

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	REV	DESCRIPTION	DATE	APPROVED
MULTI-USE	M2/M3-A1	-	INITIAL T2SS LLI/IPF RELEASE	1-20-84	KE (corp.)
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	B	B	INC NOR 80569, ECP MI-H0796	89-01-11	72 RJU
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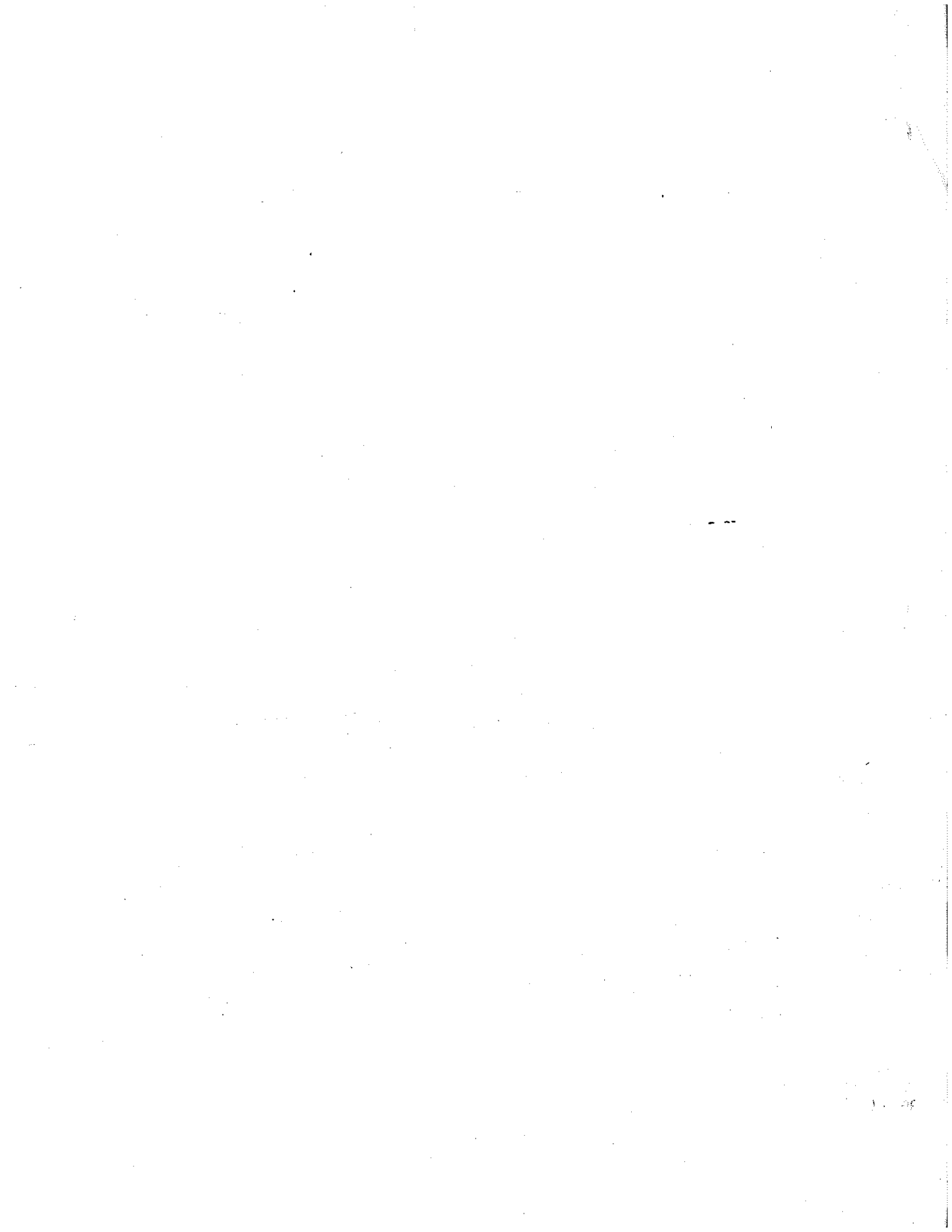
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DOCUMENTATION

