MIL-C-23437E(EC)
9 MARCH 1987

SUPERSEDING
MIL-C-23437D(EC)
22 July 1968

MILITARY SPECIFICATION SHEET

CABLE, SPECIAL PURPOSE, ELECTRICAL

This specification is approved for use within SPACE AND NAVAL WARFARE SYSTEMS COMMAND (EC), Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

NOTE: PVC insulation not to be used in aircraft or aerospace applications.

1. SCOPE

1.1 Scope. This specification covers shielded pairs, polyvinylchloride insulated and jacketed multiconductor cable for use within shore communication stations, not to be used onboard ship.

1.2 Classification. Cables shall be of the following number of pairs as specified (see 6.1):

1 pair
3 pairs
6 pairs
11 pairs
26 pairs
52 pairs
104 pairs

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Space and Naval Warfare Systems Command (ELEX 8111) Washington, DC 20363 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC/NA

FSC 6145

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.2.1 Part number. The part number consists of the letter "M", the basic number of this specification, followed by a dash number taken from Table I.

Example: M23437-026

- 026 — Dash Number
- M23437 — Specification Number

M23437-026 indicates - Cable, Special Purpose, Electrical; 26 Pairs.

TABLE I. DASH NUMBERS

DASH NUMBER	CABLE PAIRS
001	1
003	3
006	6
011	11
026	26
052	52
104	104

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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

SPECIFICATIONS

FEDERAL

A-A-1586 - Tape, Pressure-Sensitive Adhesive (Waterproof)

MILITARY

MIL-C-17/28 - Cables, Radio Frequency, Flexible, Coaxial, 50 OHMS, M17/028-RG058
MIL-I-631 - Insulation, Electrical, Synthetic-Resin Composition, Nonrigid
MIL-C-12000 - Cable, Cord, and Wire, Electric; Packaging of
MIL-W-16878 - Wire, Electrical, Insulated, General Specification For
MIL-W-16878/17 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated, 105° C, 600 Volts, Polyamide Jacket.
MIL-C-39012/16 - Connectors, Plug, Electrical, Coaxial, Radio Frequency, (Series BNC, (Cabled), Pin Contact, Class 2)
MIL-C-39012/21 - Connectors, Coaxial, Radio Frequency (Series BNC (Uncabled) - Receptacles, Female, Jam Nut Mounted, Class II)
MIL-I-45208 - Inspection System Requirements

STANDARDS

FEDERAL

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

MILITARY

MIL-STD-129 - Marking for Shipment and Storage

(Copies of specifications, standards, handbooks, drawings, publications and other Government documents required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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

ASTM

ASTM B33	- Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM D470	- Standard Methods of Testing Crosslinked Insulations and Jackets for Wire and Cable
ASTM D2240	- Rubber Property-Durometer Hardness

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

ASSOCIATION OF AMERICAN RAILROADS

American Association of Railroad Rules and Regulations

(Application for copies should be addressed to the Association of American Railroads, 59 East Van Buren Street, Chicago, IL 60605.)

MUNSELL COLOR CHARTS FOR PLASTIC CABLE AND WIRE

(Application for copies should be addressed to the Munsell Color Company, Inc., 2441 N. Calvert Street, Baltimore, MD 21218.)

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Ratings, Rules and Regulations

(Application for copies should be addressed to Official Classification Committee, 1 Park Avenue at 33rd Street, New York, NY 10016.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.3).

3.2 Material.

3.2.1 Conductor. The conductor shall be number 22 American Wire Gage (AWG) (nominal diameter .0253) tinned solid copper wire in accordance with ASTM B33.

3.2.1.1 Conductor joints. Conductor joints may be brazed using a silver alloy solder and a nonacid flux, or welded. Joints shall be butted and shall be free from lumps and sharp projections. The tensile strength of any section of a brazed or welded conductor joint shall be not less than 85 percent of the tensile strength of an adjacent section without a joint.

3.2.1.2 Conductor resistance. The direct current (d.c.) resistance of each conductor shall not exceed 18.3 ohms per 1,000 foot length when measured at or corrected to 68° Fahrenheit (F).

3.2.2 Insulation material. The insulation material shall be .010 + .004, -.002 inch thick of polyvinylchloride in accordance with MIL-W-16878/17. Over the insulation shall be put a jacket of polyamide material of .003 ± .001 inch thick in accordance with MIL-W-16878. The insulated conductor shall meet all requirements of MIL-W-16878/17 prior to cabling. The water tank test of MIL-W-16878 is not required; heat resistance test and solder test shall be performed on the finished insulated conductor.

3.2.2.1 Color coding of insulation. The color coding of insulation shall be as shown in Table II so as to identify each pair in the completed cable. (NOTE: Spare pair(s) are acceptable for cables of 26 pairs through 104 pairs provided the outside diameter does not exceed that specified in Table III).

