



**DEFENSE LOGISTICS AGENCY
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5 May 2016

MEMORANDUM FOR MILITARY/INDUSTRY DISTRIBUTION

SUBJECT: Initial Draft(s) of: MIL-PRF-85045/31A W/Amendment 1 and MIL-PRF-85045/32
W/Amendment 2
Project Number(s): 6015-2016-001, 6015-2016-002, respectively.

The initial draft(s) for these subject document(s), are now available for viewing and downloading from the DLA Land and Maritime-VA Web site:

<http://www.landandmaritime.dla.mil/programs/milspec/>

These QPL documents are being amended to add new mechanical strippability tests to aid in the qualification process. Concurrence or comments are required at this Center within 30 days from the date of this letter. Late comments will be held for the next coordination of the document. Comments from military departments must be identified as either "Essential" or "Suggested". Essential comments must be justified with supporting data. Military review activities should forward comments to their custodians of this office, as applicable, in sufficient time to allow for consolidating the department reply. Lack of response to this draft will be construed as concurrence.

If these document(s) are of interest to you, please provide your comments or suggested changes. The point of contact for this document is Ms. McWilliams, phone number 614-692-0571, facsimile transmission, 614-692-6939, e-mail Mary.McWilliams@dla.mil, or may be mailed via the US Postal Service to DLA LAND AND MARITIME, ATTN: VAT (Attention: Mary McWilliams), P.O. Box 3990, Columbus, OH 43218-3990.

Sincerely,

/signed/

MICHAEL A. RADECKI
Chief,
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cc:
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NOTE: This draft, dated 5 May 2016, prepared by DLA-CC, has not been approved and is subject to modification, DO NOT USE PRIOR TO APPROVAL. (Project 6015-2016-001)

METRIC

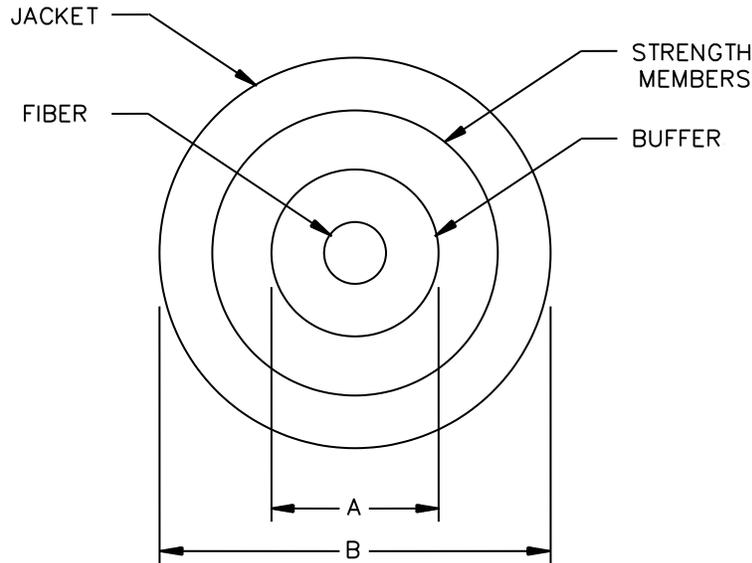
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W/Amendment 1
DRAFT
SUPERSEDING
MIL-PRF-85045/31A
21 September 2015

PERFORMANCE SPECIFICATION SHEET

CABLE, FIBER OPTIC, SINGLE (ONE) FIBER, CABLE CONFIGURATION
TYPE 2 (OFCC), CLASS SM AND MM, TEMPERATURE RANGE
AND OTHER PERFORMANCE CHARACTERISTICS (METRIC)

This specification is approved for use by all
Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein
shall consist of this specification sheet and MIL-PRF-85045.



µm	Inches
900	.035
50	.002

mm	Inches
2.2	.087
1.8	.070

Dimensions	
A µm	B mm
900 ± 50	1.8 – 2.2

NOTES:

1. Dimensions are in millimeters.
2. Inch equivalents are given for reference purposes.

FIGURE 1. Single fiber optical cable.



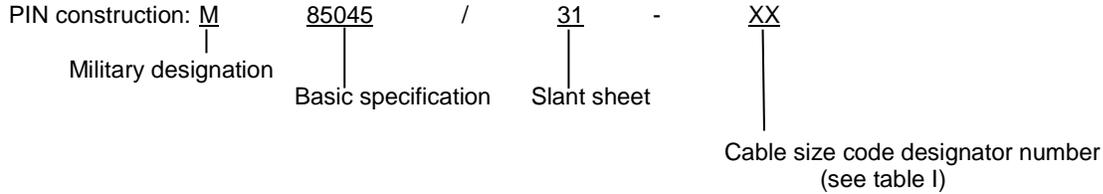
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CLASSIFICATION:

Fiber optic cable configuration type: 2 (OFCC).

Fiber cable class: MM (Graded-index, glass core and glass cladding, multimode).
SM (Dispersion-unshifted, glass core and glass cladding, single-mode).

Part or Identifying Number (PIN): See PIN construction below. Additional manufacturer's marking is allowed.



PIN example: M85045/31-01 is a single mode cable consisting of enhanced 9/125 micron fiber with an operating temperature range -55° C to +165° C, and fiber coating diameter of 125 micron.

TABLE I. Cable code designation number.