REV																								
SHEET																								
REV STATUS OF SHEETS	REV	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B			
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17						
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES	DAAH01-82-C-A184										U.S. ARMY MISSILE COMMAND REDSTONE ARSENAL, ALABAMA													
MATERIAL	DATE	84-01-20										WIRE AND CABLE, ULTRA-FLEXIBLE, FEP-FLUOROCARBON INSULATED												
	ENGINEER	A. W. Hall																						
	CHECKED	The Henderson																						
	PREPARED	R.A. J...																						
TSD Rethompson 1-20-84	SUBMITTED											SIZE	FSCM NO.	DRAWING NO.										
1-23-84	APPROVED BY ORDER OF COMMANDER USAF/COM											A	18876	MIS-35755										
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CR 01/31/89

MIS-35755 B
CODE IDENT 18876
11 January 1989
SUPERSEDING
MIS-35755A
19 June 1986

MISSILE INTERIM SPECIFICATION

WIRE AND CABLE, ULTRA-FLEXIBLE, FEP-FLUOROCARBON INSULATED

1. SCOPE

1.1 Scope. This specification covers ultra-flexible FEP fluoro-carbon insulated wire and multi-conductor cable. The conductors are highly stranded bare copper, sizes 20, 22, 24, 26 and 28 AWG. These constructions are suitable for continuous use within a temperature range of -85 to 302 degrees Fahrenheit (°F) (-65 to 150 degrees Celsius (°C)) and are rated for 200 volts rms.

1.2 Classification. The wire and cable shall be one of the following types as specified (see 6.3):

Type U	Insulated Wire and Cable
Type S	Insulated Wire and Cable with Shield

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Industry

ASTM D 2116	FEP-Fluorocarbon Molding and Extrusion Materials, Standard Specification for
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STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
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MIS-35755B

MIL-STD-202

Test Methods for Electronics
and Electrical Component Parts

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

2.2 Other publications. The following documents of the latest issue in effect form a part of this specification to the extent specified herein:

American Society for Testing and Materials

B 49

Hot-Rolled Copper Redraw Rod for
Electrical Purposes

B 298

Silver-Coated Soft or Annealed
Copper Wire

(Applications for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Qualification. The material furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein. After a product has been qualified, neither the constituent materials nor the method of manufacture of that product shall be changed without requalification.

3.2 Material composition and construction

3.2.1 Conductors. Conductor strands shall be electrolytic tough-pitch uncoated copper conforming to ASTM B 49, which has been drawn down to size 44 AWG (0.0020 \pm 0.0001 inch (0.05 \pm 0.003 millimeter (mm))).

3.2.2 Stranding. Conductor stranding shall be as specified in table I. Sizes 26 and 28 conductors shall be bunch-stranded with a nominal 0.5 inch (12.7 mm) lefthand lay length. Sizes 22 and 24 are rope-lay conductors consisting of 3 bunch-stranded members which are cabled together. The component members are bunch-stranded with a nominal 0.5 inch (12.7 mm) right-hand lay length. These bunched members are cabled (roped) together with a nominal 0.33 inch (8.4 mm) left-hand lay. Size 20 is a rope-lay conductor consisting of 7 bunch-stranded members which are cabled together. The component members are bunch-stranded with a nominal 0.5 inch (12.7 mm) right-hand lay length. These bunched members are cabled (roped) together with a nominal 0.33 inch (8.4 mm) left-hand lay.

TABLE I. Stranding.

Conductor size, AWG	Stranding			Diameter of finished conductor, inch (mm)
	No. of stranded members	No. of strands contained in bunched members	Strand size, AWG	
28	1	40	44	0.015 ±0.001 (0.4 ±0.03)
26	1	66	44	0.019 ±0.001 (0.5 ±0.03)
24	3	35	44	0.024 ±0.001 (0.6 ±0.03)
22	3	50	44	0.029 ±0.001 (0.7 ±0.03)
20	7	37	44	0.041 ±0.001 (1.0 ±0.03)

3.2.3 Insulation. Insulation shall be extruded FEP-fluorocarbon conforming to ASTM D 2116, type I. The wall thickness shall be 0.005 ± 0.001 inch (0.13 ± 0.03 mm).

3.2.3.1 Insulation color. Insulation color shall be as follows:

Single conductor: White

Two conductors: Red and black

Three conductors: White, red, and black

3.2.4 Shielding. Type S constructions shall have a braid composed of 0.002 inch (0.05 mm) diameter (size 44 AWG) silver-coated soft copper strands conforming to ASTM B 298 applied over the insulated wires. The braid shall be a push-back type. Shielding coverage shall be not less than 85 percent.

