MILITARY SPECIFICATION

CABLES, FIBER OPTICS, (METRIC),
GENERAL SPECIFICATION FOR

This amendment forms a part of MIL-C-85045E, dated 21 May 1992, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 1

1.2.1, line 2: Delete "single letter" and substitute "single number".

TABLE I, footnotes, delete and substitute as follows:

"1/ The cable is constructed using buffered fibers (see 6.5.2) with no individual protective jackets or strength members.
2/ The cable is constructed using OFCCs (see 6.5.8) that are not grouped into bundles having bundle jackets or binders.
3/ The cable is constructed using buffered fibers or OFCCs that are grouped into cable bundles (see 6.5.3) with bundle jackets or binders.
4/ The cable is constructed using fiber ribbons (see 6.5.9)."

PAGE 2

2.1.1, SPECIFICATIONS, MILITARY, delete the following:

"MIL-C-572 - Cord, Yarns and Monofilaments Organic Synthetic Fiber."

PAGE 3

STANDARDS, MILITARY, following MIL-STD-2003, add:

"MIL-STD-2042 - Fiber Optic Topology Installation Standard Methods For Naval Ships."

PAGE 4

2.2, after EIA/TIA-455-25, add:

"EIA/TIA-455-32 - Fiber optic Circuit Discontinuities".

EIA-455-104, delete existing title and substitute the following:

"Fiber Optic Cable Cyclic Flexing Test."

PAGE 6

Delete the 3 lines preceding 3.3.4 at the top of the page.

3.3.4, delete and substitute:

"3.3.4 Strength members. Unless otherwise specified, strength members shall be aramid yarn, glass fibers, composites, or combinations thereof (see 3.1)."

3.4, line 7: Delete "short term minimum bend diameter" and substitute "short term (dynamic) minimum bend diameter (see 6.5.10)".

Add the following at end of paragraph:

"The long term (static) minimum bend diameter (see 6.5.7) shall be as specified (see 3.1)."

3.4.1, line 3: Delete "The softening point of the fiber and coatings shall not be lower than 85°C." and substitute "The fiber and coatings shall maintain their physical characteristics at temperatures not greater than 85°C."

3.4.2.2.1: Delete and substitute:

"3.4.2.2.1 OFCC jacket color coding. Unless otherwise specified (see 3.1), individual OFCC jackets shall be color coded for identification by solid colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV. For cable designs with more than 12 OFCCs within a bundle, the OFCCs may be marked for identification in lieu of color coding."

PAGE 8

Table IV: Delete and substitute:

"TABLE IV. Munsell color limits for color numbers eleven and twelve.

Symbol	Munsell notation	
	Rose	Aqua
Centroid	10RP 8/6	10BG 7/6
H+	2.5R 8/6	2.5B 7/6
H-	7.5RP 8/6	7.5BG 7/6
V+	-	10BG 7.5/4-6
V-	10RP 7/6	10BG 6.5/6
C+	-	10BG 7/8
C-	10RP 8/4	10BG 7/4

PAGE 9

TABLE VI, delete "1/" and substitute the following:

"1/ The change in optical transmittance requirement for freezing water immersion, gas flame, and shock are for the specified test length and shall not be normalized for one kilometer."

PAGE 10

3.6.8, delete and substitute:

"3.6.8 Impact. When tested in accordance with 4.7.4.8, the cable shall meet the following requirements: a visual examination of the cable jacket shall reveal no cracking, splitting, or other defect to permit jacket penetration. The jacket may crack or split on any low temperature impact after the second low temperature impact. The change in optical transmittance shall not exceed the value specified in 3.5.2 after the test."

PAGE 11

3.6.12.2, line 2: Delete "5 mm" and substitute "20.0 mm".

Add the following sentence at the end of the paragraph:

"Splitting or cracking of the cable between the gland nuts (inside of the stuffing tube) is allowed."

PAGE 12

TABLE VII, delete and substitute the following:

"TABLE VII. Temperature ranges.

Application	Operating range (°C)	Storage range (°C)
Ground tactical (T)	-46 to +71	-54 to +85
Shipboard (B)	-28 to +65	-40 to +70 1/
Ground benign (G)	-40 to +75	-40 to +75
Aircraft (A)	-46 to +125	-54 to +125
Space (S)	-60 to +85	-60 to +85

1/ The shipboard nonoperational temperature range is the same as the shipboard storage temperature range."