Cable size code designation number	Fiber size (microns)	Fiber size code (see MIL-PRF-49291)	Operating temperature range °C (° F)	Coating diameter (microns)
01	9/125	/11-01	-55 to +165 (-67 to 329)	125
03	9/125	/11-02	-55 to +165 (-67 to 329)	245
02	62.5/125	/10-01	-55 to +165 (-67 to 329)	125
04	62.5/125	/10-02	-55 to +165 (-67 to 329)	245
20	50/125	/12-01	-55 to +165 (-67 to 329)	500
40	50/125	/12-02	-55 to +165 (-67 to 329)	245

DESIGN AND CONSTRUCTION:

Fiber:

Class SM enhanced 9/125 micron fibers shall be in accordance with MIL-PRF-49291/11.
Class MM 62.5/125 micron fibers shall be in accordance with MIL-PRF-49291/10.
Class MM 50/125 micron fibers shall be in accordance with MIL-PRF-49291/12.

Buffer diameter: 900 ± 50 µm. See figure 1.

REQUIREMENTS:

Finished cable:

Dimensions and configuration: See figure 1.

Mass per unit length: ≤ 5.0 kg/km.

Color, cable jacket: Color of cable jacket shall conform to optical fiber size as specified in table 1104-I of MIL-STD-1678-1. The colors shall be within the light and dark color limits in accordance with 3.4.2.1.1 of MIL-PRF-85045.

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Connector interface requirement. Cable shall include as part of the strength member (i.e., cable strain relief) a braided yarn (such as one made from an aromatic polyimide, otherwise known as aramid yarn, or other solid form, but braided, of a liquid crystal polymer). This braided yarn shall be capable of being crimped to the cable entry end of the connector and withstanding a 50 lb pullout force when exerted on the cable. Trade names for aramid yarns include Kevlar, Twaron, Nomex, New Star and Tejinoconex.

Materials:

Jacket red light transparency: Fiber breaks inside the cable jacket shall be easily recognized when pulsed, red light from a laser (monochromatic light) is sent through the optical fiber in the cable. The monochromatic light shall have a nominal wavelength of 635 nm, a nominal pulse rate of 3 Hz and a minimum optical power level of 1 mW. Fracture in the optical fiber shall be created by placing the middle of a 1 meter length of fiber optic cable in a free from loop until a kink occurs in the cable jacket and the change in optical transmittance of the cable is reduced by at least 20 dBm.

Number of fibers: 1.

Concentricity: ≤ 0.8 .

Short term minimum bend diameter: Eight times the cable outer diameter. (The short term minimum bend diameter is to be used in all environmental and mechanical tests which specify a cable minimum bend diameter.)

Long term minimum bend diameter: Sixteen times the cable outer diameter.

Minimum continuous length: The minimum continuous length of all cables shall be not less than 0.5 km. If lengths less than 0.5 km are specified in the purchase order, conformance inspection shall be performed on test specimens not less than 0.5 km in length from which the purchase order lengths are cut.

PERFORMANCE REQUIREMENTS:

Qualification inspection: Test performed, test sequence, test procedure, cable performance and test sample (specimen) quantity and length shall be in accordance with table II with any exception (such as a modification or addition) listed in this specification sheet.

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TABLE II. Qualification and conformance inspections.

Group	Qualification Inspection	Requirement paragraph	Test paragraph	Cable length <u>1/ 2/ 25/ 26/</u>	Conformance Inspection
I	Visual & mechanical inspection	3.4,3.9,3.10	4.7.2	3 samples, 0.5 km each <u>3/</u>	A
	Attenuation rate	3.5.1	4.7.4.1	3 samples, 0.5 km each <u>4/</u>	A
	Polarization Mode Dispersion (SM only)	<u>5/</u>	<u>5/</u>	3 samples, 0.5 km each <u>4/</u>	
II	Crosstalk	3.5.2	4.7.4.3	3 specimens, 6 m each <u>6/ 24/</u>	
	Electromagnetic effects	<u>5/</u>	4.7.6.16	1 specimen, 6 m <u>6/</u>	
	Jacket red light transparency	<u>5/</u>	<u>5/</u>	1 specimen, 1 m <u>6/</u>	
III	Temperature cycling	3.7.1	<u>5/</u>	2 samples, 0.5 km each (1 on reel, 1 off) <u>4/</u>	C
	Temperature cycling with mandrel	3.7.1	4.7.6.1	2 samples, 0.5 km each (1 on reel, 1 off) <u>4/</u>	
	Temperature humidity cycling	3.7.3	4.7.6.3	2 samples, 0.5 km each <u>7/</u>	C
	Storage temperature	3.7.4	4.7.6.4	2 samples, 0.5 km each <u>7/</u>	
	Low temperature flexibility (cold bend)	3.6.3	4.7.5.3	2 specimens, 8 m each <u>8/</u>	B
	Cyclic flexing	3.6.4	4.7.5.4	6 specimens, 5 m each (2 specimens at each temp) <u>9/</u>	
	Crush	3.6.5	4.7.5.5	2 specimens, 5 m each <u>8/</u>	
	Cable twist-bend	3.6.6	4.7.5.6	6 specimens, 5 m each <u>9/ 24/</u> (3 specimens at each temp)	C
	Impact	3.6.8	4.7.5.8	2 specimens, 5 m each <u>8/</u>	C
	Altitude immersion	<u>5/</u>	<u>5/</u>	1 specimen, 0.46 km each <u>10/</u>	
	Temperature life (Life aging)	<u>5/</u>	<u>5/</u>	2 specimens, 300 m each <u>8/</u>	C
	Tensile loading and elongation	3.6.1	4.7.5.1	2 specimens, 150 m each <u>11/</u>	C
	Operating tensile loading	3.6.1.1	4.7.5.1.1	2 specimens, 150 m each <u>12/</u>	C
	Freezing water immersion (ice crush)	3.7.7	4.7.6.7	2 specimens, 30 m each <u>8/</u>	
	Fungus resistance	3.8.4	4.8.4	2 specimens, 0.5 m each <u>8/</u>	
	Cable element removability	3.6.18	4.7.5.18	2 specimens, 0.5 m each <u>8/</u>	C
Flammability (60 degree angle)	3.7.12.1	4.7.6.12.1	2 specimens, 6 m each <u>8/</u>	C	

See notes at end of table.