3.2.4.1 Insulation over shielding. Insulation over shielding shall be extruded FEP-fluorocarbon conforming to ASTM D 2116, type I, color clear. The wall thickness shall be .005 minimum for 26 and 28 AWG, .007 minimum for 24, 22 and 20 AWG.

3.2.5 Cabling. Multiconductor cables shall be composed of type U singles which are cabled together with a uniform, right-hand lay. Winding shall be in a manner that prevents residual twist or strain in finished cables. Lay lengths shall be as specified in table II.

TABLE II. Multiconductor cable lay lengths.

Conductor size, AWG	Cable construction	Lay length, nominal, inch (mm)
28	Triad	0.50 (12.7)
28	Pair	0.33 (8.4)
26	Triad	0.50 (12.7)
26	Pair	0.33 (8.4)
24	Pair and Triad	0.50 (12.7)
22	Pair and Triad	0.50 (12.7)
20	Triad	0.75 (19.1)
20	Pair	0.50 (12.7)

3.2.6 Dimensions. Dimensions of the finished wire and cable shall be as specified in tables III, IV and VIII.

TABLE III. Type U wire and cable dimensions.

Wire size, AWG	Overall diameter, inch (millimeter)					
	Single		Pair ^{1/}		Triad	
	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum
28	0.025 (0.64)	0.027 (0.69)	0.050 (1.27)	0.054 (1.37)	0.054 (1.37)	0.058 (1.47)
26	0.029 (0.74)	0.031 (0.79)	0.058 (1.47)	0.062 (1.57)	0.062 (1.57)	0.067 (1.70)
24	0.034 (0.86)	0.036 (0.91)	0.068 (1.73)	0.072 (1.83)	0.073 (1.85)	0.077 (1.96)
22	0.039 (0.99)	0.041 (1.04)	0.078 (1.98)	0.082 (2.08)	0.084 (2.13)	0.088 (2.24)
20	0.051 (1.30)	0.053 (1.35)	0.102 (2.59)	0.106 (2.69)	0.110 (2.79)	0.144 (3.66)

^{1/} Major axis

TABLE IV. Type S wire and cable dimensions.

Wire Size, AWG	Diameter Over Shield Braid, Inch (millimeter)					
	Single		Pair ^{1/}		Triad	
	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum
28	0.037 (0.94)	0.039 (0.99)	0.059 (1.50)	0.063 (1.60)	0.063 (1.60)	0.067 (1.70)
26	0.041 (1.04)	0.043 (1.09)	0.067 (1.70)	0.071 (1.80)	0.071 (1.80)	0.076 (1.93)
24	0.046 (1.17)	0.048 (1.22)	0.077 (1.96)	0.081 (2.06)	0.082 (2.08)	0.086 (2.18)
22	0.051 (1.30)	0.053 (1.35)	0.087 (2.21)	0.091 (2.31)	0.093 (2.36)	0.097 (2.46)
20	0.060 (1.52)	0.062 (1.57)	0.111 (2.82)	0.115 (2.92)	0.119 (3.02)	0.123 (3.12)

^{1/} Major axis.

3.3 Performance properties

3.3.1 Conductor elongation. Elongation of the whole conductor removed from the finished wire shall be not less than 10 percent.

3.3.2 Electrical properties

3.3.2.1 Insulation flaws. One hundred percent of all wire shall be spark tested for insulation flaws after extrusion of insulation. Type U multiconductor cables shall also be spark tested after cabling component wires.

3.3.2.2 Dielectric withstanding voltage (type S only). Type S construction shall be free of breakdowns when tested for dielectric withstanding voltage.

3.3.2.3 Insulation resistance. Insulation resistance shall be not less than 1000 megohms per 1000 feet (3.28 megohms per meter).

3.4 Workmanship. The wire or cable shall be free of kinks and abraded, cracked, or peeled surfaces, shall be a uniform and consistent product and shall be free from any defects which will adversely affect the serviceability of the product.

4. QUALITY ASSURANCE PROVISIONS

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

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

- a. Qualification inspection (see 4.3)
- b. Quality conformance inspection (see 4.4).

4.3 Qualification tests. Qualification tests are the tests performed on samples submitted for approval as qualified products. They shall consist of all the examinations and tests contained in this specification.

4.4 Quality conformance inspection. Quality conformance inspection consists of all the tests performed on individual lots which have been submitted for acceptance. The tests are described in the following subparagraphs.

