INCH - POUND
MIL-C-28840A
AMENDMENT 6
5 May 2000
SUPERSEDING
AMENDMENT 5
5 August 1993

MILITARY SPECIFICATION

CONNECTORS, ELECTRICAL, CIRCULAR THREADED, HIGH DENSITY, HIGH SHOCK SHIPBOARD, CLASS D, GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-C-28840A, dated 26 May 1981, and is approved for use by the Space and Naval Warfare Systems Command, Department of The Navy, and is available for use by all Departments and Agencies of the Department of Defense.

PAGE 1

1.2.1, Backshell Designator: Add “Size” after “Backshell”.

PAGE 2

TABLE I, column 2, class code B: Delete “High Impact” and substitute “High Impact Shock”.

TABLE I, column 6: delete “Ranges” and substitute “Rings”.

TABLE I, column 6, class codes B and E: Delete “Carbon” and substitute “Corrosion.”

PAGE 3

1.2.1.4, delete and substitute:

“1.2.1.4 Contact styles. The following designators identify the various contact styles.

a. Connectors ordered with standard contacts as indicated in MIL-STD-1698.

P - Pin Contacts	-20-22	(see MIL-C-39029/83-450)
S - Socket Contacts	-20-22	(see MIL-C-39029/84-452)
D - Pin Contacts	-20-28	(see MIL-C-39029/83-451)
E - Socket Contacts	-20-28	(see MIL-C-39029/84-453)
F - Pin Contacts	-20-20	(see MIL-C-39029/83-508)
G - Socket Contacts	-20-20	(see MIL-C-39029/84-509)

The P, S, D, E, F, and G designators are used to indicate that the connectors will be used with full complements of the applicable standard contacts as indicated in MIL-STD-1698. The connectors that accommodate crimp removable contacts (P, S, D, E, F, or G) may be ordered without standard contacts by adding an appropriate note on the purchase order. The connector part numbers and the marking requirements remain unchanged.

b. Connectors used with other than standard contacts as indicated in MIL-STD-1698.

A - Less pin contacts
B - Less socket contacts

The A or B designators are used to indicate that the connectors will be used with other than standard contacts as indicated in MIL-STD-1698. (Example: Shielded, coaxial, thermocouple, fiber optic. . . contacts). The A or B designators are part of the connector part number and shall be marked on the connector. The connector will be supplied without contacts. The contacts that will be used with the connectors should be ordered separately (see 3.4.1.1.1 and 6.2).

NOTE: When A and B designators are used, the requirements stated herein may not be met."

1.2.1.5, delete "key way" and substitute "keyway".

1.2.1.6, title and first sentence: add "size" after "Backshell".

PAGE 5

1.2.4, delete paragraph in its entirety.

1.3, delete "rnage and substitute range". Delete "connectors" and substitute "contacts".

TABLE III, footnote 1/, delete and substitute: "1/ In accordance with MIL-C-24643 and MIL-W-16878."

2.1, under specifications, military, delete "MIL-C-915 - Cable and Cord, Electrical for Shipboard Use, General Specification for."

PAGE 6

2.1, delete: "MIL-J-5624" and substitute "MIL-T-5624".

2.1, after MIL-L-23699, add the following:

"MIL-C-24643 - Cable and Cord, Electrical, Low Smoke for Shipboard Use, General Specification for."

PAGE 7

2.1, under standards, military, delete
"MIL-STD-1698 - Insert arrangements for MIL-C-28840 High Density, High Shock, Circular, Electrical Connectors" and substitute
"MIL-STD-1698 - Insert Arrangements for MIL-C-28840 (EC) High Density, High Shock, Circular Electrical Connectors."

2.1, add the following standards:

"MS3186 - Connector Mounting Nuts, Plain Hexagon.

MS9068 - Pack, Preformed - AMS 3304, O Ring (Ags)."

3.3.4.1, delete "glass filled epoxy".

3.3.4.1.1, delete and substitute:

"3.3.4.1.1 Resilient materials. Resilient materials shall be silicone or fluorosilicone and have the shore A durometer specified as follows:

Pin insert face	70 ± 5
Socket insert	70 ± 5
Gaskets	40 ± 5
Grommets	50 ± 5
O - Rings	60 ± 5
Wire separator	70 ± 5

PAGE 8

3.3.5b, delete and substitute:

"b. Non-magnetic corrosion-resisting steel in accordance with QQ-S-763, class 316 series."

