HIGH-FLEX MV REELING CABLE · PORT CRANES | 3-IN-1 · POWER · CONTROL · FIBRE | 12/20 kV | 10 sizes | PUR | 12G50

FC-MRT-P-PFM 12/20 kV

3-in-1 MV Power, Pilot and Fibre-Optic Reeling Cable 12/20 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, halogen-free PUR sheath. Complete technical data sheet: construction, dimensions, weights, current ratings, standards and installation guidance for 10 sizes.

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01 Application and Product Overview

FC-MRT-P-PFM is a high-flex medium-voltage reeling cable rated 12/20 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 5.5 mm thick and its own tinned-copper braid screen; inner and outer sheaths are halogen-free polyurethane (PUR), flame-retardant, abrasion- and cut-resistant. Power cores from 25 – 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.

10 sizes	12/20 kV	+90 °C	Halogen-free
Cross-section 25 – 300 mm²	Rated voltage U_0/U	Maximum conductor temperature	Sheath: PUR

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)

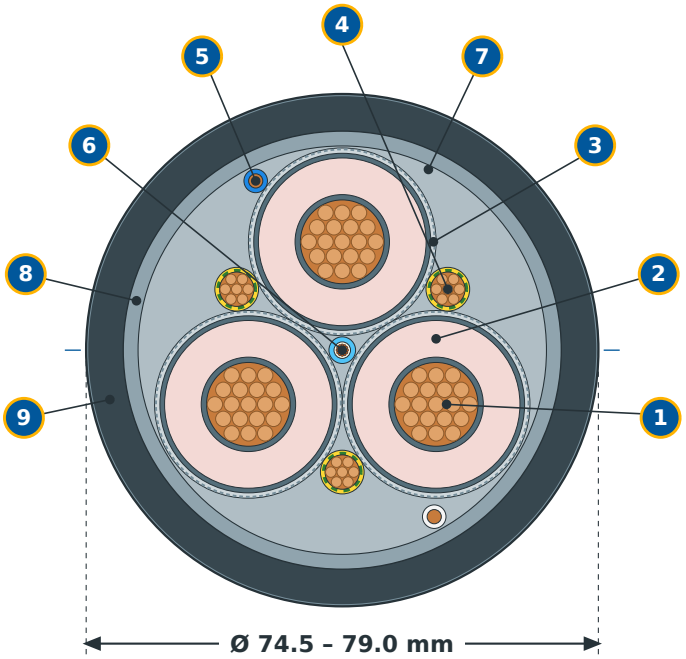
- Halogen-free insulation and sheaths; no halogen acid gases when burned (IEC 60754-1/-2)
- Abrasion-, cut- and tear-resistant PUR sheath; flexible in motion down to −30 °C
- Flame retardant to IEC 60332-1-2

02 Construction

FEICHUN · CROSS-SECTION A-A · 12/20 kV

FC-MRT-P-PFM

Sample size 3×95+3G16+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 polyurethane (PUR), flame-retardant, abrasion- and cut-resistant

The drawing shows size 3×95+3G16+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, 16 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 polyurethane (PUR), flame-retardant, abrasion- and cut-resistant

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 polyurethane (PUR) outer sheath combines high abrasion resistance with strong cut and tear resistance. These are the properties that limit cable life on equipment that is wound and unwound repeatedly, dragged over steel and concrete, and exposed to seawater spray. PUR stays flexible down to −30 °C in motion, resists mineral oil, UV radiation and ozone, and emits no halogen acid gases when burned (IEC 60754-1/-2), which matters in tunnels, enclosed machinery spaces and below-deck areas.