3.7.8, line 3: Delete "shall be 75 percent" and substitute "shall be not less than 75 percent".

Line 4: Delete "Unless otherwise specified (see 3.1), the requirements of 3.5.2 shall be met after the test."

PAGE 13

3.7.9, line 4: Delete "more than 10 percent" and substitute "greater than 50 percent".

3.7.13, delete the last sentence and substitute:

"Unless otherwise specified (see 3.1), discontinuities shall not have a magnitude greater than the value specified in 3.5.2 and a duration greater than 50 μs."

3.7.17, delete and substitute as follows:

"3.7.17 Tempest. When specified and tested in accordance with 4.7.5.17, the shielded enclosure containing the cable penetration shall meet the requirements of NASCEM 5204, appendix A (NSA 65-5) and appendix B (NSA 65-6)."

PAGE 15

4.5.1, line 2: Delete "6 sample units." and substitute "2 sample units, one a minimum of 1 km in length and one a minimum of 0.5 km in length. The 1 km sample unit shall be cut to form two sample units, each a minimum of 0.5 km in length."

PAGE 16

4.5.1.2, line 5: Delete "subjected to the inspection of" and substitute "subjected to the applicable inspections of."

PAGES 17, 18, 19

TABLE VIII, delete and substitute:

"TABLE VIII. Qualification inspection.

Inspection	Requirement paragraph	Test paragraph	Specimen quantity and length 1/ 2/
Group I			
Visual and mechanical	3.4, 3.9, 3.10	4.7.1	3 units 0.5 km each 3/
Attenuation rate	3.5.1	4.7.3.1	3 units 0.5 km each 4/
Group II			
Crosstalk	3.5.3	4.7.3.3	3 units 0.5 km each 4/
Tempest	3.7.17	4.7.5.17	1 unit 6 m 5/
Group III			
Temperature cycling	3.7.1	4.7.5.1	2 units 0.5 km each 4/ (1 on reel, 1 off reel)
Humidity	3.7.3	4.7.5.3	2 units 0.5 km each 6/
Storage temperature	3.7.4	4.7.5.4	2 units 0.5 km each 6/
Low temperature flexibility (cold bend)	3.6.3	4.7.4.3	2 units 8 m each 7/
Cyclic flexing	3.6.4	4.7.4.4	6 units 5 m each 8/ (2 units for each temperature)
Crush	3.6.5	4.7.4.5	2 units 5 m each 7/
Cable twist-bending	3.6.6	4.7.4.6	6 units 5 m each 8/ (2 units for each temperature)
Impact	3.6.8	4.7.4.8	2 units 5 m each 7/
Barometric pressure (reduced)	3.7.5	4.7.5.5	1 unit .46 km 9/
Cable life	3.7.6	4.7.5.6	2 units 300 m each 7/
Tensile loading and elongation	3.6.1	4.7.4.1	2 units 150 m each 10/

See footnotes at end of table.

TABLE VIII. Qualification inspection - Continued.