3.4, delete "Key Way" and substitute "Keyway".

3.4.1, line 2: Delete "nor" and substitute "or".

After 3.4.1.1, add the following new paragraph:

"3.4.1.1.1 Indirect shipment. Environment resisting connectors may be ordered without contacts (see 1.2.1.4b and 6.2)."

3.4.2, delete and substitute:

"3.4.2 Insert design and construction. The entire insert and wire sealing or wire support member of the insert assembly shall be of one integral part, designed to provide sealing and support around the wires. The entire insert shall be nonremovable from the shell and shall be keyed, bonded, and secured so as to prevent rotation or movement within the shell. The rigid dielectric shall be one molded piece or no more than two pieces bonded to form essentially one molded piece. Inserts shall be of voidless construction, eliminating all air paths between contacts."

PAGE 9

FIGURE 3, RECEPTACLE: Delete " | ® | E | C | .008 | " and substitute " | ⊕ | E | C | .008 | ".

PAGE 10

FIGURE 3, title: Delete and substitute:

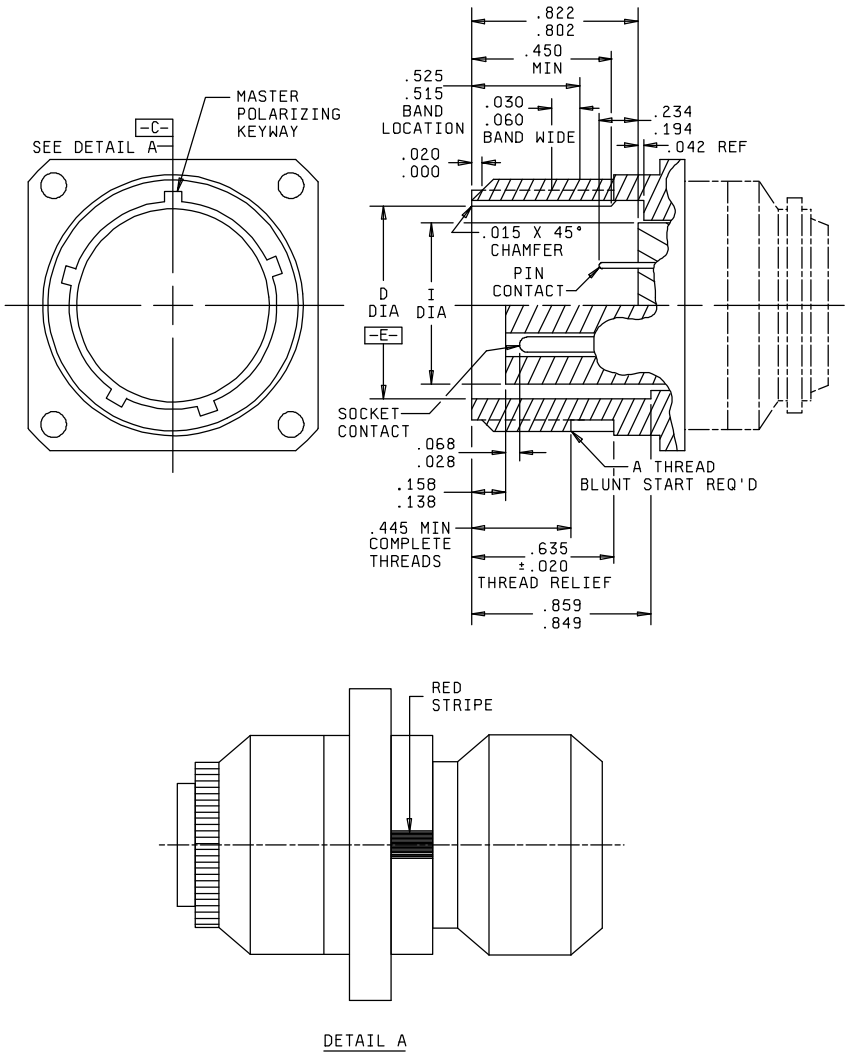
"FIGURE 3. Connector, electrical, position key and keyways, mating - Continued."