TABLE II. COLOR CODING

PAIR NUMBER	COLOR	PAIR NUMBER	COLOR
1	Blue and white (or natural)	28	Green-white (stripe) and white (or natural)
2	Orange and white (or natural)	29	Brown-white (stripe) and white (or natural)
3	Green and white (or natural)	30	Slate-white (stripe) and white (or natural)
4	Brown and white (or natural)	31	Blue-white (stripe) and red
5	Slate and white (or natural)	32	Orange-white (stripe) and red
6	Blue and red	33	Green-white (stripe) and red
7	Orange and red	34	Brown-white (stripe) and red
8	Green and red	35	Slate-white (stripe) and red
9	Brown and red	36	Blue-white (stripe) and black
10	Slate and red	37	Orange-white (stripe) and black
11	Blue and black	38	Green-white (stripe) and black
12	Orange and black	39	Brown-white (stripe) and black
13	Green and black	40	Slate-white (stripe) and black
14	Brown and black	41	Blue-white (stripe) and yellow
15	Slate and black	42	Orange-white (stripe) and yellow
16	Blue and yellow	43	Green-white (stripe) and yellow
17	Orange and yellow	44	Brown-white (stripe) and yellow
18	Green and yellow	45	Slate-white (stripe) and yellow
19	Brown and yellow	46 1/	Blue-white (stripe) and violet
20	Slate and yellow	47	Orange-white (stripe) and violet
21	Blue and violet	48	Green-white (stripe) and violet
22	Orange and violet	49	Brown-white (stripe) and violet
23	Green and violet	50	Slate-white (stripe) and violet
24	Brown and violet	51	Red and white (or natural)
25	Slate and violet	52	Red-white (stripe) and white (or natural)
26	Blue-white (stripe) and white (or natural)	(For 52	
27	Orange-white (stripe) and white (or natural)	or 104	
Spare	Red and Black	pair) 1/	

1/ At the manufacturer's option, pair number (46) and the "Spare" pair may be used to assure the required number of (nondefective) pairs.

3.2.2.1.1 Defective pair(s). Each end of the cable length containing defective pair(s) shall be tagged. The tags shall indicate the specific defective pair(s). For reel marking of length(s) containing defective pair(s) (see 5.3.1).

3.2.2.2 Color standards. The colored insulation shall match the centroid colors as defined in the latest revision of the Munsell Color Charts for Plastic Wire and Cable. The color pigments shall be chosen to yield uniform dielectric constant between colors and shall have no injurious effects on the insulation.

3.2.2.2.1 Insulation striping. All insulation striping shall be such as to provide readily discernible white stripes on the polyvinylchloride insulation. These stripes may be integral of the insulation or the striping may be provided as an external plastic coating on the insulation over which shall be the transparent polyamide jacket or on the surface of the polyamide jacket.

3.2.2.3 Twisting of pairs. The insulated conductors shall be twisted into pairs. The average length of lay in any pair of the finished cable shall be not less than 3 inches or more than 6 inches when measured on any 10-foot length.

3.2.2.4 Shielding of pairs. Each pair shall be shielded with a closely woven braid of number 36 AWG tinned copper wire in accordance with ASTM B33. The shielded coverage of the twisted pair shall be not less than 90 percent when tested as specified in 4.6.2.

3.2.2.4.1 Insulation shielding. Each shielded pair shall be helically wrapped with a double polyester tape, .0005 inch minimum thickness in accordance with Type G of MIL-I-631. Heat sealable (or equal) polyester tape may be used, or an adhesive may be applied between the polyester layers, with an overlap of at least 10 percent. The tape shall not unwrap after the jacket has been removed.

3.2.3 Cable construction. The shielded pair shall be assembled to form a substantially cylindrical core assembled from pairs stranded with various lays to minimize crosstalk. Adjacent layers may be stranded in the same direction or in opposite directions. For 104 pair cable, the cable shall be formed in two 52 pair concentric units or four 26 pair units. The 52 pair cable shall be formed in a single concentric unit or two concentric units or four 13 pair units.

3.2.3.1 Binder tape. For separation, a colored binder tape shall be applied around the center concentric unit for 2 units of the 52 pair cable, around each of the 4 units of the 52 pair cable and around each 26 or 52 pair units for 104 pair cable. The colors of the binding tape shall be readily recognizable. Bindings shall be applied with a lay of not more than 4 inches.

3.2.4 Core covering. The cable core shall be helically wrapped with a single wrap of .003 inch thick maximum polyester tape in accordance with Type G of MIL-I-631. The core covering shall be applied with an overlay of at least 10 percent. This requirement is not applicable for single pair cable.

