HIGH-FLEX MV REELING CABLE · PORT CRANES | 3-IN-1 · POWER · CONTROL · FIBRE | 20/35 kV | 8 sizes | HFFR rubber | 12G50

FC-MRT-H-PFM 20/35 kV

3-in-1 MV Power, Pilot and Fibre-Optic Reeling Cable 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, halogen-free elastomer (HFFR rubber) sheath. Complete technical data sheet: construction, dimensions, weights, current ratings, standards and installation guidance for 8 sizes.

Document no. FC-TDS-MV488-2026-43F90716-EN · Revision 0 · Issued 4 November 2026 · Language: English (AU)

01 Application and Product Overview

FC-MRT-H-PFM is a high-flex medium-voltage reeling cable rated 20/35 kV for ship-to-shore cranes, rail-mounted gantry cranes and electrified port equipment, with the configuration 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125. Each power core has a class 5 copper conductor, semi-conductive layers, EPR insulation 9.0 mm thick and its own tinned-copper braid screen; inner and outer sheaths are halogen-free cross-linked elastomer (HFFR rubber), flame-retardant, low smoke, resistant to weather and ozone. Power cores from 50 – 300 mm².

Typical applications

- Medium-voltage supply of ship-to-shore (STS) cranes and rail-mounted gantry cranes through motor-driven cable reels
- Short crane data links (reel to E-house, PLC or camera converter) over OM2 multimode fibre in the same reel
- Shore connections and mobile equipment powered from the terminal MV network
- Stackers, reclaimers, ship loaders and open-cast mining machines travelling on rails with a cable reel
- Outdoor operation with seawater spray, salt mist, UV radiation and ozone
- MV-supplied cranes that use ground-check or pilot-wire protection

Design

Three screened power cores and three split PE conductors with two 2.5 mm² pilot cores for earth-continuity monitoring and protective interlocks of the MV supply. This is a 3-in-1 design in the DIN VDE 0250 reeling-cable tradition: power cores, pilot cores and optical fibres share one sheath, so one reel, one slip-ring/rotary-joint assembly and one cable route replace three separate cables. The cable contains one optical element (12 multimode fibres OM2 50/125). OM2 multimode fibres work with low-cost 850 nm transceivers and are a good fit for the short links typical of a crane, such as reel-to-E-house or reel-to-PLC connections up to a few hundred metres.

8 sizes	20/35 kV	+90 °C	Halogen-free
Cross-section 50 – 300 mm²	Rated voltage U_0/U	Maximum conductor temperature	Sheath: HFFR rubber

Key features

- Fine-wire class 5 copper conductors and a very short core lay length for repeated reeling
- 3-in-1 design: power, pilot and 12 multimode fibres OM2 50/125 in a crush-resistant loose-tube element on the cable axis
- Three split PE conductors in the interstices keep the cross-section round and balanced

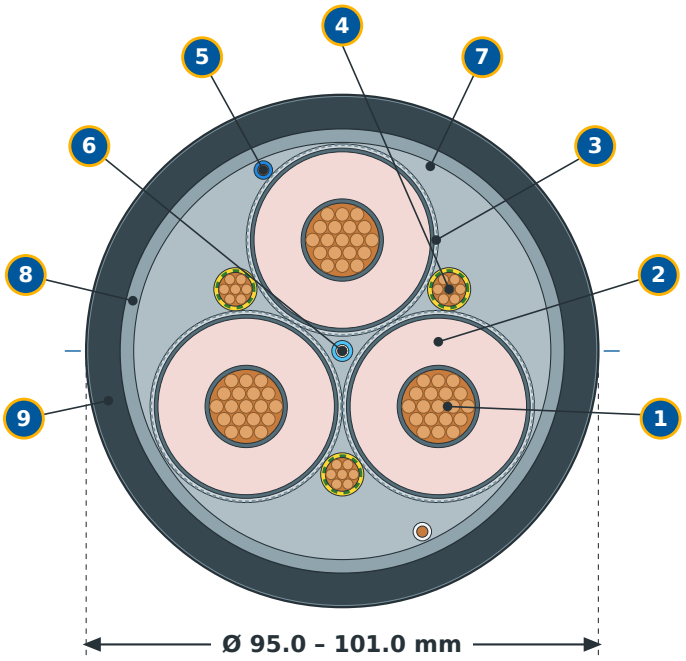
- Designed for 20 N/mm² continuous tensile load (on the total copper cross-section of the power cores)
- Halogen-free insulation and sheaths; no halogen acid gases when burned (IEC 60754-1/-2)
- Low smoke density to IEC 61034-2
- Flame retardant to IEC 60332-1-2