PAGE 11

FIGURE 4, add to vertical centerline the datum feature symbol " -B- ".

FIGURE 5, delete and substitute:

“



Inches	mm	Inches	mm	Inches	mm	Inches	mm
.015	0.38	.042	1.07	.194	4.93	.525	13.34
.020	0.52	.060	1.52	.234	5.94	.635	16.14
.028	0.71	.068	1.73	.445	11.31	.802	20.37
.030	0.76	.138	3.51	.450	11.43	.822	20.88
.040	1.03	.158	4.01	.515	13.08	.849	21.56
						.859	21.82

FIGURE 5. Connector, receptacle, electrical, interface dimensions.”

PAGE 14

FIGURE, column “B MIN. THREAD”: Delete in its entirety.

PAGE 15

FIGURE 6, wire seal grommet dimension: Delete “.190, .130” and substitute “.190, .145”.

PAGE 16

FIGURE 6, title, delete and substitute:

“FIGURE 6. Connector back-end configuration - Continued.”

PAGE 17

FIGURE 7, accessory thread length dimension: Delete “.233/.223” and substitute “.238/.218”.

PAGE 20

FIGURE 9, under designation, pitch column, thread size .7500: Delete “1.1” and substitute “.1”.

PAGE 21

3.4.2.6, line 2: Delete “enceed” and substitute “exceed”.

After 3.4.4.3, add the following new paragraph:

“3.4.4.4 Jam (panel) nut. The panel nut for M28840/14 connectors shall be as specified in the specification sheet. MS3186 may be used for procurement of spare panel nuts. Panel nuts supplied with M28840 do not require bayonet clearance slots.”

PAGE 22

3.4.5.3, last sentence: Delete “peropheral” and substitute “peripheral”.

3.4.6.1, first sentence: Delete “unused” and substitute “unwired”.

3.4.7, last sentence: Delete “and shall be fabricated of 100 percent fluorosilicone.”

3.11, title: Delete and substitute “High Impact Shock.”

3.12, add at the end of the sentence: (see 4.6.8).”

PAGE 23

3.14, title: Delete and substitute “Salt spray (corrosion).”

3.15.1, title: Delete and substitute “At ambient temperature.”

3.16, delete and substitute:

“3.16 fluid immersion. When tested as specified in 4.6.12, the connectors shall meet the requirements for coupling torque (see 3.28) and dielectric withstanding voltage (see 3.9).”

3.18, title: Delete and substitute "Humidity." Line 3, delete "moisture resistance" and substitute "humidity."

3.23, title: Delete and substitute "Maintenance age (contact installing and removal forces)."

3.24, title: Delete and substitute "EMI shielding."

3.24, delete "shells" and substitute "connectors".

PAGE 24

3.25, delete and substitute:

"3.25 Impact. When connector plugs with MIL-C-28840 straight strain relief clamps and protective covers are tested as specified in 4.6.20, there shall be no breaking or cracking of inserts, bending of pins or any other damage which prevents the connectors from being mated or renders them unfit to continue further testing. Any chipping of the inserts which affects its polarization or retention in the shell shall be considered a failure."

3.26.1.3, title and first sentence: Delete "insulating spacers" and substitute "wire separator".

After 3.26.1.4, add the following new paragraph:

"3.26.1.5 Receptacle shell. The receptacle shell shall be marked with a red stripe directly above the master keyway to help align the plug and receptacle prior to mating as shown on figure 5. A red band shall also be placed on the shell in such a manner that it will just be covered by the coupling ring when the connector is fully mated to insure a full mate. The location of the fully mated indicator band and master polarizing keyway stripe shall be as shown on figure 5."

3.27, delete "galling or mating parts" and substitute "galling of mating parts".

After 3.27, add the following new paragraph:

"3.28 Coupling torque. When tested as specified in 4.6.23, the coupling torque for mating of the counterpart connectors and protective covers shall meet the requirement of table IV-A.

TABLE IV-A. Coupling Torque.

Shell size	Maximum engagement and disengagement (lb-in)
A (11)	12
B (13)	16
C (15)	20
D (17)	24
E (19)	28
F (23)	36
G (25)	40
H (29)	47
J (33)	53

"

After 3.28, add the following new paragraph:

"3.29 Change effectivity. The manufacturers and distributors are allowed 6 months from the date of this specification for depletion of stock."