TABLE II. Qualification and conformance inspections - Continued.

Group	Qualification Inspection	Requirement paragraph	Test paragraph	Cable length <u>1/</u> <u>2/</u> <u>25/</u> <u>26/</u>	Conformance Inspection
IV	Thermal shock	3.7.2	4.7.6.2	1 specimen, 0.49 km each <u>4/</u> (on reel)	
	Fluid immersion	3.7.9	4.7.6.9	1 specimen, 1 m <u>13/</u> and 3 flat extruded jacket material strips <u>14/</u> for each specified fluid	C
	Jacket self-adhesion or blocking	3.7.11	4.7.6.11	1 specimen, 30 m <u>13/</u>	
	Vibration	<u>5/</u>	<u>5/</u>	4 specimens, 30 m <u>13/</u>	
	Shock	3.7.13	4.7.6.13	4 specimens, 30 m <u>13/</u>	
	Dynamic bend	3.6.2	4.7.5.2	1 specimen, 150 m <u>15/</u>	B
	Corner bend	3.6.9	4.7.5.9	2 specimens, 5 m <u>16/</u>	
	OFCC kink	<u>5/</u>	<u>5/</u>	2 specimens, 1 m <u>13/</u>	
	Cable clamp	<u>5/</u>	<u>5/</u>	2 specimens, 1 m <u>13/</u>	
	Serpentine cable bend	<u>5/</u>	<u>5/</u>	2 specimens, 1 m <u>13/</u>	
V	Dripping	3.6.13	4.7.5.13	1 specimen, 30 cm <u>13/</u>	
	Cable jacket tear strength	3.6.14	4.7.5.14	5 flat extruded jacket material strips <u>22/</u>	C
	Cable jacket mechanical strippability	<u>5/</u>	<u>5/</u>	1 specimen <u>23/</u>	
	Cable jacket material tensile strength & elongation	3.6.15	4.7.5.15	5 specimens <u>17/</u>	
	Cable abrasion resistance, cable-to-cable	3.6.16	4.7.5.16.2	4 specimens, 2 m <u>18/</u>	C
	Cable shrinkage	3.6.17	4.7.5.17	3 specimens, 0.5 m <u>16/</u>	C
	Durability of identification	3.6.19	4.7.5.19	3 specimens, 2 m each <u>16/</u>	
	Flaming smoke generation	<u>5/</u>	<u>5/</u>	1 specimen <u>19/</u>	C
	Continuous flame	<u>5/</u>	<u>5/</u>	1 specimen <u>20/</u>	C
	Wicking	3.7.10	4.7.6.10	2 specimens, 2 m <u>16/</u>	C
Cable strain relief pull out force	<u>5/</u>	<u>5/</u>	5 specimens, 2 m each <u>16/</u>		
VI	Acid gas generation	3.8.1	4.8.1	1 specimens 1 m <u>21/</u>	C
	Toxicity index	3.8.3	4.8.3	1 specimen, 1 m <u>21/</u>	C
	Thermal vacuum outgassing	3.3.6.1	4.8.5.1	1 specimen, 1 m <u>21/</u>	C

Notes:

1/ Tolerance on 0.5 km length is ± 5 percent provided results are normalized to 1 km.

2/ Tolerance on shorter lengths is ± 5 percent.

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.

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- 5/ As stated under the applicable tests in this specification sheet.
- 6/ A specimen cut from one of the visual and mechanical inspection test samples shall be used.
- 7/ The same samples as used in the temperature cycling test shall be used.
- 8/ A specimen cut from each sample used in the temperature cycling test shall be used.
- 9/ Three specimens cut from each sample used in the temperature cycling test shall be used.
- 10/ A specimen cut from one of the samples used in the temperature cycling test shall be used.
- 11/ A specimen cut from each specimen used in the temperature life test shall be used.
- 12/ The same specimen as used in the tensile loading and elongation test shall be used.
- 13/ A specimen cut from the specimen used in the thermal shock test shall be used.
- 14/ Three flat extruded jacket material strips as specified in 4.7.5.15 shall be used in this test.
- 15/ A specimen cut from the specimen used in the thermal shock test or one of the specimens used in the tensile loading and elongation test shall be used.
- 16/ Specimens cut from the specimen used in the thermal shock test shall be used.
- 17/ Flat extruded jacket material as specified in 4.7.5.15 shall be used in this test.
- 18/ Specimen cut from the specimen used in the thermal shock test shall be used. Two specimens shall be used for scraping abrasion and two specimens shall be used in the cable to cable abrasion testing.
- 19/ Use 76 mm (3 inch) lengths of cable adjacent to one another to form a 76 mm (3 inch) strip. For a 2 mm (.08 inch) diameter cable, an approximate length of 3 m is needed.
- 20/ Use 305 mm (12 inch) lengths of cable adjacent to one another to form a 457 mm (18 inch) strip. For a 2 mm (.08 inch) diameter cable, an approximate length of 69 m is needed.
- 21/ A specimen cut from one of the samples used in the temperature cycling test or specimen used in the thermal shock test shall be used.
- 22/ Flat extruded jacket material strips (i.e., strips of flat extruded material with the same composition of the cable jacket and of sufficient dimensions in which dumbbells can be cut) prepared as specified in 4.7.5.14 cited method and obtain from flat extruded material that underwent the thermal shock test shall be used.
- 23/ Sufficient length to obtain 5 stripping trials shall be used.
- 24/ The 3 specimens shall be prepared as a cable bundle bound with lacing tape per MIL-STD-1678-4.
- 25/ A sample is the initial 0.5 km cable length.
- 26/ A specimen is a cable length that is cut from the initial 0.5 km cable length (i.e., the sample) or is cut from a longer previous cut length (i.e., cut from a longer specimen).