Inspection	Requirement paragraph	Test paragraph	Specimen quantity and length 1/ 2/
Group III (Continued)			
Operating tensile loading	3.6.1.1	4.7.4.1.1	2 units 150 m each 11/
Freezing water immersion	3.7.7	4.7.5.7	2 units 30 m each 7/
Fungus	3.8.4	4.8.4	2 units 0.5 m each 7/
Knot	3.6.10	4.7.4.10	6 units 5 m each 8/
Cable element removability	3.6.18	4.7.4.18	2 units 0.5 m each 7/
Flammability (60 degree angle)	3.7.12.1	4.7.5.12.1	2 units 6 m each 7/
Group IV			
Thermal shock	3.7.2	4.7.5.2	1 unit 0.49 km 4/ (on reel)
Gas flame	3.7.14	4.7.5.14	1 unit 10 m 12/
Weathering	3.7.8	4.7.5.8	1 unit 2 m 12/ and 3 material samples 13/
Fluid immersion	3.7.9	4.7.5.9	1 unit 2 m 12/ and 3 material samples 13/ for each specified fluid
Paint susceptibility	3.7.16	4.7.5.16	2 units 2 m 14/
Jacket self adhesion or blocking	3.7.11	4.7.5.11	1 unit 30 m 12/
Shock	3.7.13	4.7.5.13	1 unit 30 m 12/
Dynamic bend	3.6.2	4.7.4.2	1 unit 150 m 15/
Hosing: Low pressure	3.6.12.1	4.7.4.12.1	1 unit 1.5 m 12/
Hydrostatic	3.6.12.2	4.7.4.12.2	1 unit 2 m 12/
Radial compression	3.6.7	4.7.4.7	1 unit 10 m 12/
Pressure cycling	3.6.11	4.7.4.11	1 unit 30 m 12/
Corner bend	3.6.9	4.7.4.9	2 units 5 m 14/
Group V			
Dripping	3.6.13	4.7.4.13	1 unit 30 cm 12/
Cable jacket tear strength	3.6.14	4.7.4.14	3 units 1 m each 14/
Cable jacket material tensile strength and elongation	3.6.15	4.7.4.15	5 units 16/
Cable abrasion resistance	3.6.16	4.7.4.16	4 units 2 m each 17/
Cable shrinkage	3.6.17	4.7.4.17	3 units 0.5 m each 14/
Durability of identification	3.6.19	4.7.4.19	3 units 2 m each 14/
Ribbon delamination	3.6.20	4.7.4.20	3 units 2 m each 14/
Smoke generation and flame propagation	3.7.12.3	4.7.5.12.3	220 m 18/
Flame extinguishing	3.7.12.2	4.7.5.12.2	1 unit 50 m 12/
Wicking	3.7.10	4.7.5.10	2 units 2 m 14/
Water absorption	3.7.15	4.7.5.15	2 units 19/
Group VI			
Acid gas generation	3.8.1	4.8.1	1 unit 1 m 20/
Halogen content	3.8.2	4.8.2	1 unit 1 m 20/
Toxicity index	3.8.3	4.8.3	1 unit 1 m 20/
Thermal vacuum outgassing	3.3.7.1	4.8.5.1	1 unit 1 m 20/
Material flammability	3.3.7.2	4.8.5.2	1 unit 1 m 20/
Odor	3.3.7.3	4.8.5.3	1 unit 1 m 20/
Material toxicity (offgassing)	3.3.7.4	4.8.5.4	1 unit 1 m 20/

1/ Tolerance on 0.5 km length is plus or minus 10 percent provided results are normalized to 1 km.
2/ Tolerance on shorter lengths is plus or minus 10 percent.

TABLE VIII. Qualification inspection - Continued.

3/ The visual and mechanical inspection shall only be conducted on a 2 m section of each sample.
4/ The same samples as used in the visual and mechanical inspection shall be used.
5/ A specimen cut from one of the visual and mechanical inspection test samples shall be used.
6/ The same samples as used in the temperature cycling test shall be used.
7/ A specimen cut from each sample used in the temperature cycling test shall be used.
8/ Three specimens cut from each sample used in the temperature cycling test shall be used.
9/ One of the samples used in the temperature cycling test shall be used.
10/ A specimen cut from each sample used in the life test shall be used.
11/ The same samples as used in the tensile loading and elongation test shall be used.
12/ A specimen cut from the sample used in the thermal shock test shall be used.
13/ Three jacket material samples as specified in 4.7.4.15 shall be used in this test.
14/ Specimens cut from the sample used in the thermal shock test shall be used.
15/ A specimen cut from the sample used in the thermal shock test or one of the samples used in the tensile loading and elongation test shall be used.
16/ Jacket material samples as specified in 4.7.4.15 shall be used in this test.
17/ Specimens cut from the sample used in the thermal shock test shall be used. Two specimens shall be used for scraping abrasion testing and two specimens shall be used in the cable to cable abrasion testing.
18/ A specimen consisting of several pieces, each cut from samples used in previous tests, shall be used.
19/ Jacket material samples as specified in 4.7.5.15 shall be used.
20/ A specimen cut from one of the samples used in the temperature cycling or thermal shock tests shall be used."

PAGE 19

TABLE IX, requirement column, delete "3.4, 3.8, 3.9" and substitute "3.4, 3.9, 3.10."

PAGE 20

4.6.3.1: Delete and substitute:

"4.6.3.1 Sampling plan. Two sample units shall be selected from those types covered by a single specification sheet within 12 months after the date of notification of qualification and during every 12 month period thereafter, except when the total production in a 12 month period is less than 2 units of product (2 km) or a total of 24 months have elapsed since the inspection was performed, in which case only one sample unit shall be tested."