4.1, line 5: Delete "disapproval" and substitute "disapproved".

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4.3.1, line 8: Delete "receptacle boxing mounting,".

4.3.1, before last sentence, add the following:

"Box mount receptacle shell sizes will be tested to groups 1, 2, 3, and 4 of table V, except for those tests requiring moisture or fluid sealing and rear accessory hardware. One sample in each shell size for which qualification is desired shall be tested in accordance with MIL-C-28840, table V, group 5."

4.3.2, line 7: Delete "mot" and substitute "not".

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TABLE V, groups 1 and 2:

Group 1, inspection column: Delete "Visual and mechanical" (2 places) and substitute "Visual and mechanical examination" (2 places).

Group 1, inspection column: Delete "Contact installing and removal" and substitute "Maintenance aging".

Group 1, inspection column: Delete "Contact stability" and substitute "Pin contact stability".

Group 1, inspection column: Delete "Insulation resistance" and substitute "Insulation resistance at ambient temperature".

Group 1, inspection column: Delete "Moisture resistance" and substitute "Humidity".

Group 1, following the humidity test, add "Coupling torque" with associated references "3.28" and "4.6.23."

Group 1, inspection column: Delete "Corrosion" and substitute "salt spray (corrosion)".

Group 1, following the salt spray (corrosion) test, add "Coupling torque" with associated reference "3.28" and "4.6.23."

Group 2, inspection column: Delete "Visual and mechanical" (2 places) and substitute "Visual and mechanical examination" (2 places).

Group 2, inspection column: Delete "Insulation resistance" and substitute "Insulation resistance at ambient temperature".

Group 2, inspection column: Delete "Insulation resistance (long time)" and substitute "Insulation resistance at elevated temperature" with associated references "3.15.2" and 4.6.11.3".

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TABLE V, groups 3 through 6:

Group 3, inspection column: Delete “Visual and mechanical” (2 places) and substitute “Visual and mechanical examination” (2 places).

Group 3, inspection column: Dielectric withstanding voltage, test column: Delete “4.6.5.2” (2 places) and substitute “4.6.5.1” (2 places).

Group 3, inspection column: Delete “Insulation resistance” and substitute “Insulation resistance at ambient temperature”.

Group 4, inspection column: Delete “Visual and mechanical” (2 places) and substitute “Visual and mechanical examination” (2 places).

Group 4, Dielectric withstanding voltage, test column: Delete “4.6.5.2” and substitute “4.6.5.1”.

Group 4, inspection column: Delete “Moisture resistance” and substitute “Humidity”.

Group 4, inspection column: Delete “Corrosion” and substitute “salt spray (corrosion)”.

Group 4, inspection column: Delete “Drop Test” and substitute “Impact”.

Group 5, inspection column: Delete “Visual and mechanical” (2 places) and substitute “Visual and mechanical examination” (2 places).

Group 5, inspection column: Delete “Shock” and substitute “High impact shock”.

Group 5, inspection column: Delete “Moisture resistance” and substitute “Humidity”.

Group 5, inspection column: Delete “Corrosion” and substitute “Salt spray (corrosion)”.

Group 6, inspection column: Delete “EMI” and substitute “EMI shielding”.

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4.3.2.2.1, line 1: Delete “Two connectors of each class” and substitute “Two mating connectors”.

4.3.2.2.2, line 1: Delete “One connector” and substitute with “One mating connector”.

4.3.2.2.3, line 1: Delete “Twelve” and substitute “Eleven”.

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TABLE VI, delete and substitute:

"TABLE VI. Test cable and accessory size.

Designator 1 /	M24643 Cable	M28840/6 Backshell	M28840/5 Adapter	M28840/4 Conduit 2 /	Tensile Load (pounds)
A (11)	/52-02UN	-01WB	-01WB	-03BE	50
B (13)	/52-03UN	-03WB	-02WB	-03BE	50
C (15)	/45-01U0	-06WB	-05WB	-04BE	50
D (17)	/45-02U0	-08WB	-08WB	-05BE	50
E (19)	/45-03U0	-11WB	-11WB	-05BE	75
F (23)	/45-04U0	-13WB	-14WB	-06BE	75
G (25)	/45-05U0	-16WB	-18WB	-08BE	75
H (29)	/45-06U0	-20WB	-21WB	-10BE	100
J (33)	/31-09UN	-23 WB	-24WB	-16BE	100

1/ Shell sizes are provided within parentheses for information and are not a part of the designator.
2/ BC or BE type designators are acceptable."

