

METRIC

MIL-PRF-85045/29B
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SUPERSEDING
MIL-PRF-85045/29A
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PERFORMANCE SPECIFICATION SHEET

CABLE, FIBER OPTIC, TWELVE/EIGHTEEN FIBER BUNDLE, BLOWN OPTICAL FIBER, CABLE CONFIGURATION TYPE 3 (CABLE BUNDLE), APPLICATION B (SHIPBOARD), CABLE CLASS SM AND MM, (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 and MIL-PRF-85045.

CLASSIFICATION:

Fiber optic cable configuration type (bundle): 3.

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

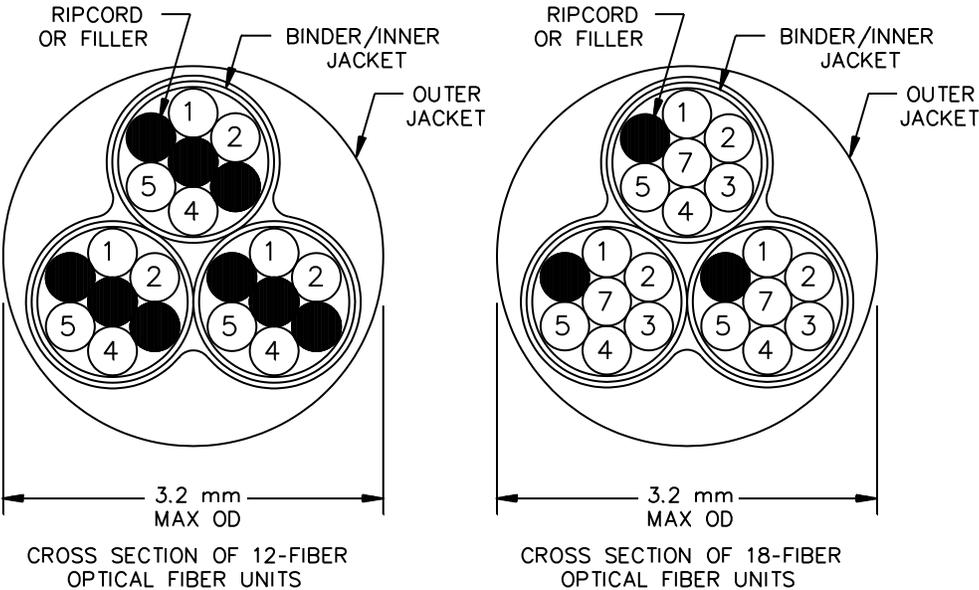


FIGURE 1. Blown optical fiber bundle cable.

Part or Identifying Number (PIN):

12 fiber bundle cable (multimode): M85045/29-0112.
18 fiber bundle cable (multimode): M85045/29-0118.
12 fiber bundle cable (single mode): M85045/29-0212.
18 fiber bundle cable (single mode): M85045/29-0218.

DESIGN AND CONSTRUCTION:

Fiber: Type MM fibers shall be in accordance with MIL-PRF-49291/6.
Type SM fibers shall be in accordance with MIL-PRF-49291/7.

Buffer diameter: $250 \pm 15 \mu\text{m}$.

Dimensions and configuration: See figure 1. An outer jacket shall be applied over three optical fiber bundle sub-units with rip cords or fillers in each sub-unit.

OFCC kink: Not applicable.

Outer jacket color: Slate or blue (MIL-PRF-49291/6 fiber).
Yellow (MIL-PRF-49291/7 fiber).

Concentricity: Applicable with the following modification. The concentricity shall be measured by first locating the areas where the binder/inner jacket is nearest the jacket outside diameter. From these measurements the minimum and the maximum wall thicknesses will be selected and used to calculate concentricity. The ratio of the minimum wall thickness to the maximum wall thickness shall be ≥ 0.50 .

Jacket material: The overall jacket shall be composed of a low halogen, low smoke, low toxicity polymer material.

Mass per unit length: $\leq 6 \text{ kg/km}$.

Short term minimum bend diameter: 76 mm. (The short term minimum bend diameter is to be used in all environmental and mechanical tests that specify a cable minimum bend diameter).