3.2.5 Jacket material. The jacket material shall be polyvinylchloride, colored slate in accordance with 3.2.2.2, which shall meet the physical (finished cable) requirements outlined in 3.2.5.1 and 3.2.5.2. The cable jacket shall have a hardness of 80 ±5 as determined on a shore durometer Type A, tests specified in ASTM D2240.

3.2.5.1 Tensile strength. The cable jacket shall have a minimum tensile strength of 2000 pounds per square inch when tested in accordance with FED-STD-228 or ASTM D470.

3.2.5.2 Elongation. The cable jacket shall have a minimum elongation of 250 percent when tested in accordance with FED-STD-228 or ASTM D470.

3.2.5.3 Jacket thickness and outside cable diameters. The jacket thickness and outside cable diameters shall be as specified in Table III. The minimum spot thickness of the jacket shall be not less than 70 percent of the specified thickness. The average thickness at any cross section of the jacket material shall be not less than 90 percent of the specified thickness.

TABLE III. JACKET THICKNESS AND OUTSIDE DIAMETERS

NUMBER OF PAIRS	NOMINAL JACKET THICKNESS (INCH)	OUTSIDE DIAMETER (INCHES) +10 PERCENT MAX
1	.015	.166
3	.031	.315
6	.050	.450
11	.060	.565
26	.060	.772
52	.070	1.120
104	.085	1.620

3.2.6 Cable marking. The tape shall be permanently marked and inserted between the jacket and core covering. Single pair tape marking shall be inserted between the jacket and the shield. The footage shall be sequentially marked every 12 inches. The tape shall be marked at least every 24 inches with a dash number taken from Table I.

3.2.6.1 Cable length. Each cable length shall be marked on at least one end with its specific length by an appropriate method.

3.3 Electrical requirements.

3.3.1 Crosstalk. The crosstalk between two adjacent shielded pairs (two single shielded paired cables shall be taped together) of the cable 100 feet in length, with the same direction of cable lay shall be attenuated not less than 45 db and shall be above the general curve shown on Figure 1. The test procedure shall be in accordance with 4.6.5. The test frequencies shall be as follows:

KHZ (kcs)	MHZ (Mcs)	MHZ (Mcs)
	1.0	10
160	1.6	16
400	4.0	40

3.3.2 Continuity. In each length of cable, the conductors shall be free from grounds (contacts between a conductor and shield) short circuits and open circuits. The shield of each pair shall be continuous and free of shorts to any other conductor or shield.

3.3.3 Cold bend. After cables are tested as specified (see 4.6.6), the cable shall withstand the dielectric voltage test and there shall be no evidence of cracks or flaws in either the insulation or the jacket material.

3.3.4 Dielectric withstanding voltage. In each length of completed cable, the insulation between conductors, between conductors and shield and between adjacent shields shall withstand the dielectric dc potential for 3 seconds as follows:

	DC VOLTS
Between conductors	3,600
Between conductors and shield	1,800
Between shields of two adjacent pairs	600

3.3.5 Aging stability. After cables are tested as specified (see 4.6.7), there shall be no evidence of cracks or flaws in either the insulation material or the jacket. After the test, the cable shall meet the dielectric withstanding voltage requirements of 3.3.4.

3.3.6 Patching. The manufacturer's method and practices of making patches to the conductor insulation and cable jacket shall be subject to approval by the procuring activity via the Government inspector. The finished product shall meet all specification requirements. Patching shall be held to a minimum and in no case shall any shipping length contain more than one jacket patch. No build up or patch that cannot be contained in a single mold shall be made.

3.4 Cable put-up. Cable shall be put-up on reels which shall contain lengths as follows (see 5.2.1.1):

a. Put-up for cables having one pair through and including 52 pair shall be:

(1) 85 percent minimum of all cables shall be furnished on reels which contain either 500 or 1000 foot continuous lengths plus or minus 10 percent.

(2) 15 percent maximum of all cables may be furnished in random 100 foot minimum lengths to a maximum of 1100 feet per reel.

b. Put-up for cable having 104 pair shall be:

(1) 85 percent minimum of all cable shall be furnished on reels which contain 500 foot continuous lengths plus or minus 10 percent.

(2) 15 percent maximum of all cable may be furnished in random 100 foot minimum lengths to a maximum of 550 feet per reel.

3.5 Workmanship. Workmanship shall be such that the finished product shall meet all requirements of this specification.

4. QUALITY ASSURANCE PROVISIONS

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

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

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

a. First article inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in MIL-I-45208 and 4.4, 4.5, 4.5.3 and 4.5.4.

4.4 First article inspection. First article inspection shall consist of the tests listed in Table IV. First article approval for any paired cable shall include approval for any smaller paired cable(s). No failures are permitted.