4.4.2, line 2: Delete "yhe" and substitute "the".

PAGE 30

TABLE VII, inspection column: Delete "Insulation resistance" and substitute "Insulation resistance at ambient temperature."

4.4.2.2.1, line 2: Delete "normal" and substitute "special".

4.4.2.2, table VII, group B: Delete "Insulation resistance" and substitute "Insulation resistance at ambient temperature".

4.5.1.1, add the following at the end of the paragraph: "When a manufacturer is qualified in all shell sizes, the group C inspection shall be performed on three sizes, one each of small, medium, and large. They shall be selected such that after three consecutive group C inspections, all shell sizes shall have been inspected."

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TABLE VIII, inspection column: Delete "contact installing and removal" and substitute "Maintenance aging (contact installing and removal)".

TABLE VIII, inspection column: Delete "Moisture resistance" and substitute "Humidity".

TABLE VIII, inspection column: Delete "Corrosion" and substitute "Salt spray (corrosion)".

TABLE VIII, inspection column; Delete "Visual and mechanical" and substitute "Visual and mechanical examination".

4.5.1.2, delete and substitute:

"4.5.1.2 Connectors. Sample connectors shall consist of four mating plugs and receptacles in small, medium, and large shell size. Two mating connectors in small, medium, and large shell size shall be subjected to the tests of table VIII, group 1, and the remaining mating connectors shall be subjected to group 2."

4.5.1.5, line 5: Delete "dincontinued" and substitute "discontinued".

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4.6.4, delete and substitute:

"4.6.4 Contact retention. A minimum load of 20 pounds shall be applied to individual contacts. The connector shall have all contacts in place during the test. The load shall be applied at a rate of approximately 1 pound per second until the specified load has been reached. Twenty percent of the contacts in each connector shall be tested (see 3.8), except when testing under table V, group 3, where only 10 percent shall be tested. Connectors shall be tested with the accessory removed prior to the test and loads shall be applied from the mating end of the contacts. The load shall be applied after the slack in the contact has been taken up and the displacement of the contacts shall be measured under load after the load has been applied for a minimum period of 5 seconds. Remove and reinsert the contacts using the tools specified in 3.4.1.2. The contacts shall be retained in the connector (see 3.8)."

4.6.5.1, add at end of the paragraph: "(see 3.9)."

4.6.6, line 5: Delete "locking" and substitute "coupling".

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4.6.7, line 11: Delete "locking" and substitute "coupling".

4.6.8, delete paragraph in its entirety.

4.6.9.1, second sentence: delete "corrosion" and substitute "salt spray" in two places.

4.6.10, title: Delete and substitute "Salt Spray (corrosion) (see 3.14)."

4.6.10.1, title: Delete and substitute "Salt spray (corrosion)."

4.6.10.2, title: Delete and substitute "Salt spray (corrosion)."

4.6.11.1, title: Delete and substitute "Insulation resistance (see 3.15)."

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4.6.11.2, title: Delete "Insulation resistance at room temperature" and substitute "Insulation resistance at ambient temperature."

4.6.11.3, add at the end of paragraph: "(see 3.15.2)."

4.6.12, delete and substitute:

"4.6.12 Fluid immersion (see 3.16). Connector samples shall be subjected to the test specified in method 1016 of MIL-STD-1344 (one sample per fluid). Following the fluid immersion cycles, the connectors shall be tested for coupling torque as specified in 3.28 and dielectric withstanding voltage at sea as specified in 3.9 within 3 hours. Samples shall be subjected to the fluids specified in method 1016 of MIL-STD-1344 as shown in table X.

4.6.12.1, delete paragraph in its entirety.

4.6.13, line 2: Delete "laod" and substitute "load".

4.6.14, title: Delete and substitute "Humidity (see 3.18)."

PAGE 35

TABLE X, delete and substitute:

"TABLE X. Fluids for fluid immersion test.

