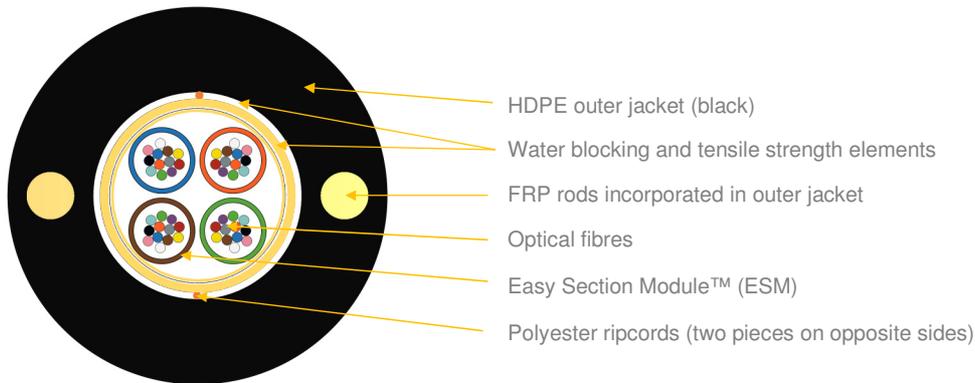


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| Type: | MAR-FM | REV: 1.6 |
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| Project: | 008-21 | |

Single HDPE jacket outdoor distribution aerial and duct cable with Easy Section Modules™ MAR-FM (up to 110m) (modul 12)



*schematic drawing of 48F configuration, not to scale

APPLICATION:

Mixed use duct/aerial
FTTH networks
Fully dielectric
For installation along power lines with an operation voltage below 150 kV and producing space potential below 4 kV.

DESIGN:

ESM™ - Easy Section Module with 12 fibres each, 1,35mm.
Water blocking aramid yarns as a strain relief
Water swellable elements
FRP rods as strength and anti-buckling elements
UV resistant black HDPE sheath
Polyester ripcord, two pieces on opposite sides

DESIGNS:

| Variant | Quantity [pcs] | | | | Ø nominal (±5%, min 0,5mm) [mm] | Nominal weight (±10%) [kg/km] | Max allowed tension T _M [N] | Max operating tension T _L [N] |
|-----------|----------------|-------------------|----------------|----------------|------------------------------------------|-------------------------------------|----------------------------------------------|------------------------------------------------|
| | Fibres | Fibres per module | Total elements | Active modules | | | | |
| 1M x 12F | 12 | 12 | 1 | 1 | 5,9 | 29 | 600 | 170 |
| 2M x 12F | 24 | 12 | 2 | 2 | 7,2 | 38 | 800 | 220 |
| 3M x 12F | 36 | 12 | 3 | 3 | 8,0 | 45 | 950 | 270 |
| 4M x 12F | 48 | 12 | 4 | 4 | 8,5 | 48 | 1000 | 300 |
| 6M x 12F | 72 | 12 | 6 | 6 | 10,2 | 70 | 1500 | 400 |
| 8M x 12F | 96 | 12 | 8 | 8 | 11,5 | 90 | 1900 | 550 |
| 12M x 12F | 144 | 12 | 12 | 12 | 11,5 | 95 | 2000 | 600 |
| 16M x 12F | 192 | 12 | 16 | 16 | 13,5 | 125 | 2650 | 750 |
| 18M x 12F | 216 | 12 | 18 | 18 | 13,5 | 127 | 2670 | 760 |
| 24M x 12F | 288 | 12 | 24 | 24 | 14,5 | 143 | 3000 | 800 |

Other variants, designs, mechanical and environmental properties available on demand

MECHANICAL AND ENVIRONMENTAL CHARACTERISTICS

| Test | Specification | Method | Requirements |
|------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tensile strength | IEC60794-1-21 Method E1 | Mandrel diameter: ≥ 30 x OD Load T _M : as provided in the table above | Fibre strain: e ≤ 0.3%, during test, reversible Cable strain: e ≤ 0.5%, during test, reversible Δα ≤ 0,5dB/km, during test, reversible |
| | | Mandrel diameter: ≥ 30 x OD Sustained Load T _L : as provided in the table above | Fibre strain: e ≤ 0.1%, no attenuation change |
| Crush resistance | IEC60794-1-21 Method E3 | Load: 2000 N / 10 cm / 15 minutes Plate size: 100 mm x 100mm Number of pts: at 5 different points 200mm apart | Δα ≤ 0.1dB @ 1550nm, during test, reversible No jacket cracking and fibre breakage |
| | | Load: 3000 N / 10 cm / 15 minutes Plate size: 100 mm x 100mm Number of pts: at 5 different points 200mm apart | Δα reversible, No jacket cracking and fibre breakage |