Preconditioning. If preconditioning is required, it shall be performed as part of cable fabrication process and supplied already preconditioned. No preconditioning shall be performed as part of qualification.

Optical properties:

Maximum attenuation rate:

For cable with MM 62.5/125 micron fiber: 4.0 dB/km at 850 nm \pm 20 nm, 2.0 dB/km at 1300 nm \pm 20 nm, and otherwise 4.5 dB/km over the wavelength range from 800 nm to 1600 nm. This requirement for 4.5 dB/km over the wavelength range from 800 nm to 1600 nm is measured as part of the maximum attenuation rate for qualification only.

For cable with SM 09/125 micron fiber: 1.0 dB/km at 1310 nm \pm 20 nm, 1.0 dB/km at 1383 nm \pm 20 nm, 0.75 dB/km at 1550 nm \pm 20 nm, 0.75 dB/km at 1625 nm \pm 20 nm, and otherwise 1.0 dB/km over the wavelength range from 1250 nm to 1650 nm. The requirement for 1.0 dB/km over the wavelength range from 1250 nm to 1650 nm is measured as part of the maximum attenuation rate for qualification only.

For cable with MM 50/125 micron fiber: 4.0 dB/km at 850 \pm 20 nm, 2.0 dB/km at 1300 nm \pm 20 nm, and otherwise 4.5 dB/km over the wavelength range from 800 nm to 1600 nm. The requirement for 4.5 dB/km over the wavelength range from 800 nm to 1600 nm is measured as part of the maximum attenuation rate for qualification only.

Polarization mode dispersion (single mode only): The polarization mode dispersion shall be ≤ 0.2 ps/ $\sqrt{\text{km}}$ when measured in accordance with either TIA-455-122 or TIA-455-124.

Change in optical transmittance: Measurements to be made at 850 nm \pm 20 nm for multimode and 1550 \pm 20

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nm for single mode.

Crosstalk: Applicable except each specimen length shall be 6 m when testing three adjacent single fiber cables. The middle portions of the three adjacent cables shall be wrapped around a $15 \pm .5$ mm ($.59 \pm .02$ inch) mandrel for 5 turns. The three cables shall be twisted in an approximate 60 cm (24 inch) cable lay (twist) to maintain physical position to each other. Then the middle portion of the three adjacent cables shall be wrapped around the mandrel.

Mechanical properties:

Cyclic flexing: 500 cycles at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 100 cycles at $-55^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Change in optical transmittance measurements are to be made every 100 cycles for the 500 cycle exposure and every 25 cycles for the 100 cycle exposure. Each change in optical transmittance measurement shall be performed with the specimen in the same position in the test cycle. The cycling may be halted to perform the change in optical transmittance measurement.

Crush: Applicable except that the compression loading shall not be less than 500 N/cm times the outer cable jacket in cm, shall be held for 1 minute and released and shall be applied at a rate of not less than 250 N/min.

Cable twist bending: 500 cycles at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and 100 cycles at $-55^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The test load shall be 10 N (2.2 lb). Change in optical transmittance measurements are to be made every 100 cycles for the 500 cycle exposure and every 25 cycles for the 100 cycle exposure. Each change in optical transmittance measurement shall be performed with the specimen in the same position in the test cycle. The cycling may be halted to perform the change in optical transmittance measurement.

Radial compression: Not applicable.

Impact: Applicable except test shall be performed for 50 cycles at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ and for 20 cycles at the minimum operating temperature.

Altitude immersion. Test shall be performed in accordance with TIA-455-15 using the setup and procedure specified in measurement 3305 of MIL-STD-1678-3. Instrument end connections shall not be submerged and shall be either routed outside the chamber or to an optical interface port. The change in optical transmittance shall be measured during and after the test. During each cycle, optical transmittance measurements shall be made at each ramp and during the plateau. The requirements for the change in optical transmittance shall be met. No damage to the cable shall occur and no evidence of water penetration into the cable interior.

Tensile loading and elongation: Applicable except tensile loading ≥ 270 N.

Operating tensile loading: Applicable.

Dynamic bend: Applicable except tensile load ≥ 90 N.

Hosing: Not applicable.

Dripping: Applicable except test is to be performed at 200°C (392°F).

Environmental properties:

Temperature range: See table III.

TABLE III. Temperature range.

PIN <u>1</u> /	Operating °C (°F)	Nonoperating °C (°F)	Storage °C (°F)
M85045/31-01,-03, for 09/125 -02,-04, for 62.5/125 -20,-40, for 50/125	-55 to +165 (-67 to 329)	-40 to + 85 (-40 to 185)	-40 to +85 (-40 to 185)

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Note:

1/ See table I for PIN fiber size code designator number.

Electromagnetic effects: Electromagnetic effects test shall be performed in accordance with measurement 3308 of MIL-STD-1678-3.

Temperature cycling: Applicable except perform the test as follows for the operating temperature range of -55°C to +165°C. Specimens shall be tested in accordance with TIA-455-3 using the setup and procedure specified in Measurement 3301 of MIL-STD-1678-3 with the temperature profile in table 3301-II. The change in optical transmittance shall be measured during and after the test. At a minimum for the "during test" measurements, an optical transmittance measurement shall be performed towards the end of each soak period (maintain step) after every cycle. A post test visual examination of the specimens shall reveal no surface impairment or any damage detrimental to the operation of the specimens. Test fixtures, if used, must be of minimum mass and approved by the qualifying activity. No other mass (item that causes significant thermal lag) shall be added inside the chamber.