Sample number	Test fluid (method 1016 of MIL-STD-1344)
1	d
2	e
3	a
4	b
5	f
6	g
7	c
8	l
9	h
10	i

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4.6.16, title: Delete and substitute "Cable pull-out (see 3.20)."

4.6.17, delete and substitute:

"4.6.17 External bending moment (see 3.21). The receptacle connector shall be mounted as in normal service to a rigid panel. Before mating the plug connector to the receptacle, and adapter or test torque arm shall be attached as shown on figure 10. After mating the plug and receptacle connectors, the distance "L" from the point of load application "P" to the mounting panel shall be determined. The load shall be applied at point "P" and shall then be determined as the bending moment listed in table XII, divided by the level arm "L". This load shall be applied at a rate of approximately 10 pounds per second until the required load is achieved. The applied load shall be held for 1 minute, then the load shall be released.

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FIGURE 10, delete and substitute:
“

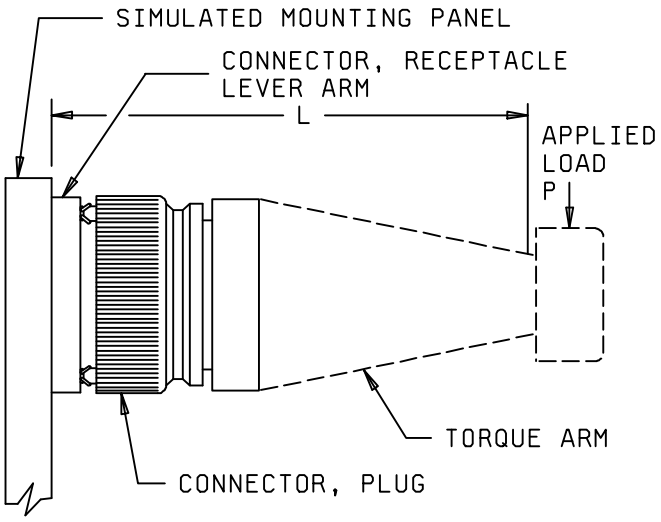


FIGURE 10. External bending moment test set -up.”

PAGE 39

4.6.19, line 2: Delete “100 percent of the contacts” and substitute “20 percent of the contacts in each connector”.

4.6.20, delete and substitute:

“4.6.20 Impact (see 3.25). Connector plugs with MIL-C-28840 straight strain relief clamps and protective covers shall be tested as specified in method 2015 of MIL-STD-1344. The following conditions apply.

a. Drop height shall be 6 feet (1.829 meters).

b. Number of drops shall be ten.

c. Plate shall be indexed at 36° intervals.”

FIGURE 12, delete in its entirety.

PAGE 40

4.6.21, delete and substitute:

“4.6.21 EMI shielding (see 3.24). The connectors under test shall be mounted to a shielded room wall as shown on figure 13. Mounting should simulate normal mounting procedures and be detailed in the test report. Two identical 1.5 meter long test cables - one shielded and one unshielded - will be required. Shielding effectiveness of the shielded cable and connector will be obtained as follows:

a. Connect the unshielded test cable to the connectors. The cable should be supported horizontally on a wooden table (or other nonconducting material) at a height of one meter or greater above the floor (or ground plane) and arranged in a semi-circle having a radius of approximately 0.45 meter.

b. Place the receiver antenna in front of the connectors, centered between the connectors, one meter distance from the plate containing the connector and 0.5 meter above the plane of the cable. The antennas used in these tests shall be linearly polarized. Circularly polarized antennas such as the conical log spiral antennas shall not be used.

c. Connect the signal source to the test cable as shown on figure 13. A 5-ohm matching termination should be used at the generator output. If the generator is not calibrated, the output should be monitored with a voltmeter or power meter.

d. Connect the receiver, either a tuned EMI receiver or spectrum analyzer, to the receiver antenna. The test wires will be selected such that the wires are on opposite sides and at the outer perimeter of the connector. A 50-ohm load will be connected between the wire pairs at the other connector.

e. With the receiver and signal generator set to 100 MHz, increase the signal generator output until a level at least 100 dB above the minimum discernible level of the receiver is obtained. Record both the generator output level and receiver level. Continue recording output and received levels as the generators are swept over the 100 MHz - 1,000 MHz frequency range maintaining at least 100 dB dynamic range. The received level may be photographically recorded if a spectrum analyzer is used, otherwise record at least three frequencies per octave.