02 Construction

FEICHUN · CROSS-SECTION A–A · 20/35 kV

FC-MRT-H-PFM

Sample size 3×120+3G25+2×2.5+12G50 · Rev 0 · Illustrative, not to scale



No.	Component	Material
1	Conductor	Bare annealed fine-wire copper, class 5 to IEC 60228 (tinned on request)
2	Semi-conductive layers and insulation	Inner and outer semi-conductive compound with EPR insulation, extruded in one pass
3	Core screen	Tinned-copper wire braid, coverage ≥ 80 %
4	Split PE conductor	Class 5 copper, green-yellow insulation, laid in the interstices between the power cores
5	Pilot cores	Class 5 copper, blue and white insulation
6	Optical element	12 multimode fibres OM2 50/125; gel-filled loose tube, aramid strength members
7	Filler and binder tape	Halogen-free compound, polyester tape
8	Inner sheath	Halogen-free polymer compound
9	Outer sheath	Halogen-free cross-linked elastomer (HFFR rubber), flame-retardant, low smoke, resistant to weather and ozone

The drawing shows size 3×120+3G25+2×2.5+12G50. Other sizes have the same construction with scaled dimensions.

Construction details

Conductor	Bare annealed fine-wire copper; tinned on request, class 5 to DIN EN 60228 / IEC 60228 / VDE 0295
Insulation	Halogen-free EPR/HEPR rubber to IEC 60502-2, maximum conductor temperature 90 °C
Core screen	Semi-conductive layers extruded together with the EPR insulation; tinned-copper wire braid screen, coverage ≥ 80 %
Core identification	Power cores brown, black, grey to DIN VDE 0298-300
Protective conductor	Three PE conductors (3G), green-yellow, 25 mm² each, laid in the interstices between the power cores
Pilot cores	Two pilot cores 2 × 2.5 mm² (blue, white) laid in the free space between the power cores
Optical element	One element: 12 multimode fibres OM2 50/125, located at the centre of the cable
Stranding	Power cores, split PE conductors and control or optical elements are stranded together with a very short lay length
Inner sheath	Halogen-free polymer compound, extruded tightly over the stranded cores
Outer sheath	Halogen-free cross-linked elastomer (HFFR rubber), flame-retardant, low smoke, resistant to weather and ozone

Optical fibre data

Fibre type	Multimode G50/125 µm OM2, IEC 60793-2-10 A1a.1
Attenuation, cabled	≤ 3.0 dB/km at 850 nm; ≤ 1.0 dB/km at 1300 nm
Modal bandwidth (OFL)	≥ 500 MHz·km at 850 nm; ≥ 500 MHz·km at 1300 nm
Typical link reach	1 Gbit/s Ethernet up to 550 m (1000BASE-SX); 10 Gbit/s up to 82 m
Optical element	Gel-filled loose tube with aramid strength members and a crush-resistant TPU element sheath, placed on the cable axis where bending strain is lowest
Fibre colours	IEC 60304 / DIN VDE 0888 colour sequence; tube and element marked for identification
Fibre strain, reeling	≤ 0.25 % at the rated tensile load of the cable
Optical test	Attenuation of every fibre measured by OTDR after cabling; values recorded in the test certificate

Sheath material

The halogen-free, flame-retardant cross-linked elastomer (HFFR rubber) sheath combines the elasticity of a rubber reeling cable with low smoke density (IEC 61034-2) and no halogen acid gas when burned (IEC 60754-1/-2). It is the preferred choice for cable reels in tunnels, enclosed bulk-handling buildings, ship holds and other areas where people must be protected from corrosive smoke. Moving use down to −25 °C.