4.4.1 Sampling for quality conformance inspection. Unless otherwise specified, sampling shall be in accordance with MIL-STD-105, Inspection Level S-4 at an acceptable quality level (AQL) of 4.0 percent defective.

4.4.2 Lot formation. A lot shall consist of all the completed wire or cable of the same construction manufactured in one continuous operation by the same process, by the same manufacturer, using the same conductor batch and on the same machine without change in machine settings, in accordance with this specification and submitted for inspection at one time.

4.4.3 Inspection. Inspection of the sample specified in 4.4.1 to determine compliance with the characteristics specified in table V shall be conducted in accordance with the corresponding test and inspection paragraphs.

TABLE V. Quality conformance inspection.

Characteristic	Requirement source	Test and inspection paragraph
Composition and construction	3.2	4.5.1
Dimensions	3.2.6	4.5.2
Workmanship	3.4	4.7
Packaging and packing	5.1	4.7
Marking	5.2	4.7

4.5 Tests

4.5.1 Composition and construction. The composition shall be certified by the supplier (see 6.2) and the construction shall be visually inspected to establish conformance to the requirements of 3.2.

4.5.2 Dimensions. Finished wire and cable dimensions shall be measured to establish conformance to the requirements of 3.2.6.

4.5.3 Conductor elongation. Conductor elongation shall be tested on a section of whole conductor removed from the finished wire. A tensile machine with jaw separation of 1 to 12 inches (25.4 to 304.8 mm) per minute shall be used. The net increase in conductor length shall be measured at time of tensile rupture. The break shall be in the conductor itself and away from the machine jaws. Results shall conform to the requirements of 3.3.1.

4.6 Electrical tests. One hundred percent of the completed wire and cable shall be subjected to the applicable electrical tests, except that insulation resistance may be performed on a sampling basis. When specified (see 6.2), the manufacturer shall certify performance of the tests and conformance to the requirements. Results shall conform to the requirements of 3.3.2.

4.6.1 Insulation flaws (spark test). The wire, after extrusion of the primary insulation, shall be passed through a bead chain electrode spark test device that makes intimate metallic contact with practically all the insulation surface. Electrode potential shall be 2500 volts rms, 3000 Hz, while the wire conductor is maintained at ground potential. The rate of passage of the wire through the electrode shall be such that the insulation is subjected to not less than 50 potential cycles at any given point. Any portion showing insulation breakdown shall be cut out of the wire including not less than 2 inches (50.8 mm) on each side of the failure. Type U multiconductor constructions shall also be spark tested after cabling component wires.

4.6.2 Dielectric withstanding voltage (type S). Type S construction shall be tested dry for dielectric withstanding voltage in accordance with MIL-STD-202, Method 301. A potential of either 1500 volts dc or 750 volts, 60 Hz, shall be applied in turn between each primary conductor and shield and other conductors tied together at ground. Voltage shall be maintained for not less than 1 minute.

4.6.3 Insulation resistance. Completed wire and cable shall be tested dry for insulation resistance in accordance with MIL-STD-202, Method 302. Insulation resistance shall be measured between each primary conductor and other primary conductors and shield tied together after a charging potential of 500 volts dc has been maintained for not less than 1 minute.

4.7 Visual inspection and examination. All wires and cables shall be visually examined for conformance to the workmanship requirements in 3.4 and packaging, packing and marking requirements in 5.1 and 5.2.

5. PACKAGING

5.1 Packaging and packing. Wire and cable shall be furnished in not less than 25 foot (7.6 meter) lengths on reels or spools of appropriate barrel diameter to accommodate the specific wire or cable; or as otherwise specified on the purchase order. Reels and spools shall be shipped in containers that will assure protection of the contents during normal handling relative to shipping, receiving and storage.

5.2 Marking. Interior and exterior container markings shall include, but not be limited to, the following information:

- a. Manufacturer's name and address
- b. Manufacturer's designation (see 6.3)
- c. Lot or batch number
- d. Date of manufacture
- e. Number of this specification
- f. Type
- g. Length in feet (meters)
- h. Wire or cable size (AWG) and description

6. NOTES

6.1 Intended use. The wire and cable in accordance with this specification is primarily intended for use as component wires of cast urethane flat cables where extreme flexibility is required. This design is not preferred for hook-up or harnessing applications due to the limited cut-through and abrasion resistance afforded by FEP-fluorocarbon insulation material.