Temperature cycling with mandrel. Applicable except perform with portion of cable being wrapped around a 20 ± 1 mm ($.79 \pm 0.04$ inch) mandrel for 5 turns and that table 3301-I specified in MIL-STD-1678-3 measurement 3301 can be used in lieu of table XIII of MIL-PRF-85045.

Temperature humidity cycling: Applicable except that the change in optical transmittance measurements may be made periodically. At a minimum, one optical transmittance measurement shall be made at the end of each temperature plateau.

Storage temperature: Applicable.

Temperature life (life aging): Applicable except perform as follows for the operating temperature range of -55°C to +165°C. The high exposure temperature shall be 165°C +5°C, -0°C. Specimens shall be tested in accordance with TIA/EIA-455-4 for the duration of 1,000 hours at the high exposure temperature. The change in optical transmittance shall be measured after the test. The specimens shall be visually examined after the test to the extent feasible. Specimens shall not be damaged, and there shall be no distortion, leaking of coating or other damage detrimental to the operation of the fiber optic cable. The requirement for the change in optical transmittance shall be met after the test. Performance of a cable/fiber retention test is not required as part of the final inspection for this test.

Weathering: Not applicable.

Flammability (60 degree angle): Applicable.

Fluid immersion: Applicable except that specimens and flat extruded jacket material strips shall be exposed to the all of the fluids at the temperatures specified in MIL-STD-1678-3 table 3409-AI for temperature range 2. Specimens and flat extruded jacket material strips shall be maintained at ambient conditions for a minimum of 4 hours prior to fluid testing. After immersion, all specimens and flat extruded jacket material strips shall be removed, blotted and suspended as specified in 4.7.6.9 prior to inspection. After testing, each specimen and flat extruded jacket material dumbbell shall be visually examined for conformance to the inspection requirements.

Flame extinguishing: Not applicable.

Smoke generation and flame propagation: Not applicable.

Flaming smoke generation: $D_m \leq 225$ when tested in the flaming condition in accordance with ASTM-E-662. The size and configuration of the specimen shall conform to the 76 mm (3 inch) by 76 mm (3 inch) square specified in ASTM-E-662. The thickness of the specimen shall be 2 mm (.08 inch). The specimen shall be constructed by laying 3 inch lengths of cable adjacent to one another to form a 76 mm (3 inch) strip. Wire or cable clamps may be used to permanently hold the cable lengths in place. Longer cable lengths may be used if the top or bottom clamps are used to hold the cables. If top or bottom clamps are used, the length of cable

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exposed outside of the clamp(s) shall be 76 mm (3 inches).

Continuous flame: Flame spread factor, $F_s \leq 2.75$, Heat evolution factor, $Q \leq 6$ when performed in accordance with ASTM-E-162. The thickness of the specimen shall be 2 mm (.08 inch). The specimen shall be constructed by laying 305 mm (12 inch) lengths of cable adjacent to one another to form a 457 mm (18 inch) strip. Wire or cable clamps may be used to permanently hold the cable lengths in place. Longer cable lengths may be used if the top or bottom clamps are used to hold the cables. If top or bottom clamps are used, the length of cable exposed outside of the clamp(s) shall be 305 mm (12 inches).

Vibration: Applicable except specimens shall be tested for random vibration in accordance with 5.3.c of MIL-STD-1678-3 measurement 3201. Optical discontinuities shall be measured during the test. A minimum of four specimens shall be monitored for optical discontinuity. The change in optical transmittance shall be monitored after the test. The specimens shall be visually examined after the test. The requirement for optical discontinuity shall be met during the test and the requirement for the change in optical transmittance shall be met after the test.

Shock: Applicable except specimens shall be tested both in accordance with MIL-S-901, grade A, class I implementing the restrictions and using the test fixtures specified in measurement 3202 of MIL-STD-1678-3 and in accordance with TIA-455-14, test condition D implementing the further guidance and, as applicable the fixtures, as specified in measurement 3202 of MIL-STD-1678-3. Optical discontinuities shall be measured during the test. A minimum of four specimens shall be monitored for discontinuity. The change in optical transmittance shall be monitored after the test. The specimens shall be visually examined after the test. The requirement for optical discontinuity shall be met during the test and the requirement for the change in optical transmittance shall be met after the test.

Corner bend. Applicable except that test force shall be 132 N. The radius for the corner bend to use for single fiber cable is the same as specified for the core components.

OFCC kink. Applicable except test the specimens for kink resistance to a diameter of 9 mm (.35 in) by placing cable in a free form loop using the methods specified in IEC 794-I-E10 and hold at this diameter for 24 hours. The change in optical transmittance shall be measured both during and after the test. Visual inspection performed during and after the test shall reveal no kinking, cracking, splitting, tearing, or collapsing of the cable jacket for free form loop diameters not less than the minimum short term bend diameter of the cable. At a minimum, the visual inspection shall be done as the bend diameter is decreased, at two times spaced at least 4 hours apart while holding in the tight bend for 24 hours, and after the test. Change in optical transmittance shall not exceed the values specified in 3.5.2 during and after the test.

Cable clamp. The specimen length (two 1 m minimum lengths, using same specimens after performed kink) with 6 standard plastic straps spaced 100 mm (4 inches) apart, hold for 24 hours and measure for the change in optical transmittance. The change in optical transmittance shall not exceed the values specified in 3.5.2 during and after the test. Cable length shall be placed adjacent to the length of a 25 mm (approximately 1.0 inch) diameter metal mandrel. The plastic straps (adjustable, self-clinching, plastic tie down strap) used shall conform to MS3367-4 of SAE AS 33671. Plastic straps shall be installed using a tool conforming to SAE AS90387 with the minimum tensile load as specified in table 2 of the SAE standard. This configuration is specified for test purposed only as miniature nylon straps are not used on military aircraft. Visual inspection shall be performed after the test and shall reveal no kinking, cracking, splitting, tearing or collapsing of the cable jacket.