TABLE IV. FIRST ARTICLE INSPECTION

INSPECTION	REQUIREMENT PARAGRAPH	TEST METHOD PARAGRAPH
Visual and dimensional	3.2.1, 3.2.1.1, 3.2.2 thru 3.2.2.3, 3.2.2.4.1 thru 3.2.5, 3.2.6, 3.2.6.1 and 3.3.6 thru 3.5	4.6.1, 4.6.2
Conductor resistance	3.2.1.2	4.6.3
Shielding of pairs	3.2.2.4	4.6.2
Tensile strength	3.2.5.1	FED-STD-228 or ASTM D470
Elongation	3.2.5.2	FED-STD-288 or ASTM D470
Jacket thickness and outside cable diameters	3.2.5.3	4.6.1
Crosstalk	3.3.1	4.6.5
Continuity	3.3.2	4.6.3
Cold bend	3.3.3	4.6.6
Dielectric withstanding voltage	3.3.4	4.6.4
Aging stability	3.3.5	4.6.7

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the tests specified in 4.5.3 and 4.5.4.

4.5.1 Inspection lot. All cable of the same number of pairs offered for delivery at one time, shall be considered a lot for purposes of sampling and inspection. Quantities of cable which might be delivered against two or more contracts may be combined into one lot for purposes of sampling if produced at the same time.

4.5.2 Unit of product. The unit of product shall be considered as cable having the same number of pairs and length or lengths which have a total length of approximately 500 or 1000 feet.

4.5.2.1 Sample. The sample shall consist of that number of sample units required by the sampling plan for the lot size determined in 4.5.1.

4.5.3 Group A inspection. The Group A inspection shall consist of the tests shown in Table V.

TABLE V. GROUP A INSPECTION

INSPECTION	REQUIREMENT PARAGRAPH	TEST METHOD PARAGRAPH
Subgroup I		
Visual and dimensional	3.2.1, 3.2.1.1, 3.2.2 thru 3.2.2.3, 3.2.2.4.1 thru 3.2.5, 3.2.6, 3.2.6.1 and 3.3.6 thru 3.5	4.6.1, 4.6.2
Jacket thickness and outside cable diameters	3.2.5.3	4.6.1
Subgroup II		
Continuity	3.3.2	4.6.3
Conductor resistance	3.2.1.2	4.6.3
Dielectric withstanding voltage	3.3.4	4.6.4

4.5.3.1 Sampling for Group A, Subgroup I inspection. A sample shall be selected in accordance with Table VI for Subgroup I inspection of Table V. Within each sample, the insulated conductors shall be selected in accordance with Table VII.

TABLE VI. SAMPLING FOR GROUP A, SUBGROUP I INSPECTION

LOT SIZE NUMBER OF UNITS (REELS) OF CABLE	SAMPLE REELS TO BE INSPECTED	ACCEPTANCE NUMBER	REJECTION NUMBER
1 to 13	All	—	—
14 to 25	13	0	1
26 to 62	20	1	2
63 to 160	32	1	2
161 to 410	50	2	3

TABLE VII. SAMPLING FOR GROUP A, SUBGROUP II AND MEASUREMENT OF COLOR PAIR TESTS

PAIRS IN CABLE	PAIRS TO BE TESTED
1	1
3	3
6	6
11	7
26	10
52	15
104	20

4.5.3.2 Sampling for Group A, Subgroup II pair tests. In every length of finished cable, tests shall be performed on the number of pairs specified in Table VII. Each of the selected pairs shall be subjected to Subgroup II tests of Table V. If any pair fails in any tests, the entire length of cable shall be rejected. The same pair on the adjacent reels shall be subjected to the same test in which failure occurred.

4.5.3.2.1 Sampling for measurement of colors. In each selected cable length (see 4.5.3.1) pairs shall be selected at random in accordance with Table VIII for verification of the color in accordance with 3.2.2.2 by comparison with Munsell color cards. The number of pairs on one end of the cable, so examined shall be the same as specified in 4.5.3.1. If any pair is found not having color as specified, every pair in that specific length shall be compared with the Munsell color card. Also, the reels of cable preceding and following shall be examined to determine the extent of incorrect coloring. If the color insulation does not conform to 3.2.2.2 the cable shall be rejected.

4.5.4 Group B inspection. The Group B inspection shall consist of the test shown in Table VIII. Samples of the completed cable shall be inspected in accordance with 4.5.4.1. For crosstalk tests, the number of pairs within the cable sample shall be tested in accordance with 4.5.4.2 and the test results shall be computed in accordance with Table IX to determine acceptance.

TABLE VIII. GROUP B INSPECTION

INSPECTION	REQUIREMENT PARAGRAPH	TEST METHOD PARAGRAPH
Crosstalk	3.3.1	4.6.5

4.5.4.1 Sample units for Group B inspection. Cable units shall be selected as shown in Table IX for the inspection of 4.5.4.