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|-------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Impact resistance | IEC60794-1-21 Method E4 | Impact energy: 5J Striking surface radius: 10 mm No. of impacts: at 3 different points 200mm apart | $\Delta\alpha$ reversible, No jacket cracking and fibre breakage |
| Torsion | IEC60794-1-21 Method E7 | Cable length to be twisted: 1m No. of cycles: 20 Twist angle: $\pm 180^\circ$ | $\Delta\alpha \leq 0.1$ dB @ 1550nm, during test, reversible No jacket cracking and fibre breakage |
| Cable kink | IEC60794-1-21 Method E10 | Loop diameter: 10 x OD | No cable kink |
| Repeated bending | IEC60794-1-21 Method E6 | Mandrel radius: 20x OD No. of cycles: 20 | No jacket cracking and fibre breakage |
| Bending | IEC60794-1-21 Method E11 | Mandrel radius: 15 x OD / 5 turns (wrapped and unwrapped) No. of cycles: 10 | $\Delta\alpha \leq 0.1$ dB @ 1550nm, during test No jacket cracking and fibre breakage |
| Water penetration | IEC 60794-1-22 Method F5B | Water head: 1m Sample length: 3m Number of samples: 10 pcs Time: 168 hrs | No water leakage for 9 out of 10 samples |
| Temperature range | IEC 60794-1-22 Method F1 | Operation: -20... +60 [°C] | No attenuation change |
| | | Operation: Storage: -40... +70 [°C] Transport: | $\Delta\alpha \leq 0.1$ dB/km @ 1550nm, during test, reversible |

STANDARD COMPLIANCE

The product is in compliance with the following standards: IEC 60794-3-11:2010, IEC 60794-1-21:2015, IEC 60794-1-22:2018.

SUGGESTED MAXIMUM SPAN VALUES

| Suggested max span [m] | Fibre count / modulo 12 | | | | | | | | | |
|-----------------------------|-------------------------|-----|-----|-----|-----|-----|------|------|------|------|
| | 12F | 24F | 36F | 48F | 72F | 96F | 144F | 192F | 216F | 288F |
| Ice 6,5 [mm]; wind 190 [Pa] | 50 | 50 | 60 | 60 | 60 | 70 | 70 | 80 | 80 | 90 |
| Wind 430 [Pa] | 80 | 80 | 80 | 80 | 80 | 90 | 90 | 95 | 95 | 110 |

OPTICAL FIBRES COLOUR IDENTIFICATION

| | | | | | | | | | | | | |
|--------------|-----|------|-------|--------|--------|-------|--------|------|-------|-------|------|------|
| Fibre number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Fibre colour | Red | Blue | Green | Yellow | Violet | White | Orange | Grey | Brown | Black | Aqua | Pink |

MODULES COLOUR IDENTIFICATION

Up to 12 modules

| | | | | | | | | | | | | |
|-------------|-----|------|-------|--------|--------|-------|--------|------|-------|-------|------|------|
| Tube number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Tube colour | Red | Blue | Green | Yellow | Violet | White | Orange | Grey | Brown | Black | Aqua | Pink |

More than 12 modules

| | | | | | | | | | | | | |
|-------------|--------|---------|----------|-----------|-----------|----------|-----------|---------|----------|----------------|---------|---------|
| Tube number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Tube colour | Red I | Blue I | Green I | Yellow I | Violet I | White I | Orange I | Grey I | Brown I | Light green I | Aqua I | Pink I |
| Tube number | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Tube colour | Red II | Blue II | Green II | Yellow II | Violet II | White II | Orange II | Grey II | Brown II | Light green II | Aqua II | Pink II |

"I", "II" – black marking (dashes)

FIBRE PARAMETERS

Fibre type: ITU-T G.657.A2 Corning

For selected post-production optical fibres parameters please see DSH_OFPP document.

MARKING

The following print (hot stamped / laser printing) is applied at 1-meter intervals:

- Supplier: FIBRAIN
- Standard code (product type, fibre type, fibre count)
- Year of manufacture: xxxx
- Length marking in meters
- Cable ID / Drum No

Example: FIBRAIN MAR-FM 48F SM G657A2 4M12F "YEAR OF MANUFACTURE" "LASER SYMBOL" "LENGTH MARKING" "BATCH NUMBER"

The accuracy of marking is $\pm 0.5\%$. Remarking is in accordance with Bellcore GR 20 and supersedes earlier markings. Occasional loss of marking is possible. Cables can be supplied with a range of single mode or multimode fibres and customized print.

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PACKING

Cables will be shipped on disposable wooden or treated wooden drums. Both ends of the cable will be capped and accessible for testing. Identification information will be placed on the drum. Cable length on one reel is 4000m \pm 5%, it can be changed upon arrangement and it depends on fibre count.

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