Serpentine cable bend: Test the specimens between two plates on which mandrels (rods) with a 10 mm mandrel diameter (A) are welded or otherwise permanently affixed. Apply a load on the top plate of 50 N (11.2 lbs.) for 24 hours and measure the change in optical transmittance. Change in optical transmittance shall not exceed the values specified in 3.5.2 during and after the test. Visual inspection shall be performed after the test and shall reveal no kinking, cracking, splitting, tearing, or collapsing of the cable jacket. Bottom plate shall have three mandrels placed adjacently and touching each other in the middle of the plate. Top plate shall have four mandrels placed adjacently and touching each other in the middle of the plate. Specimens shall be placed onto the bottom plate so that cable length is perpendicular to mandrels circumference. Top plate shall be placed onto bottom plate for this test so that the inner two diameters of the mandrels on the top plate are placed between the two spaces of the three mandrels on the bottom plate. Applying and removal of the load shall not exceed a rate

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of 50 N/minute (11.2 lbs/min). Fixture used to apply the loading shall conform to figure 2.

Cable jacket tear strength. Applicable. Five strips of flat extruded jacket material shall be used.

Cable jacket mechanical strippability: Test shall be performed on the outer cable jacket in accordance with TIA-455-178. Once the outer cable jacket is cut 360 degrees along the cable circumference (i.e., ring cut), the axial force to remove a 25 mm (1.0 inch) length of cable jacket shall not exceed 15.6 N (3.5 lbs.). A strip rate of 250 ± 50 mm/min (10 ± 2 inch/min) shall be used.

Water absorption: Not applicable.

Jacket material tensile strength and elongation: Tensile strength 900 N/cm^2 minimum, elongation 125 percent minimum. Restrictions on the setup and test procedure and compliance with data recording shall be in accordance with MIL-STD-1678-3 measurement 3410.

Cable shrinkage: Applicable except total shrinkage of 30 cm length shall not be greater than 3.18 mm (.125 inch).

Paint susceptibility: Not applicable.

Wicking: Applicable except maximum water penetration shall be 25 mm (1 inch).

Cable strain relief pull out force: The pull out force of the cable strain relief (that is, the cable member for strain relief to a connection device comprised of a material such as arimid yarn) shall be tested in accordance with TIA-455-6 by applying a 98 N (22 lb) force for a minimum duration of one minute. One end on each length of fiber optic cable shall be terminated onto the end of a MIL-PRF-29504 terminus (or other suitable fiber optic connector if approved by the qualifying activity prior to test sample fabrication). Fabrication shall be performed as specified in requirement 4103 of MIL-STD-1678-4. Specimen shall consist of a MIL-PRF-29504/18 or a /20 terminus affixed to the 2 meter cable sample at one end and a suitable connector to mate with the optical instrumentation detector interface at the other cable sample end. A test cable shall interface the specimen through a MIL-PRF-29504/18 or a /20 terminus at one cable end and the optical source at the other cable end. An axial tensile load shall be applied on the detector end cable (specimen) through a mandrel or other approved means. Load shall not be applied to the coupling mechanism (such as a MIL-PRF-64266 connector). The change in optical transmittance shall be measured during and after the test and meet the optical requirement for this measurement. The cable strain relief shall be visually inspected after the test. No evidence of strain relief damage, breakage, or disengagement (pull out) shall occur.

Chemical properties:

Thermal vacuum outgassing: Applicable for non metallic materials only.

Mechanical strippability. Test shall be performed in accordance with TIA-455-178 using the setup and procedure specified in measurement 3204 of MIL-STD-1678-3. The strip force shall be obtained ten times from each length for each individual fiber optic cable. Once the outer cable jacket is removed, the coated optical fiber shall be stripped of their coatings with the use of a commercially available mechanical fiber stripper. This coating removed shall consist of both those applied during the optical fiber draw and that applied during the cabling process. After stripping, the optical fiber shall be inspected using 10X magnification for compliance. The coating shall be mechanically strippable with commercially available stripping tools. There shall be no scratches, nicks, or inclusions in the stripped optical fibers or residual coating material on the stripped optical fiber which cannot be easily removed with a cotton pad or a wipe moistened with a fiber optic grade cleaning solution. The maximum strip force shall be not less than 1.8 N (.41 lb-f) and not greater than 25 N (5.6 lb-f).