03 Electrical, Thermal and Mechanical Characteristics

Electrical data

Rated voltage U_0/U	20/35 kV AC
Test voltage	50 kV AC, 5 min
Maximum operating voltage, DC	30/52.5 kV
Current-carrying capacity	To DIN VDE 0298-4 at 30 °C ambient; the table gives rated design values
Conductor resistance	Maximum at 20 °C, class 5 to IEC 60228

Thermal and mechanical data

Maximum conductor temperature	+90 °C
Maximum temperature at short circuit	+250 °C
Ambient temperature, fixed installation	−40 °C to +90 °C
Ambient temperature, in motion	−25 °C to +90 °C
Minimum bending radius	6 × D fixed; 12.5 × D on a cable reel
Maximum tensile load	20 N/mm² continuous, on the total copper cross-section of the power cores
Maximum torsional load	To be agreed with FeiChun for the specific reel design
Maximum travelling speed	60 m/min on a cable reel; higher speeds on request
Flame propagation	IEC 60332-1-2 / DIN EN 60332-1-2
Halogen-free	Yes (insulation, inner and outer sheath); IEC 60754-1/-2
UV and ozone resistance	Resistant
Mineral oil resistance	Resistant, IEC 60811-404
Optical element, temperature in operation	−40 °C to +70 °C

Sheath material comparison

Property	PUR	PUR low-temp	CSP rubber	CPE rubber	PCP rubber	HFFR rubber
Abrasion resistance	Excellent	Excellent	Good	Good	Very good	**Good**
Cut and tear resistance	Excellent	Excellent	Good	Good	Very good	**Good**
Mineral oil resistance	Very good	Very good	Very good	Very good	Very good	**Good**
Weather, UV and ozone resistance	Very good	Very good	Excellent	Very good	Excellent	**Very good**
Cold flexibility (moving)	−30 °C	−40 °C	−30 °C	−30 °C	−25 °C	**−25 °C**
Halogen-free (IEC 60754-1/-2)	Yes	Yes	No	No	No	**Yes**

The column of the sheath used in this cable is highlighted. Ratings are qualitative; ask FeiChun for test data on a specific requirement.

04 Dimensions, Weights and Rated Data – 20/35 kV (8 sizes)

Type designation cores × mm²	FeiChun article no.	Conductor Ø max mm	Outer Ø min mm	Outer Ø max mm	Min. bend radius mm	Weight approx. kg/km	Max. pull force N	R_{20} max Ω/km	Rated current A	I_k (1 s) kA
3×50+3G10+2×2.5+12G50	FC-MV488-001	9.6	83.0	88.0	1,100	8,460	3,000	0.386	186	7.15
3×70+3G16+2×2.5+12G50	FC-MV488-002	11.1	87.0	92.5	1,156	9,700	4,200	0.272	230	10.01
3×95+3G16+2×2.5+12G50	FC-MV488-003	12.6	91.5	97.0	1,212	10,990	5,700	0.206	278	13.59
3×120+3G25+2×2.5+12G50	FC-MV488-004	14.8	95.0	101.0	1,262	12,440	7,200	0.161	322	17.16
3×150+3G25+2×2.5+12G50	FC-MV488-005	16.0	99.0	105.0	1,312	13,850	9,000	0.129	370	21.45
3×185+3G35+2×2.5+12G50	FC-MV488-006	17.7	103.0	109.5	1,368	15,670	11,100	0.106	422	26.45
3×240+3G50+2×2.5+12G50	FC-MV488-007	20.2	109.0	115.5	1,444	18,440	14,400	0.0801	497	34.32
3×300+3G50+2×2.5+12G50	FC-MV488-008	22.4	114.5	121.5	1,518	20,970	18,000	0.0641	571	42.90