TABLE IX. SAMPLING FOR GROUP B INSPECTION

LOT SIZE, FEET OF CABLE	NUMBER OF CABLE UNITS FOR TESTS REQUIRED	FAILURES ALLOWED	REJECTION NUMBER 1/
Up to 17,000	3	0	1
17,001 to 35,000	4	0	1
35,001 to 70,000	5	0	1
70,001 to 140,000	7	0	1
140,001 to 280,000	10	1	2
280,001 to 560,000	14	1	2
560,001 to 1,120,000	20	2	3
1,120,001 to 2,240,000	28	3	4

1/ The lot shall be rejected if the number of cable failures is equal to or exceeds the rejection number of cable units indicated herein.

4.5.4.2 Sampling for Group B pair tests. The number of pairs to be tested shall be selected in accordance with table X: (See 4.5.4.1 to determine whether the sample lot is accepted.)

TABLE X SAMPLING FOR GROUP B PAIR TESTS

NUMBER OF PAIRS IN ASSEMBLED CABLE	NUMBER OF RANDOM PAIR COMBINATIONS OF CROSSTALK REQUIRED	ACCEPTANCE NUMBER 1/	REJECTION NUMBER
104	20	2	3
52	15	2	3
26	10	1	2
11	5	0	1
6	3	0	1
3	2	0	1
1	1	0	1

1/ A failure is defined as a pair faulted to one or more adjacent pairs.

4.5.5 Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot, rework it to correct the defects or screen out the defective units, as applicable, and reinspect. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots. Rejected lots shall be inspected using tightened inspection; the sample size shall be the sample shown in Table VI and Table IX for the next larger lot size for the applicable test.

4.5.6 Noncompliance. If a sample fails to pass Group A or B inspection, the manufacturer shall notify the qualifying 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 with 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, acceptable to the qualifying activity has been taken. After the corrective action has been taken, Group A or B inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted; however, final acceptance and shipment shall be withheld until the Group A or B 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 and the qualifying activity.

4.6 Test procedures.

4.6.1 Visual and dimensional examination. A 3-foot length of cable cut from one end of the sample shall be examined to verify color coding, material striping (if applicable) marking and jacket thickness and outside diameter are in accordance with the applicable requirements. The cable shall be examined for jacket imperfection on all of the surface which is visible without unwinding the cable from the reel.

4.6.2 Shielding coverage. The shielding shall conform to 3.2.2.4 and shall be determined by the following formula:

$$K = (2F - F^2) \times 100$$

Where:

K = Percent coverage.

a = Angle of braid with axis of cable.

$$\text{Tan } a = \frac{2\pi (D + 2d) P}{C}$$

d = Diameter of individual braid wire, in inches.

C = Number of carriers.

D = Effective diameter of cable under shield, in inches.

$$F = \frac{NPd}{\text{Sin } a}$$

N = Number of wires per carrier.

P = Picks per inch of cable length.

4.6.3 Conductor resistance and continuity tests. The conductor resistance and continuity tests shall be measured to determine conformance with 3.2.1.2 and 3.3.2.

4.6.4 Dielectric. The cable shall be subjected to a dielectric test to determine conformance with 3.3.4. All connections to the shield of the shielded pairs shall be made to the shield.

4.6.5 Crosstalk test. This test determines the crosstalk between adjacent individual pairs within the same cable or between two single paired cables. A known signal voltage shall be fed into a shielded pair and the voltage induced into an adjacent pair is determined to be the crosstalk of that cable pair.

4.6.5.1 Equipment required. The equipment required shall be:

a. 50 ohm output signal source from 160 kilohertz to 40 megahertz.

b. Any 50 ohm input receiver capable of measuring to the required limits specified.

c. Other types of terminations may be used in lieu of miniboxes such as coaxial type fittings.

4.6.5.2 Equipment set-up. The equipment set-up shall be as follows:

a. Figure 2 shows the equipment connected for calibration of the receiver. The signal generator and the receiver are connected by a very short length of RG-058 cable as specified in MIL-C-17/28. Connectors MIL-C-39012/16-0101, conforming to MIL-C-39012/16, are assembled to the cable ends. The connectors, MIL-C-39012/21-0001 conforming to MIL-C-39012/16, with backshells shown in Figure 2, are used to facilitate connections between the lines to be tested and the test equipment. Extreme care shall be used in maintaining continuity between the cable shields and the backshells.

4.6.5.3 Crosstalk test. The crosstalk test between two shielded pairs within the same cable shall be tested as indicated herein (see Figure 2). The cable shall meet the crosstalk requirement of 3.3.1.

a. Set the signal generator to a high output level of at least 1 volt and adjust the input attenuator of the receiver to a reference output reading. This reading should be recorded and the output level of the signal generator should remain the same throughout the test.

b. Remove the receiver and terminate the signal generator with a 50 ohm resistive load.

c. Connect the shielded pair (which is adjacent to the other shielded pair in the cable under test) to the receiver (see Figure 2).

d. Adjust the receiver attenuator for the same reading as indicated in step a. The difference in the attenuator readings is the crosstalk in decibels which shall conform to 3.3.1.