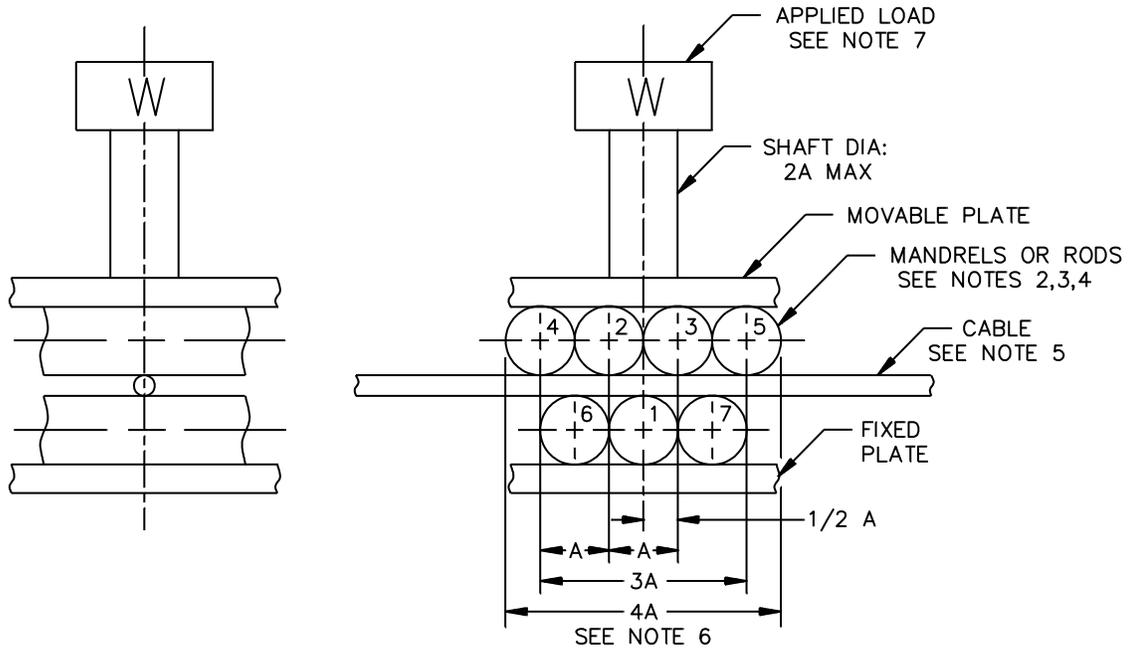


Figure 2. Serpentine cable bend test fixture.

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NOTES:

1. Material (plates, mandrels, shaft): Metal.
2. Dimensions: A = mandrel diameter.
3. Mandrels 1, 2 and 3: primary applied loading members.
4. Mandrels 4, 5, 6, and 7: stability members.
5. Cable placed at centerline of applied load.
6. When load is applied, top mandrels are to fit into spacing between lower mandrels (as shown on figure with centerlines). Guide pins or other means can be used to ensure this alignment.
7. Weight, W is the applied load. Preference is to apply the load from a controlled device such as a tensile test machine or press.

Qualification by similarity:

The limited inspections for qualification by similarity listed in table V are applicable under the constraints specified in the individual qualification by similarity paragraphs.

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TABLE V. Qualification by similarity.

	Cable size code designation	03	40	04	20
	M49291 spec sheet/fiber type	/11-02	/12-02	/10-02	1/12-01
	Coating diameter	245	245	245	500
	Fiber size (µm)	SM	50/125	62.5/125	50/125
	Notes		1/, 3/, 4/	2/, 3/, 5/	2/, 3/, 6/
Group	Inspection				
I	Visual & mechanical inspection	X	X	X	X
	Attenuation	X	X	X	X
	Polarization Mode Dispersion	X			
II	Crosstalk	X			
	Electromagnetic effects	X			
	Jacket red light transparency	X			
III	Temperature cycling	X	X	X	X
	Temperature cycling with mandrel	X			
	Temperature humidity cycling	X	X	X	X
	Storage temperature	X	X	X	X
	Low temperature flexibility (cold bend)	X			
	Cyclic flexing	X	X		
	Crush	X	X		
	Cable twist-bend	X	X		
	Impact	X	X		
	Altitude immersion	X			
	Temperature life (life aging)	X			
	Tensile loading and elongation	X	X		
	Operating tensile loading	X	X		
	Freezing water immersion (ice crush)	X	X		
	Fungus resistance	X			
Cable element removability	X				
Flammability (60 degree angle)	X				
IV	Thermal shock	X	X	X	X
	Fluid immersion	X			
	Jacket self-adhesion or blocking	X			
	Vibration	X	X	X	
	Shock	X	X	X	
	Dynamic bend	X	X	X	X
	Corner bend	X			
	OFCC kink	X	X	X	X
	Cable clamp	X	X	X	X
Serpentine cable bend	X	X	X	X	
V	Dripping	X			
	Cable jacket tear strength	X			
	Cable jacket mechanical strippability	X			
	Cable jacket material tensile strength & elongation	X			
	Cable abrasion resistance, cable-to-cable	X			
	Cable shrinkage	X			
	Durability of identification	X			
	Flaming smoke generation	X			
	Continuous flame	X			
	Wicking	X			
Cable strain relief pull out force	X				
VI	Acid gas generation	X			
	Toxicity index	X			
	Thermal vacuum outgassing	X			

See notes at end of table.

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NOTES:

1/ Limited qualification sequence valid only if qualified under this specification sheet for the M85045/32-03 cable (i.e., the single mode fiber size with a 245 micron coating diameter). Otherwise, entire test sequence shall be performed.

2/ Limited qualification sequence valid only if qualified under this specification sheet for the M85045/32-40 cable (i.e., the multimode 50/125 micron fiber size with a 245 micron coating diameter). Otherwise, entire test sequence shall be performed. There is one exception to allow a limited qualification sequence. This exception is if not qualified for M85045/32-40 cable, but are qualified under this specification sheet for the M85045/32-03 cable. In this case the limited qualification sequence listed under the M85045/32-40 cable may be performed for the M85045/32-04 cable (i.e., the multimode 62.5/125 micron fiber size with a 245 micron coating diameter) or the M85045/32-20 cable (i.e., the multimode 50/125 micron fiber size with a 500 micron coating diameter).

3/ Testing may be performed on either one or two lengths of cable, each with a minimum length of 0.5 km. Test order must be observed up to and including the storage temperature test. If only one cable length is used, the thermal shock test shall be performed after the storage temperature test.

4/ Applicable if the only difference between the previously qualified single mode cable and the 50/125 micron fiber multimode cable under test is that the optical fiber with the same coating diameter had been changed from a single mode fiber to a multimode fiber.