Current-carrying capacity: rated design values to DIN VDE 0298-4 for flexible cables, free air, 30 °C ambient; for other ambient temperatures, grouping or layered winding on a reel, apply the factors below. Pull force = 20 N/mm² × total copper cross-section of the power cores. Diameters, dimensions and weights are nominal design values and vary within manufacturing tolerances; confirm critical dimensions before dimensioning reels, guides or festoon systems. Other sizes and configurations are produced to order.

Ambient temperature factors (conductor 90 °C)

°C	20	25	30	35	40	45	50
Factor	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Short-circuit current rating

I_k = 0.143 kA/mm² × cross-section of the power core (conductor 90 °C → 250 °C). For another short-circuit duration t: $I_{k,t} = I_{k,1s} / \sqrt{t}$ (0.1 s ≤ t ≤ 5 s).

Derating on a cable reel (DIN VDE 0298-4)

1 layer: 0.80 · 2 layers: 0.61 · 3 layers: 0.49 · 4 layers: 0.41. Permissible current = table current × layer factor × temperature factor.

05 Reeling Performance and Reel Design Data

The values below support the dimensioning of the cable reel: minimum reel core diameter, copper weight for earthing and loop-resistance calculations, cable weight, and the rated current for the number of layers wound on the reel.

Type designation cores × mm²	Outer Ø max mm	Min. bend radius on reel, mm	Min. reel core Ø mm	Copper weight kg/km	Cable weight kg/100 m	Current, 1 layer A	2 layers A	3 layers A	4 layers A
3×50+3G10+2×2.5+12G50	88.0	1,100	2,200	2,370	846.0	149	113	91	76
3×70+3G16+2×2.5+12G50	92.5	1,156	2,312	3,100	970.0	184	140	113	94
3×95+3G16+2×2.5+12G50	97.0	1,212	2,424	3,810	1,099.0	222	170	136	114
3×120+3G25+2×2.5+12G50	101.0	1,262	2,524	4,750	1,244.0	258	196	158	132
3×150+3G25+2×2.5+12G50	105.0	1,312	2,624	5,590	1,385.0	296	226	181	152
3×185+3G35+2×2.5+12G50	109.5	1,368	2,736	6,830	1,567.0	338	257	207	173
3×240+3G50+2×2.5+12G50	115.5	1,444	2,888	8,760	1,844.0	398	303	244	204
3×300+3G50+2×2.5+12G50	121.5	1,518	3,036	10,410	2,097.0	457	348	280	234

Reel design guidance

- Minimum reel core diameter = 2 × minimum bending radius = 25 × D (outer diameter D).

- Spring reels suit short travel and low tensile load; motor-driven reels with torque control keep the cable under constant, low tension.
- Fit a guide or level-wind that keeps the cable parallel to the reel axis to prevent crossing turns.
- Rated current falls with the number of layers on the reel because heat is not dissipated; see the layer factors below.

06 Selection Guide and Sizing Aid

FC-MRT-H-PFM covers 8 sizes. The smallest, 3×50+3G10+2×2.5+12G50, has an outer diameter of up to 88.0 mm and weighs about 8,460 kg/km; the largest, 3×300+3G50+2×2.5+12G50, has an outer diameter of up to 121.5 mm and weighs about 20,970 kg/km, 2.5 times as much. Across the range the rated current in free air rises from 186 A to 571 A at 30 °C, and the minimum bending radius from 1,100 mm to 1,518 mm.

Example 1. A drive draws 142 A continuously, the cable is wound in 2 layers on the reel and the ambient temperature is 40 °C. Required table current = 142 / (0.61 × 0.91) = 256 A. The smallest suitable size is 3×95+3G16+2×2.5+12G50 with 278 A.