4.6.6 Cold bend test. The cold bend test shall be performed in the following manner:

4.6.6.1 Specimens. For cables with an overall diameter of less than .500 inch, the test specified in 4.6.6.2 shall be conducted on three specimens of cable; the length of each specimen shall be at least 150 times the diameter. For cable of .500 inch and greater nominal diameter, the test specified in 4.6.6.2 shall be conducted on two specimens of cable; the length of each specimen shall be at least 120 times the diameter of the cable.

4.6.6.2 Procedure. One end of the test specimen shall be clamped circumferentially at two points, approximately 45 degrees apart, to a mandrel whose diameter is 10 times that of the test specimen. The specimen shall be wrapped around the mandrel for one full turn. The mounted specimen shall then be conditioned for 20 hours at $-40^{\circ} \pm 2^{\circ}$ C except for cable .250 inch overall nominal diameter and smaller which shall be conditioned for 20 hours at $-50^{\circ} \pm 2^{\circ}$ C. During this conditioning period, the specimens shall be kept reasonably straight. After this conditioning, but while the specimens are still in the cold chamber at the conditioning temperature, the specimens shall

be wrapped for three close turns (two close turns for cables having a diameter .500 inch and greater) around the mandrel at a uniform rate of 15 $\pm$3 revolutions per minute, preferably by means of an electrically driven motor. The cable shall be guided by a free moving sheave or transversing device in intimate contact with the cable at the initial point of bend. The cable shall be removed from the cold chamber and shall satisfactorily meet the dielectric withstanding voltage requirement of 3.3.4. The cable shall then be visually examined for evidence of cracks or flaws in the insulation material or jacket.

4.6.7 Aging stability. The cable shall meet the aging stability test unless otherwise specified. Specimens of the cable shall be duplicates of those specified in 4.6.6.1. The specimens shall be suspended in a test oven at the test temperature without touching one another or the walls of the oven. Heated air at atmospheric pressure shall be circulated so as to maintain a uniform temperature of 98° $\pm$2° C in the oven. The specimens shall be conditioned for a period of 7 days. After this conditioning period, the specimens shall be removed from the oven and conditioned at room temperature for a minimum of 4 hours. They shall then be subjected to the cold bend test specified in 4.6.6, except that the conditioning and test temperature shall be -25° $\pm$2° C.

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

5. PACKAGING

5.1 Packaging requirements. Packaging requirements for domestic shipment for early cable installation are as follows (see 6.2.1):

5.1.1 Packaging. The cable shall be shipped on reels. The diameter of the drum shall be large enough to prevent damage to the cable from reeling or unreeling. The reels shall be substantial and so constructed as to prevent damage to the cable during shipment and handling. The ends of the cables shall be sealed as specified in 5.2.1.1.1.. The cable shall have both ends brought out so that cable can be readily tested without unreeling.

5.1.2 Packing. Packing of reels shall be accomplished in a manner which will insure acceptance by common carrier and will afford protection against physical and mechanical damage during direct shipment from the supply source to the using activity for early installation. The method of packing or loading shall conform to the Association of American Railroads Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

5.1.3 Marking. Shipment marking information shall be provided on both flanges of each reel in accordance with the contractor's commercial practice. The information shall include the following:

a. Description/part number

b. National Stock Number

c. Contract or order number

d. Contractor's name

Where paper labels are used containing the shipment marking information, labels shall be protected by transparent compound to prevent deterioration of the markings.

5.2 Packaging requirements for domestic shipment and storage or overseas shipment. The requirements and levels of preservation, packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.2.1).

5.2.1 Levels of protection. The following provides various levels of protection during domestic shipment and storage or overseas shipment, which may be required when procurement is made by a government activity (see 6.2.1).

5.2.1.1 Level A. Cables shall be furnished on nonreturnable reels which shall contain lengths as specified in 3.4. The 100 feet of cable samples which have satisfactorily passed the crosstalk tests shall be furnished provided that the footage is properly tagged to the cable and marked on the reel. The cable length(s) shall have both ends brought out so that cable can be readily tested without unreeling. The reels shall be constructed with flanges of sufficient thickness to protect the cable from damage during handling, shipment and storage. The diameter of the reel core shall be not less than 20 times the diameter of the cable.

5.2.1.1.1 End seals. The ends of the cable shall be sealed in accordance with MIL-C-12000 or with pressure sensitive tape conforming to A-A-1586 applied over the ends and back from the ends by approximately 4 inches.