5/ Applicable if the only difference between the previously qualified 50/125 micron fiber multimode cable and the 62.5/125 micron fiber multimode cable under test is that the optical fiber with the same coating diameter had been changed from a 50/125 micron fiber multimode fiber to a 62.5/125 micron fiber multimode fiber.

6/ Applicable if the only difference between the previously qualified 50/125 micron fiber multimode cable and the 50/125 micron fiber multimode cable under test is that the coating diameter had been changed from 245 microns to 500 microns.

Qualification by similarity for multimode once qualified for single mode: Manufacturers who are qualified under this specification sheet for single mode fiber cable and whose multimode fiber cable passes the visual and mechanical, attenuation rate, temperature cycling, temperature humidity cycling, storage temperature, cyclic flexing, crush, cable twist-bending, impact (low temperature only), tensile loading and elongation, operating tensile loading, freezing water immersion, thermal shock, vibration, shock, dynamic bend, OFCC kink, cable clamp and serpentine cable bend inspections specified herein, are qualified by similarity is applicable if the only difference between the previously qualified cable and the cable under test is that the optical fiber with the same coating diameter had been changed from a single mode fiber to a multimode fiber. Testing may be performed on either one or two lengths of cable, each with a minimum length of 0.5 km. Test order must be observed up to and including the storage temperature test. If only one cable length is used, the thermal shock test shall be performed after the storage temperature test. This qualification by similarity is applicable for cable with optical fiber having the same fiber coating diameter.

Qualification by similarity for 62.5/125 micron multimode once qualified for 50/125 micron multimode: Manufacturers who are qualified under this specification sheet for multimode 50/125 micron fiber cable and whose multimode 62.5/125 micron fiber cable with the same diameter optical fiber coating diameter passes the visual and mechanical, attenuation rate, temperature cycling, temperature humidity cycling, storage temperature, thermal shock, vibration, shock, dynamic bend, OFCC kink, cable clamp, and serpentine cable bend inspections specified herein, are qualified by similarity is applicable if the only difference between the previously qualified cable and the cable under test is that the optical fiber with the same coating diameter had been changed from a multimode 50/125 micron fiber to a multimode 62.5/125 micron fiber. Testing may be performed on either one or two lengths of cable, each with a minimum length of 0.5 km. Test order must be observed up to and including the storage temperature test. If only one cable length is used, the thermal shock test shall be performed after the storage temperature test. This qualification by similarity is applicable for cable with optical fiber having the same fiber coating diameter.

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Qualification by similarity for 50/125 micron multimode with a 500 micron coating once qualified for the 245 micron coating: Manufacturers who are qualified under this specification sheet for multimode 50/125 micron fiber cable with a 245 micron coating diameter and whose multimode 50/125 micron fiber cable with a 500 micron coating diameter optical fiber coating passes the visual and mechanical, attenuation rate, temperature cycling, temperature humidity cycling, storage temperature, thermal shock, dynamic bend, OFCC kink, cable clamp and serpentine cable bend inspections specified herein, are qualified under this specification sheet for multimode 50/125 micron fiber cable with a 500 micron coating diameter. This qualification by similarity is applicable is the only difference between the previously qualified cable is that the optical fiber with the coating diameter had been changed from 245 microns to 500 microns. Testing may be performed on either one or two lengths of cable, each with a minimum length of 0.5 km. Test order must be observed up to and including the storage temperature test. If only one cable length is used, the thermal shock test shall be performed after the storage temperature test.

Intended use:

This cable is intended for use as cable runs between fiber optic switches (backbone cables), as cable runs to end user equipment (cable drops), jumper cordage, and pigtails for fiber optic components. This cable is intended for use inside of protected enclosures (such as convoluted tubing or cable wrap)/cable harnesses and is not intended for installation in the overheads or cableways outside protective enclosures.

Application restriction. Cable produced under this specification sheet with the 50/125 micron optical fiber (i.e., M85045/31-20 and M85045/31-40) is not for use on Navy shipboard applications.

Bandwidth measurements (multimode cables only). For this cable construction, the bandwidth is measured as part of the requirements of the optical fiber to be cabled. The bandwidth value does not change once the optical fiber is cabled. Since the bandwidth is provided as one of the cable measured parameters, the acceptable bandwidth for the optical fiber used in this cable (and by extension, the cable) is provided for informational purposes.

For cable with MM 62.5/125 micron fiber: ≥ 200 MHz-km at 850 ± 20 nm, ≥ 500 MHz-km at 1300 ± 20 nm for cable with MM fiber.

For cable with MM 50/125 micron fiber: ≥ 1500 MHz-km at 850 ± 20 nm, ≥ 500 MHz-km at 1300 ± 20 nm for cable with MM fiber.

Referenced documents. In addition to MIL-PRF-85045, this document references the following:

MIL-STD-1678-1	MIL-PRF-49291/11	TIA-455-6	MIL-S-901
MIL-STD-1678-3	MIL-PRF-49291/12	TIA-455-14	MIL-PRF-29504/18
MIL-STD-1678-4	MIL-PRF-64266	TIA-455-15	SAE AS 33671
MIL-PRF-29504	ASTM E 662	TIA-455-124	IEC 794-I-E10
MIL-PRF-49291/10	TIA-455-3	TIA/EIA-455-4	TIA-455-178
TIA-455-122	SAE-AS90387	ASTM – E162	MIL-PRF-29504/20

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CONCLUDING MATERIAL

Custodians:

Army - CR
Navy - AS
Air Force - 85
DLA - CC
NASA - NA

Preparing activity:

DLA - CC

(Project 6015-2016-001)

Review activities:

Army - AR, AV, MI
Navy - EC, SH, YD
Air Force - 02, 19, 99

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