Example 2. A drive draws 298 A continuously, the cable is wound in 1 layer on the reel and the ambient temperature is 35 °C. Required table current = 298 / (0.80 × 0.96) = 389 A. The smallest suitable size is 3×185+3G35+2×2.5+12G50 with 422 A.

Type designation cores × mm²	Apparent power at 35 kV MVA (1 layer)	Winding capacity m
3×50+3G10+2×2.5+12G50	9.02	70
3×70+3G16+2×2.5+12G50	11.15	70
3×95+3G16+2×2.5+12G50	13.48	–
3×120+3G25+2×2.5+12G50	15.62	–
3×150+3G25+2×2.5+12G50	17.94	–
3×185+3G35+2×2.5+12G50	20.47	–
3×240+3G50+2×2.5+12G50	24.10	–
3×300+3G50+2×2.5+12G50	27.69	–

Apparent power S = √3 × U × I × 0.80 (one layer on the reel, 30 °C). Winding capacity is an indicative value for a reel with 2,500 mm flange diameter, 1,000 mm traverse width, core diameter equal to the minimum reel core diameter and 90 % fill; it is not a substitute for the reel manufacturer’s calculation.

07 Standards and Testing

Standard	Scope
DIN EN 60228 / IEC 60228 / VDE 0295	Conductors, class 5
IEC 60502-2	Power cables with extruded insulation, 6 kV to 30 kV
DIN VDE 0298-3	Application of cables – bending radii and tensile loads
DIN VDE 0298-4	Application of cables – current-carrying capacity
DIN EN 60332-1-2 / IEC 60332-1-2	Flame propagation, single cable
DIN VDE 0250-813	Reference construction of MV reeling cables
IEC 60793-2-10	Multimode optical fibres (A1a OM2 / A1b OM1)
IEC 60794-1-21	Optical cables – mechanical test methods
IEC 60754-1 / -2	Halogen acid gas emission when burned
IEC 61034-2	Smoke density when burned
IEC 60811-404	Mineral oil immersion test

Routine and type tests

- AC voltage test on every reel length (routine test): 50 kV AC, 5 min
- Partial-discharge test of the MV power cores to IEC 60502-2
- Conductor resistance and checks of dimensions, insulation thickness and sheath thickness
- Continuity of conductors and protective earth
- Bending, tensile and reeling torsion tests (type test)
- Flame propagation (IEC 60332-1-2) and confirmation of halogen-free materials
- Optical attenuation of every fibre by OTDR after cabling (routine test); reeling and torsion tests with optical monitoring (type test)

Test documentation: every delivery is accompanied by a test certificate from FeiChun’s own laboratory. Third-party witnessed tests can be arranged at the buyer’s cost.

08 Installation, Marking and Delivery

Installation guidance

- Use a spring-driven or motor-driven cable reel with a core diameter of at least twice the minimum bending radius (25 × D).
- Unwind from the shipping reel tangentially; never pull the cable over the flange of the drum, and avoid loops and kinks.
- Keep torsion within the permitted limit and tensile load within the value in the table.
- Guide the cable so that it is not run over by vehicles or crushed; inspect the sheath regularly.
- Connect all parts of the split PE conductor at both ends of the cable.
- Use terminations and joints that are approved for individually screened cores; do not cut back the semi-conductive layers unless instructed by the accessory manufacturer.

Sheath marking

FEICHUN FC-MRT-H-PFM [cross-section] 20/35 kV [year] [serial no.] [metre mark]

Packing and delivery

Reel	Steel or fumigated wooden reels; cable ends sealed with heat-shrink caps
Delivery length	As ordered, in one continuous length without joints
Lead time	2–3 weeks after technical approval
Warranty	1 year, covering failures not caused by human factors
Reel label	Type, cross-section, length, gross/net weight, batch no., reel no.

