, Dupont, etc. references to FCI.	V01904	07/27/00
H	All	New FCI Logo	V06-0709	07/31/06