6.2 Ordering data. Procurement documents should specify the following:

- a. Title, number, and date of this specification
- b. Type required
- c. Applicable wire or cable designation (see 6.3)
- d. Quantity
- e. Special preparation for delivery requirements, if applicable
- f. Requirement for certification of composition and performance of electrical testing.

6.3 Method of designation. The method of designation for individual constructions of wire and cable specified herein is in accordance with the Part Number table VI and the following example:

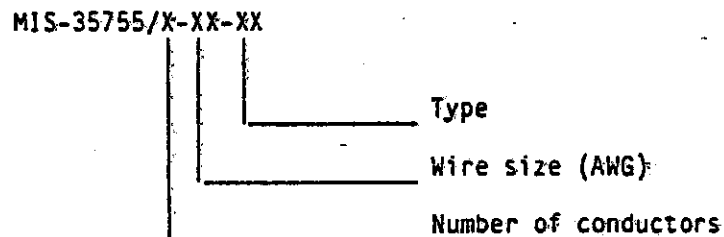


TABLE VI. Part number table.

Part Number MIS-35755	Manufacturer's designation	Manufacturer's name and location
/1-28U	N12-44B-400	New England Electric Wire Corp. 365 Main St. Lisbon, NH 03585
/2-28U	N13-44B-402	
/3-28U	N13-44B-404	
/1-28S	N12-44B-401	<u>Distributor</u>
/2-28S	N13-44B-403	Cooner Wire Co., Inc. 9186 Independence Ave. Chatsworth, CA 91311
/3-28S	N13-44B-401	
/1-26U	N12-44B-450	
/2-26U	N13-44B-452	
/3-26U	N13-44B-453	
/1-26S	N12-44B-451	
/2-26S	N13-44B-451 -	
/3-26S	N13-44B-450	
/1-24U	N12-44B-503-1	
/2-24U	N13-44B-507	
/3-24U	N13-44B-500	
/1-24S	N12-44B-504	
/2-24S	N13-44B-514	
/3-24S	N13-44B-515	
/1-22U	N12-44B-505	
/2-22U	N13-44B-501	
/3-22U	N13-44B-502	
/1-22S	N12-44B-506	
/2-22S	N13-44B-516	
/3-22S	N13-44B-517	
/1-20U	N12-44B-600	
/2-20U	N13-44B-608	
/3-20U	N13-44B-606	
/1-20S	N12-44B-601	
/2-20S	N13-44B-603	
/3-20S	N13-44B-609	

6.4 Braid construction. The braid construction in table VII following, will provide acceptable shielding coverage and braid angle.

TABLE VII. Braid construction.

Braid Construction	28 AWG			26 AWG			24 AWG			22 AWG			20 AWG		
	Single	Pair	Triad	Single	Pair	Triad	Single	Pair	Triad	Single	Pair	Triad	Single	Pair	Triad
Shield strand size, AWG	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44
No. of carriers	12	16	16	12	16	16	12	24	24	16	24	24	16	24	24
No. of ends/carryer	5	6	7	6	8	8	7	6	7	6	7	8	8	8	10
Picks/inch (25.4 mm) ±10%	43	35	29	36	25	25	36	43	37	25	38	32	33	32	22
Coverage, percent nominal	95	91	93	96	95	93	98	96	98	95	97	98	96	96	96
Braid angle ±2 degrees	34	37	34	32	32	33	36	39	37	23	39	37	36	39	39

TABLE VIII. Type SJ wire and cable dimensions.

Wire size, AWG	Diameter over shielding insulation, inch (mm)					
	Single		Pair ^{1/}		Triad	
	Nominal	Maximum	Nominal	Maximum	Nominal	Maximum
28	0.044 (1.12)	0.047 (1.19)	0.069 (1.75)	0.074 (1.88)	0.073 (1.85)	0.078 (1.98)
26	0.048 (1.22)	0.051 (1.30)	0.077 (1.96)	0.082 (2.08)	0.081 (2.06)	0.087 (2.21)
24	0.057 (1.45)	0.060 (1.52)	0.091 (2.31)	0.096 (2.44)	0.096 (2.44)	0.101 (2.57)
22	0.062 (1.57)	0.065 (1.65)	0.101 (2.57)	0.106 (2.69)	0.107 (2.72)	0.112 (2.84)
20	0.072 (1.83)	0.075 (1.91)	0.121 (3.07)	0.126 (3.20)	0.128 (3.25)	0.134 (3.40)

^{1/} Major axis

TABLE IX. Part number table for shielded jacketed wire.