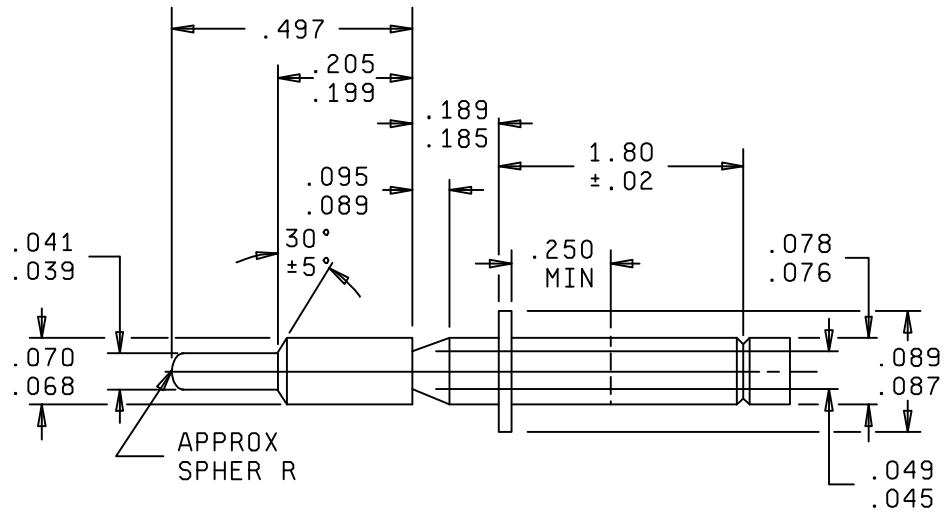
f. Replace the unshielded cable and connector with the shield connector and cable and repeat the measurements using the same signal generator levels as obtained in step e. Record the received levels. Shielding effectiveness is the difference in received levels obtained in steps e and f (see 3.24)."

After 4.6.22, add the following new paragraph:

"4.6.23 Coupling torque. For qualification testing, mating halves shall be coupled and the torque which must be applied to facilitate full coupling shall be measured and recorded (see 3.28)."

FIGURE 14: Delete and substitute new figure 14.

“



Inches	mm	Inches	mm
.020	0.51	.089	2.26
.039	0.99	.095	2.41
.041	1.04	.180	4.57
.045	1.14	.185	4.70
.049	1.24	.189	4.80
.068	1.73	.199	5.05
.070	1.78	.205	5.21
.076	1.93	.250	6.35
.078	1.98	.495	12.62
.087	2.21		

NOTES:
1. Material: Hardened tool steel.
2. Finish: 32 microinches polished.
3. Design of rear extension is optional, but must have a groove provided as indicated.
4. Dimensions are in inches.
5. Metric equivalents are given for information only.
6. All diameters concentric to each other within a .004 TIR.

FIGURE 14. Test gauge, pin, gauge location, and retention.”

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6.1.c, add the following information at end of paragraph: “Individual wires should not exceed 12 inches in length. Box mount connectors will be used only in controlled atmosphere applications where environmental sealing is not required.”

6.1.e, delete “ned” and substitute “end”.

6.1.1, line 1, delete “connector”.

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6.2.1, add at the end of the paragraph: “(see 3.1).”

* 6.3, delete the last 3 sentences and substitute: “The activity responsible for qualifications of these connectors and the Qualified Product List (QPL), is the Defense Supply Center Columbus, Attn: DSCC-VQ, 3990 East Broad Street, Columbus, Ohio 43213-1199. Application for qualification tests shall be made in accordance with provisions governing qualifications (6.3.1).”

The margin of this amendment are marked with as asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a Convenience only and the Government assumes no liability whatsoever for any inaccuracies in these Notations. Bidders and contractors are cautioned to evaluate the requirement s of this document based On the entire content irrespective of the marginal notations and relationship to the last previous Amendment.

CONCLUDING MATERIAL

Custodian:
Navy - EC

Review activity:
Navy - OS, SH, YD

Preparing activity:
DLA - CC

(Project 5935-4291)