5.2.1.1.2 Lagging. Reels shall be closed with wooden lagging. Lagging shall be 2 inch commercial lumber and shall be strapped with a minimum of 2 straps, 1 inch wide. Straps shall be stapled at intervals in accordance with the contractor's commercial practice. A minimum clearance of one cable diameter shall be provided between the inner face of the lagging and cable. The lagging shall be cut even with the outside of the reel flanges nailed with cement coated steel nails.

5.2.1.2 Packing. Packing shall be levels A and B as specified (see 6.2.1).

5.2.1.2.1 Levels A and B. Cable packaged as specified in 5.2.1.1 shall not require overpacking. The method of packing or loading of reels shall be accomplished in a manner which will insure acceptance by carrier and will

afford protection against physical or mechanical damage during shipment from the supply source to the using activity. The method of loading shall conform to the American Association of Railroads Rules Governing the Loading of Commodities and the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation.

5.3 Marking.

5.3.1 Special marking. In addition to any special marking required by the contract or order, both flanges of each reel shall be marked in accordance with MIL-STD-129 and with the following information:

Reel number	Length and location of each piece in feet for reels of multi-lengths.
Number of pairs in cable	
Date of manufacture	Specific defective pair and cable length (if applicable).

5.3.2 Metal tags, stencils or paper labels. Where practicable, metal tags, stencils or paper labels containing the information specified in 5.3.1 shall be securely attached to the reels. Where paper labels are used, they shall be securely attached and protected by a transparent compound to prevent deterioration of the markings.

6. NOTES

6.1 Intended use. Cables covered by this specification are intended for use within shore communication stations, not onboard ship.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.

b. Part number (see 1.2.1).

c. Number of feet of cable on each reel (see 3.4).

d. Packaging, packing and marking requirements other than those required by 5.1 (see 5.2).

6.3 First article. When a first article inspection is required, the item should be a standard production item from the contractor's current inventory. The first article should consist of one unit, a total length of approximately 500 or 1000 feet. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.3.1 First article approval. First article approval for any pair cable may include any smaller paired cable(s) in multiple procurement.

6.4 Conditions for use of level B preservation. When level B preservation is specified, this level of protection should be reserved for the acquisition of (name of commodities) for resupply worldwide under known favorable handling, transportation and storage conditions.

6.5 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Navy - EC

Preparing Activity:
Navy - EC

Agent:
DLA - IS

Review activities:

User activities:

(Project 6145-N312)