Part Number MIS-35755	Manufacturer's designation	Manufacturer's name and location
/1-28SJ	N12-44B-413	New England Electric Wire Corp. 365 Main St. Lisbon, NH 03585
/2-28SJ	N13-44B-439	
/3-28SJ	N13-44B-440	
/1-26SJ	N12-44B-480	<u>Distributor</u> Cooner Wire Co., Inc. 9186 Independence Ave. Chatsworth, CA 91311
/2-26SJ	N13-44B-4536	
/3-26SJ	N13-44B-4537	
/1-24SJ	N12-44B-527	
/2-24SJ	N13-44B-5027	
/3-24SJ	N13-44B-5028	
/1-22SJ	N12-44B-524	
/2-22SJ	N13-44B-5022	
/3-22SJ	N13-44B-5029	
/1-20SJ	N12-44B-605	
/2-20SJ	N13-44B-628	
/3-20SJ	N13-44B-629	

MIS-35755 B

Custodian:

Army - MI

PREPARING ACTIVITY:

U.S. Army Missile Command
Redstone Arsenal-Alabama 35898
ERR MI-H0796

GR 01/31/09
MIS-35755B

Custodian:

Army - MI

Preparing activity:

Army - MI

~~ENGINEERING ORDER~~ ~~REVISION NOTICE~~

B

NOTICE OF REVISION (NOR)
 (SEE MIL-STD-130 FOR INSTRUCTIONS)

SHT. 1 OF 1

This revision described below has been authorized for the document listed.

1. ORGANIZATION NAME AND ADDRESS HUGHES AIRCRAFT COMPANY Electro-Optical & Data Systems Group P.O. Box 902 El Segundo, CA 90245		DATE 89-05-24	MFR. CODE 82577	NO. NO. 85552
2. TITLE OF DOCUMENT WIRE AND CABLE, ULTRA-FLEXIBLE, FEP-FLUOROCARBON INSULATED		3. MFR. CODE 18876	4. DOCUMENT NUMBER MIS-35755	
7. CONFIGURATION ITEM NO. FOR SYSTEM TO WHICH ECP APPLIES		5. REVISION LETTER (Comments) B	6. ECP NO.	
① BFVS/T255 ② ISU13160659 ③ TALL12295910 ④ C-NITE 3239001-131 ⑤ 3239001-132 3239001-134				

8. DESCRIPTION OF REVISION

CORRECTED EFFECTIVITY OF NOR 80569

REF: ECA 560960

WAS:

PSN 4790 & UP

ECR 211620

AUTHORIZATION: ECA 560960-1 CL II	ORG. 79-09	EFFECTIVITY: ① PSN 5176 & UP	DISPOS. OF ITEMS: ② INCORPORATE CHANGE	PRODUCTION CONTROL 05-23-89 C.J. Petersen
PREPARED BY: C.J. Petersen	DAG 79-09	NEXT ASSEMBLY: MULTI USE	TRD. DAG: 89-05-23 R.G. Thompson	TRD. DAG: M.A. Peterson 5-23-89
DATE: 72-24	DAG 79-09	REAL: Langley 05-23-89	MFG. PART: M. M. Odeh 5/23	SYSTEM ENG: Fuller
APPROVED BY: [Signature]	DAG 79-09	PROD. & SUPPLY: [Signature] 5-25-89	PROD. EFF.: NOT REQ'D.	DATE: 11-21-89 89-05-25 O. Williams

9. THIS SECTION FOR GOVERNMENT USE ONLY

A. CHECK ONE

EXISTING DOCUMENT SUPPLEMENTED BY THIS ONE MAY BE USED IN MANUFACTURE.

REVISED DOCUMENT MUST BE RECEIVED BEFORE MANUFACTURE MAY INCORPORATE THIS CHANGE.

CUSTODIAN OF MASTER DOCUMENT SHALL MAKE ABOVE REVISION AND FURNISH REVISED DOCUMENT TO.

B. SECURITY AUTHORIZED TO BE RELEASED FOR GOVERNMENT	SIGNATURE AND TITLE	DATE
C. SECURITY AUTHORIZED TO BE RELEASED	REVISION COMPLETED (SIGNATURE)	DATE