Table XI: Delete.

PAGE 21

4.6.4, 4.6.4.1, delete in its entirety and substitute the following:

"4.6.4 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.6.4.1.4), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of periodic inspection.

"4.6.4.1 Group C inspection. Group C inspection shall consist of the inspections specified in table XII. In cases where certain requirement and tests are applicable only when specified (see 3.1), these tests shall be conducted in order shown when specified (see 3.1). Tests which are not specified in the basic specification or specific slash sheet as applicable to a specific cable construction shall not be conducted. Group C inspection shall be made on sample units selected from production units which have passed the groups A and B inspection.

"4.6.4.1.1 Sampling plan. Three sample units shall be selected from those types covered by a single specification sheet within 36 months after the date of notification of qualification and every during every 36 month period thereafter, except when the total production in a 36-month period is less than two units of product (2 km) inspection need not be made until production is at least 2 units of product.

"4.6.4.1.2 Failures. If one or more specimens fail to pass group C inspection, the production unit shall be considered to have failed.

"4.6.4.1.3 Disposition of sample units. Specimens that have been tested to group C inspection shall not be delivered on the contract or purchase order.

"4.6.4.1.4 Noncompliance. If a sample fails to pass group C 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. 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 C 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 C 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."

PAGE 22

Table XII, group III: Delete "Life (elevated temperature)" and substitute "Cable life."

TABLE XII, group IV, delete:

Shock	3.7.13	4.7.5.13

PAGE 23

Table XIII: Delete.

PAGE 24

4.7.1, add the following at the end of the paragraph:

"Visual inspection of the cable may be limited to the cable ends and the exposed surface of the cable. Unspooling of the cable to inspect the unexposed portions is not required."

PAGE 26

4.7.4.4, line 4: Delete "one hour" and substitute "two hours".

PAGE 27

4.7.4.6, line 6: Delete "1 hour" and substitute "two hours".

4.7.4.7, add the following after the 3rd sentence:

"The insert block inner diameter shall be not greater than 1 mm larger than the cable outside diameter."

Line 6: Delete "5.6 kgm" and substitute "5.6 N m".

4.7.4.8, delete and substitute as follows:

"4.7.4.8 Impact (see 3.6.8). A length of cable specimen shall be tested in accordance with EIA-455-25. The specimen shall be conditioned at the test temperature for a duration not less than two hours before conducting each test. The change in optical transmittance shall be monitored after testing. During the low temperature test, after the second cycle, the test shall be temporarily halted and the cable jacket shall be visually examined in accordance with 4.7.1. At the completion of each test, the cable jacket shall be visually examined in accordance with 4.7.1. The test shall be conducted at the conditions listed in table XVII for the application specified."

TABLE XVII, shipboard (B), temperature column, delete "operating" and substitute "nonoperating".

PAGE 29

4.7.4.12.2, delete and substitute as follows:

"4.7.4.12.2 Hydrostatic. A fully assembled cable specimen shall be tested in accordance with the procedure specified herein. One end of the specimen shall be fitted into the appropriate size of stuffing tube in accordance with MIL-STD-2042. The specimen end shall protrude from the stuffing tube a minimum of 0.5 m and a maximum of 0.75 m. The stuffing tube shall be torqued to 41 N m and preconditioned at ambient temperature for 24 hours. The stuffing tube shall then be retorqued to 41 N m and the cable internal components trimmed flush with the cable jacket end. Water pressure shall be applied to the stuffing tube end of the specimen. The water pressure shall be gradually applied up to the specified value (see 3.1) over a 3 to 10 minute time period and then held for 6 hours. Water leakage

through the specimen and slippage of the cable internal parts shall not exceed the values specified in 3.6.12.2."

4.7.4.16.1.1, delete the second sentence and substitute:

"The tester shall rub an edge (a drum with an abrading edge, or equivalent, as shown in figure 2A shall be used) repeatedly over the upper surface of the specimen in such a position that the longitudinal axis of the edge and the specimen are at right angles to each other with the edge and outer surface of the specimen in contact. The clamped end of the cable shall be positioned such that the abrading element abrades the cable for the length specified. The abrading elements shall consist of high speed tool bits which have been ground on two adjacent longitudinal sides to produce a single, sharp 90 degree longitudinal edge, free of visible nicks."