Ordering information

Field	Example	Meaning
Series code	FC-MRT-H-PFM	FeiChun series and sheath system
Core configuration	3×120+3G25+2×2.5+12G50	Number × cross-section (mm²) of the screened power cores, split PE conductors (G) and pilot or optical elements
Rated voltage	20/35 kV	U_0/U, AC
Length and packing	500 m, steel reel	Delivery length in one piece; reel type on request

Order example: FC-MRT-H-PFM 3×120+3G25+2×2.5+12G50 20/35 kV – 500 m on one steel reel. When requesting a quotation, state the cable type, configuration, cross-section, voltage, length per piece, required standards and installation conditions.

09 Certification and Quality

All cable is subject to FeiChun’s quality control, with routine testing over 100 % of the delivered length. Certificates, type tests and third-party tests (for example partial discharge or compatibility with cable accessories) are provided per project requirement; copies of the records are available on request.

10 Related Datasheets

Variants of this cable that differ in one attribute – sheath, configuration, optical fibres or voltage. All datasheets are in PDF format.

- FC-MRT-P-PFM 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, PUR
- FC-MRT-H-FM 20/35 kV – 3 screened power cores + 3 split PE conductors + 12 multimode fibres OM2 50/125, HFFR rubber
- FC-MRT-H-P 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm², HFFR rubber
- FC-MRT-H-PFM 1.8/3 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, HFFR rubber
- FC-MRT-PA-PFM 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, PUR low-temp
- FC-MRT-H-PF6 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 6 single-mode fibres G.652.D, HFFR rubber
- FC-MRT-H-PFM 3.6/6 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, HFFR rubber
- FC-MRT-C-PFM 20/35 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, CSP rubber

Overview of all datasheets: Medium-Voltage Port Reeling Cables 1.8/3 – 20/35 kV

Frequently asked questions

What is FC-MRT-H-PFM used for?
Typical applications include medium-voltage supply of ship-to-shore (STS) cranes and rail-mounted gantry cranes through motor-driven cable reels.

What are the outer diameter and minimum bending radius of 3×120+3G25+2×2.5+12G50?
The outer diameter is 95.0 to 101.0 mm and the minimum bending radius in moving or reeling operation is 1,262 mm (12.5 × D).

What minimum reel core diameter is needed for 3×120+3G25+2×2.5+12G50?
At least 2,524 mm, which is twice the minimum bending radius of 1,262 mm. A larger core diameter extends cable life.

What current rating applies to 3×120+3G25+2×2.5+12G50 on a cable reel?
The rated current in free air at 30 °C ambient is 322 A. Multiply it by 0.80 for one layer on the reel, 0.61 for two layers, 0.49 for three layers and 0.41 for four layers (DIN VDE 0298-4), and by the ambient temperature factor.

Which optical fibres does FC-MRT-H-PFM contain?
12 multimode fibres OM2 50/125. 1 Gbit/s Ethernet up to 550 m (1000BASE-SX); 10 Gbit/s up to 82 m.

Why choose a 3-in-1 reeling cable?
One cable carries power, pilot-wire monitoring and data, so the crane needs one reel channel, one slip-ring assembly with a fibre-optic rotary joint and one cable route. This saves reel space and weight and reduces the number of terminations to maintain.

How are the fibres connected on the reel?
Through a fibre-optic rotary joint (FORJ) on the reel axis, normally combined with the power slip-ring assembly. Match the number of FORJ channels to the number of fibres in use and keep spare fibres for later expansion.

Is this cable halogen-free?
Yes. The insulation and all sheaths are halogen-free; see section 03 for flame-retardancy and temperature data.

Which cross-sections are available?
FC-MRT-H-PFM: 50, 70, 95, 120, 150, 185, 240, 300 mm². Other sizes and special designs can be produced to order.

11 Trademark Notice and Intellectual Property

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Document control

Document no. FC-TDS-MV488-2026-43F90716-EN
Revision 0 — first issue
Date 4 November 2026
Product FC-MRT-H-PFM 20/35 kV

Prepared — Engineering | Checked — QC | Approved — International Business