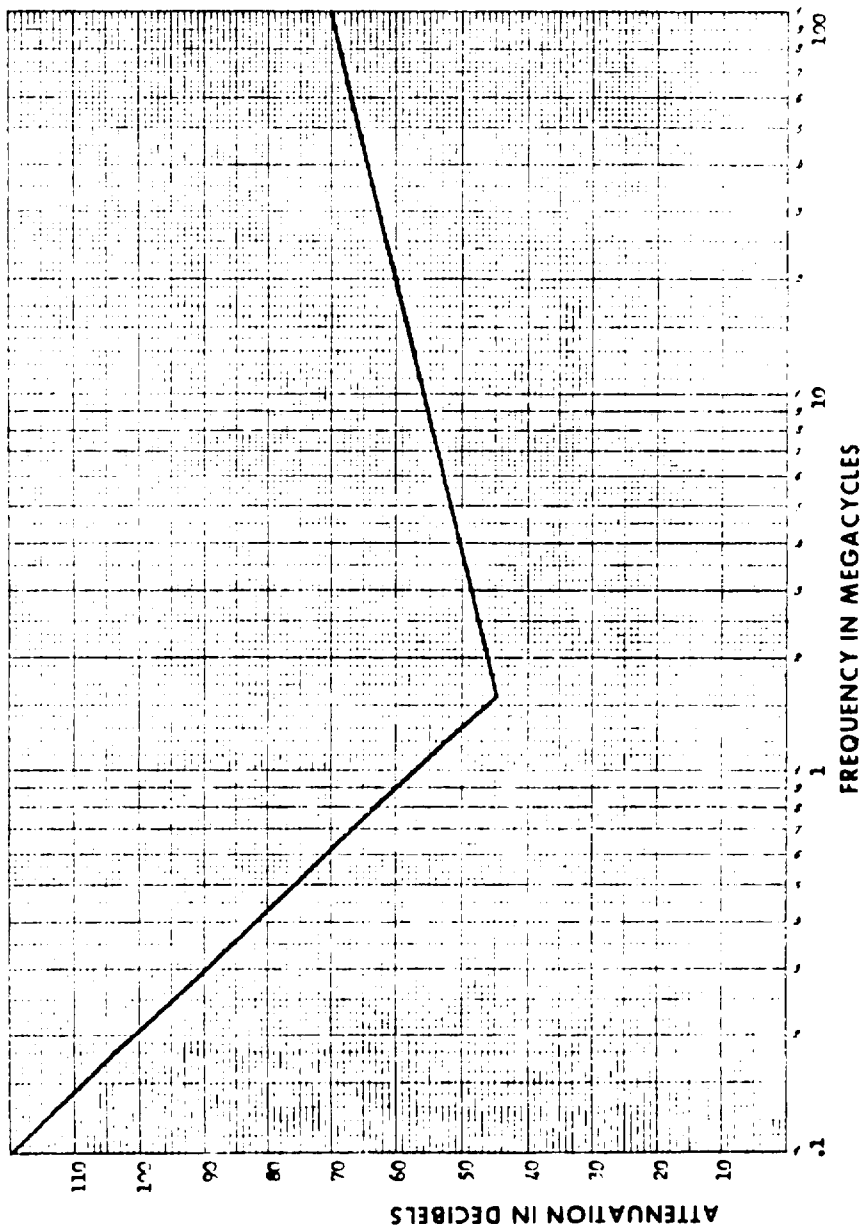

FIGURE 1. CABLE CROSSTALK TEST

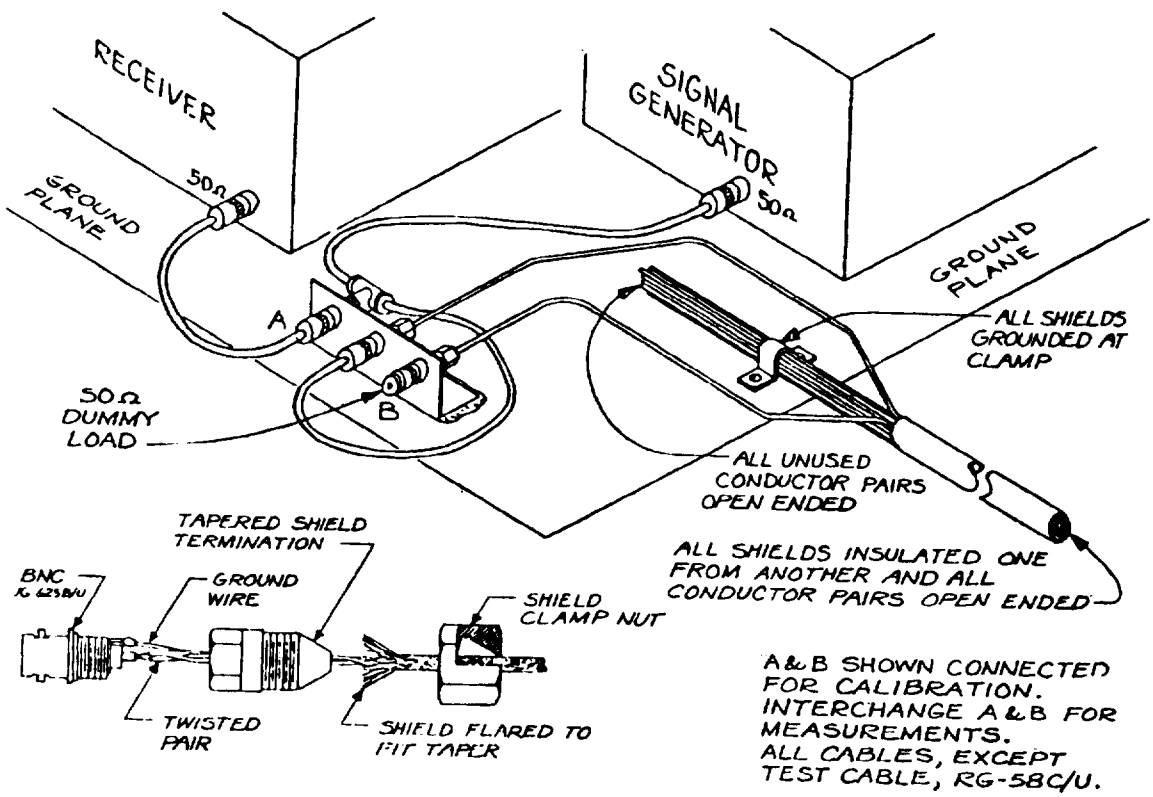

FIGURE 2. SETUP FOR CROSSTALK TESTS

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification 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.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE NAVY

SPACE AND NAVAL WARFARE SYSTEMS COMMAND
WASHINGTON, D.C. 20363-5100

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 12503 WASHINGTON D C

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE NAVY

COMMANDER
SPACE AND NAVAL WARFARE SYSTEMS COMMAND
ATTN: SPAWAR 003-121
WASHINGTON, DC 20363-5100

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-C-23437E(EC)	CABLE, SPECIAL PURPOSE, ELECTRICAL

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.