Add new figure 2A:

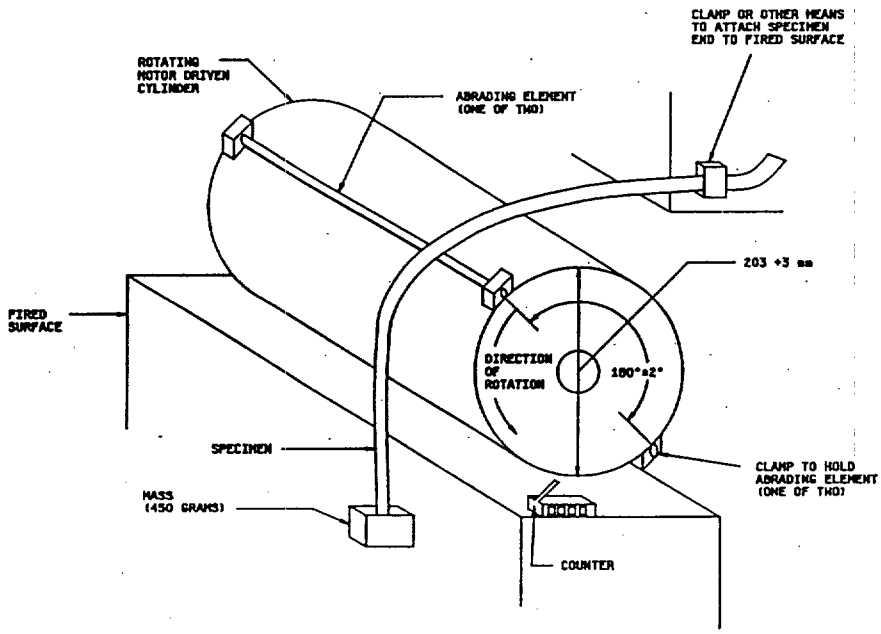

FIGURE 2A. Scraping abrasion test apparatus.

PAGE 30

4.7.4.16.1.2, line 1: Delete "0.7 kg" and substitute "0.45 kg".

Line 2: Delete "Five" and substitute "Two".

Delete the last sentence and substitute:

"Each test shall be discontinued when the specified number of cycles is attained for each of the two tests performed on each specimen."

PAGE 33

4.7.5.3c: Delete "after" and substitute "during and after."

4.7.5.4, line 2: Delete "low temperature extreme" and substitute "low storage temperature extreme."

Line 4: Delete "high operating extreme" and substitute "high storage temperature extreme."

PAGE 35

4.7.5.13, delete the last sentence and substitute:

"Signal discontinuity shall be monitored during the test, in accordance with EIA-455-32, with equipment having a time resolution sufficient to resolve discontinuities of duration not less than 50 μs."

PAGE 36

4.7.5.17, delete and substitute:

"4.7.5.17 Tempest. The cable shall be tested for conformance to 3.7.17 in accordance with MIL-STD-285. The cable shall be tested as part of a penetration of a shielded enclosure. The shielded enclosure penetration shall consist of the fiber optic cable passing through a waveguide with an inside diameter to total length ratio of 1:24."

4.8.1, line 12: Delete "1.0 ml of 1.0 normal" and substitute "1.0 ml of 0.1 normal."

PAGE 40

6.5.7, delete and substitute:

"6.5.7 Long term minimum bend diameter. Long term minimum bend diameter is the minimum diameter at which a cable may be bent for extended periods of time with no degradation in optical performance."

Following 6.5.9, add:

"6.5.10 Short term minimum bend diameter. Short term minimum bend diameter is the minimum diameter at which the cable may be bent for short periods of time (such as during cable installation) with no permanent degradation in optical performance."

PAGE 41

6.6, delete "Serial number (alpha-numeric)" and substitute "Two or three character alpha-numeric".

CONCLUDING MATERIALS

Custodians:
Army - CR
Navy - SH
Air Force - 85
NASA - NA

Review activities:
Army - AR, AV, MI
Navy - EC, OS
Air Force - 13, 17, 19, 80, 90, 99
DLA - ES

Preparing activity:
Navy - SH

Agent:
DLA - ES

(Project 6015-0029)