Long term minimum bend diameter: 76 mm.

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, the delivered cable shall be accompanied by certified test data demonstrating that the conformance inspection was performed on a test specimen not less than 0.5 km in length.

Marking: Marking of blown optical fiber bundles is not required. Shipping containers and bundle reels shall be marked.

Fiber color coding: See table I.

TABLE I. Fiber color coding.

| Sub-unit number | Position number | Fiber color | |
|-----------------|-----------------|--------------------|--------------------|
| | | 12-fiber bundle | 18-fiber bundle |
| 1 | 1 | Blue | Blue |
| | 2 | N/A ripcord | Orange |
| | 3 | Orange | Green |
| | 4 | Green | Brown |
| | 5 | Brown | Slate |
| | 6 | N/A ripcord/filler | N/A ripcord/filler |
| | 7 | N/A ripcord | Red |
| 2 | 1 | Slate | Blue |
| | 2 | White | Orange |
| | 3 | N/A ripcord/filler | Green |
| | 4 | Violet | Brown |
| | 5 | Black | Slate |
| | 6 | N/A ripcord/filler | N/A ripcord/filler |
| | 7 | N/A ripcord/filler | Violet |
| 3 | 1 | Yellow | Blue |
| | 2 | Violet | Orange |
| | 3 | N/A ripcord/filler | Green |
| | 4 | Pink | Brown |
| | 5 | Aqua | Slate |
| | 6 | N/A ripcord/filler | N/A ripcord/filler |
| | 7 | N/A ripcord/filler | Yellow |

NOTE: PINs M85045/29-0112 and M85045/29-0212 only contain 4 fibers in each

PERFORMANCE REQUIREMENTS:

Optical properties:

Maximum attenuation rate: 3.75 dB/km at 850 ± 20 nm, 1.25 dB/km at $1,300 \pm 20$ nm for class type MM fiber.

0.75 dB/km at $1,310 \pm 20$ nm and $1,550 \pm 20$ nm for class type SM fiber.

Bandwidth: Fiber with a minimum bandwidth of 500 MHz-km at 1,300 nm shall be used (multimode cables only).

Bandwidth is not specified at 850 nm.

Change in optical transmittance: Measurements to be made at $1,300 \pm 20$ nm.
For shock testing only four fibers are required to be monitored, at least one fiber per sub-unit.

Crosstalk: Applicable.

Mechanical properties:

Tensile loading and elongation: Not applicable.

Operating tensile loading: Not applicable.

Dynamic bend: Not applicable.

Low temperature flexibility: Not applicable.

Cyclic flexing: 500 cycles at +25°C ±2°C and 100 cycles at -28°C ±2°C. Minimum load shall be 1.0 kg. 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 test specimen in the same position in the test cycle. The cycling may be halted to perform the change in optical transmittance measurement. At low temperature, splitting, cracking or crazing of bundle jacket may be permitted so long as there is no splitting, cracking, or crazing of inner jacket.

Crush: Not applicable.

Cable twist bending: Not applicable.

Impact: Not applicable.

Corner bend: Not applicable.

Cable jacket tear strength: Applicable, except the cable jacket tear strength shall be 5 N/cm minimum. Test shall be performed on test samples in shear orientation on molded samples of the same jacket material: 4 in (L) by 0.5 in (W) by 0.125 in (T), with a single longitudinal slit along the length of the specimen.

Cable scraping resistance: Not applicable.

Cable to cable abrasion: Not applicable.

Durability of marking: Not applicable.

Environmental properties:

Temperature range:

Operating: -28°C to +65°C.

Non-operating: -40°C to +70°C.

Storage: -40°C to +70°C.

Temperature cycling: Temperature cycling: Change in optical transmittance measurements may be made periodically. At a minimum, one optical transmittance measurement shall be made over a period of one hour at the end of each temperature plateau.

Temperature humidity cycling: 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.

Fluid immersion: Not applicable.

Flame extinguishing and smoke generation: Applicable. Testing shall be performed in the following configuration: A MIL-PRF-85045/26 cable that contains the lowest fiber count bundle pursuing qualification. The tube ends shall be plugged with a non-flammable sealant to simulate end caps.

Shock: Applicable. The bundle shall be tested within a tube cable.

Paint susceptibility: Not applicable.

Chemical properties:

Acid gas generation: Gas generation shall be not greater than 5.0 percent of the weight of the sample.

Halogen content: < 0.2 percent.

Qualification and Conformance inspection: See table II.

TABLE II. Qualification and conformance inspection.

| Group | Qualification inspection | Requirement paragraph | Test paragraph | Cable length <u>1/</u> , <u>2/</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 |
| II | Crosstalk | 3.5.3 | 4.7.4.3 | 3 samples, 0.5 km each <u>4/</u> | |
| III | Temperature cycling | 3.7.1 | <u>5/</u> | 2 samples, 0.5 km each <u>4/</u> (1 on reel, 1 off) | C |
| | Temperature humidity cycling | 3.7.3 | 4.7.6.3 | 2 samples, 0.5 km each <u>6/</u> | C |
| | Storage temperature | 3.7.4 | 4.7.6.4 | 2 samples, 0.5 km each <u>6/</u> | |
| | Cyclic flexing | 3.6.4 | 4.7.5.4 | 6 specimens, 5 m each <u>8/</u> (2 specimens at each temp) | |
| | Temperature life (Life aging) | <u>5/</u> | <u>5/</u> | 2 specimens, 300 m each <u>7/</u> | C |
| | Fungus resistance | 3.8.4 | 4.8.4 | 2 specimens, 0.5 m each <u>7/</u> | |
| | Cable element removability | 3.6.18 | 4.7.5.18 | 2 specimens, 0.5 m each <u>7/</u> | C |
| IV | Thermal shock | 3.7.2 | 4.7.6.2 | 1 specimen, 0.49 km each <u>4/</u> (on reel) | |
| | Jacket self-adhesion or blocking | 3.7.11 | 4.7.6.11 | 1 specimen, 30 m <u>9/</u> | |
| | Shock | 3.7.13 | 4.7.6.13 | 1 sample, 30 m <u>9/</u> | |
| V | Dripping | 3.6.13 | 4.7.5.13 | 1 sample, 30 cm <u>9/</u> | |
| | Cable jacket tear strength | 3.6.14 | 4.7.5.14 | 5 flat extruded jacket material strips | C |
| | Cable shrinkage | 3.6.17 | 4.7.5.17 | 3 specimens, 0.5 m <u>9/</u> | C |
| | Flame extinguishing and smoke generation | 3.7.12.2 | 4.7.6.12.2 | 1 sample, 50 m <u>9/</u> | C |
| | Water absorption | 3.7.14 | 4.7.6.14 | 2 specimens, extruded jacket material strips <u>10/</u> | |
| VI | Acid gas generation | 3.8.1 | 4.8.1 | 1 specimens 1 m <u>12/</u> | C |
| | Halogen content | 3.8.2 | 4.8.2 | 1 specimen, 1m <u>12/</u> | |
| | Toxicity index | 3.8.3 | 4.8.3 | 1 specimen, 1 m <u>12/</u> | C |

See notes at end of table.

TABLE II. Qualification and conformance inspection - Continued.

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.
- 5/ As stated under the applicable tests in this specification sheet.
- 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/ A specimen cut from the same specimen used in the thermal shock test shall be used.
- 10/ 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.
- 11/ Left blank intentionally.
- 12/ 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.

Qualification by similarity:

Manufacturers who produce products for both MIL-PRF-85045/27-01 and products for this specification sheet, and are qualified under MIL-PRF-85045/27-01, and pass the tests and inspections specified in table II as specified herein, are qualified under this specification sheet for multimode fiber bundle (M85045/29-01). This qualification by similarity is applicable only if the 6-fiber bundle sub-unit and the bundle cable jacket for the unqualified bundle cable are the same as those for the previously qualified bundle cable. Testing may be performed on a single length of cable, with a minimum length of 0.5 km.

TABLE III. Qualification and conformance by similarity for M85045/27 with the same 6-fiber bundle and cable jacket.

| Group | Qualification inspection | Qualification inspection M85045/29-011 8 1/ | Conformance inspection M85045/29-0118 2/ |
|-------|--------------------------|--|---|
| I | Visual and mechanical | X | A |
| | Attenuation rate | X | A |
| III | Cyclic flexing | X | |

Notes:

- 1/ Where manufacturers are qualified for MIL-PRF-85045/27-01 and is pursuing qualification for MIL- PRF-85045/29-0118.
- 2/ Where manufacturers are qualified for MIL-PRF-85045/27-01 and MIL-PRF-85045/29-0118 and are performing conformance testing for M85045/29-0118.
- 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.

Manufacturers who are qualified under this specification sheet for the 18-fiber bundle cable (MIL-85045/27-0118) and whose 12-fiber bundle cable passes the tests and inspections specified in table III as specified herein, are qualified under this specification sheet for the 12-fiber bundle cable (MIL-85045/27-0112). This qualification by similarity is applicable only if the fiber bundle sub-unit and the bundle cable jacket for the unqualified 12-fiber bundle cable are the same as those for the previously qualified 18-fiber bundle cable. This qualification by similarity is applicable if the only difference between the previously qualified cable and the cable under test is that the fiber count has been changed from 18 fibers to 12 fibers. Testing may be performed on a single length of cable, with a minimum length of 0.5 km.

TABLE IV. Qualification and conformance by similarity for 12-fiber bundle.

| Group | Qualification inspection | Qualification inspection M85045/29-0112 <u>1/</u> | Conformance inspection M85045/29-01 12 <u>2/</u> |
|-------|------------------------------|--|---|
| I | Visual and mechanical | X | A |
| III | Temperature humidity cycling | X | C |

Notes:

- 1/ Where manufacturers are qualified for MIL-PRF-85045/29-0118 or MIL-PRF-85045/29-0218 and is pursuing qualification for MIL- PRF-85045/29-0112.
- 2/ Where manufacturers are qualified for MIL-PRF-85045/29-0118 and MIL-PRF-85045/29-0118 and are performing conformance testing for M85045/29-0118.
- 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.

Manufacturers who are qualified under this specification sheet for multimode fiber cable (MIL-PRF-85045/29-0118 or MIL-PRF-85045/29-0112) and whose single mode fiber cable passes the tests and inspections specified in table IV as specified herein, are qualified under this specification sheet for single mode fiber bundle (MIL-PRF-85045/29-0118 or MIL-PRF-85045/29-0112). This qualification by similarity is applicable if the only difference between the previously qualified cable and the cable under test is that the optical fiber has been changed from a multimode fiber to a single mode 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. Manufacturers who are qualified under MIL-PRF-85045/27 for both multimode (MIL-PRF-85045/27-01) and single mode fiber cable (MIL-PRF-85045/27-02) and under this specification sheet for multimode fiber cable (MIL-85045/29-0118) are qualified under this specification sheet for single mode fiber cable (MIL-85045/29-0218).

TABLE V. Qualification and conformance by similarity (fiber).

| Group | Qualification inspection | Qualification inspection M85045/29-0218 <u>1/</u> | Conformance inspection M85045/29-0218 <u>2/</u> |
|-------|------------------------------|---|---|
| I | Visual and mechanical | X | A |
| | Attenuation rate | X | A |
| III | Temperature cycling | X | C |
| | Temperature humidity cycling | X | C |
| | Storage temperature | X | |
| | Cyclic flexing | X | |
| IV | Thermal shock | X | |

Notes:

- 1/ Where manufacturers are qualified for MIL-PRF-85045/29-0118 and is pursuing qualification for MIL-PRF-85045/29-0218.
- 2/ Where manufacturers are qualified for MIL-PRF-85045/29-0118 and MIL-PRF-85045/29-0218 and are performing conformance testing for M85045/29-0218.
- 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.

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

| | |
|-----------------|------------------|
| MIL-PRF-49291/6 | MIL-PRF-85045/26 |
| MIL-PRF-49291/7 | MIL-PRF-85045/27 |

The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. 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 requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:
Navy - SH
Air Force - 85
DLA – CC

Preparing activity:
DLA – CC

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Review activity:
Air Force - 99

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