03 Electrical, Thermal and Mechanical Characteristics

Electrical data

Rated voltage U_0/U	12/20 kV AC
Test voltage	30 kV AC, 5 min
Maximum operating voltage, DC	18/36 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 +80 °C
Ambient temperature, in motion	−30 °C to +80 °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 – 12/20 kV (10 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
3×25+3G6+2×2.5+12G50	FC-MV292-001	6.2	60.5	64.5	806	4,400	1,500	0.780	121	3.58
3×35+3G6+2×2.5+12G50	FC-MV292-002	7.8	63.5	67.0	838	4,930	2,100	0.554	149	5.00
3×50+3G10+2×2.5+12G50	FC-MV292-003	9.6	66.5	71.0	888	5,770	3,000	0.386	186	7.15
3×70+3G16+2×2.5+12G50	FC-MV292-004	11.1	70.5	74.5	932	6,840	4,200	0.272	230	10.01
3×95+3G16+2×2.5+12G50	FC-MV292-005	12.6	74.5	79.0	988	7,970	5,700	0.206	278	13.59
3×120+3G25+2×2.5+12G50	FC-MV292-006	14.8	78.5	83.0	1,038	9,280	7,200	0.161	322	17.16
3×150+3G25+2×2.5+12G50	FC-MV292-007	16.0	82.5	87.5	1,094	10,530	9,000	0.129	370	21.45
3×185+3G35+2×2.5+12G50	FC-MV292-008	17.7	86.5	92.0	1,150	12,200	11,100	0.106	422	26.45
3×240+3G50+2×2.5+12G50	FC-MV292-009	20.2	92.0	98.0	1,224	14,740	14,400	0.0801	497	34.32
3×300+3G50+2×2.5+12G50	FC-MV292-010	22.4	98.0	104.0	1,300	17,050	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
3×25+3G6+2×2.5+12G50	64.5	806	1,612	1,370	440.0	97	74	59	50
3×35+3G6+2×2.5+12G50	67.0	838	1,676	1,660	493.0	119	91	73	61
3×50+3G10+2×2.5+12G50	71.0	888	1,776	2,210	577.0	149	113	91	76
3×70+3G16+2×2.5+12G50	74.5	932	1,864	2,940	684.0	184	140	113	94
3×95+3G16+2×2.5+12G50	79.0	988	1,976	3,650	797.0	222	170	136	114
3×120+3G25+2×2.5+12G50	83.0	1,038	2,076	4,590	928.0	258	196	158	132
3×150+3G25+2×2.5+12G50	87.5	1,094	2,188	5,430	1,053.0	296	226	181	152
3×185+3G35+2×2.5+12G50	92.0	1,150	2,300	6,670	1,220.0	338	257	207	173
3×240+3G50+2×2.5+12G50	98.0	1,224	2,448	8,590	1,474.0	398	303	244	204
3×300+3G50+2×2.5+12G50	104.0	1,300	2,600	10,250	1,705.0	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-P-PFM covers 10 sizes. The smallest, 3×25+3G6+2×2.5+12G50, has an outer diameter of up to 64.5 mm and weighs about 4,400 kg/km; the largest, 3×300+3G50+2×2.5+12G50, has an outer diameter of up to 104.0 mm and weighs about 17,050 kg/km, 3.9 times as much. Across the range the rated current in free air rises from 121 A to 571 A at 30 °C, and the minimum bending radius from 806 mm to 1,300 mm.

Example 1. A drive draws 117 A continuously, the cable is wound in 2 layers on the reel and the ambient temperature is 40 °C. Required table current = 117 / (0.61 × 0.91) = 211 A. The smallest suitable size is 3×70+3G16+2×2.5+12G50 with 230 A.

Example 2. A drive draws 261 A continuously, the cable is wound in 1 layer on the reel and the ambient temperature is 35 °C. Required table current = 261 / (0.80 × 0.96) = 340 A. The smallest suitable size is 3×150+3G25+2×2.5+12G50 with 370 A.

Type designation cores × mm²	Apparent power at 20 kV MVA (1 layer)	Winding capacity m
3×25+3G6+2×2.5+12G50	3.35	510
3×35+3G6+2×2.5+12G50	4.13	495
3×50+3G10+2×2.5+12G50	5.15	420
3×70+3G16+2×2.5+12G50	6.37	320
3×95+3G16+2×2.5+12G50	7.70	225
3×120+3G25+2×2.5+12G50	8.92	150
3×150+3G25+2×2.5+12G50	10.25	70
3×185+3G35+2×2.5+12G50	11.69	70
3×240+3G50+2×2.5+12G50	13.77	–
3×300+3G50+2×2.5+12G50	15.82	–

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 60811-404	Mineral oil immersion test

Routine and type tests

- AC voltage test on every reel length (routine test): 30 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

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FEICHUN FC-MRT-P-PFM [cross-section] 12/20 kV [year] [serial no.] [metre mark]
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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-P-PFM	FeiChun series and sheath system
Core configuration	3×95+3G16+2×2.5+12G50	Number × cross-section (mm²) of the screened power cores, split PE conductors (G) and pilot or optical elements
Rated voltage	12/20 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-P-PFM 3×95+3G16+2×2.5+12G50 12/20 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-PA-PFM 12/20 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-P-FM 12/20 kV – 3 screened power cores + 3 split PE conductors + 12 multimode fibres OM2 50/125, PUR
- FC-MRT-P-P 12/20 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm², PUR
- FC-MRT-P-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, PUR
- FC-MRT-C-PFM 12/20 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, CSP rubber
- FC-MRT-P-PF6 12/20 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 6 single-mode fibres G.652.D, PUR
- FC-MRT-P-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, PUR
- FC-PMR (N)TSCGEWÖU-PFM 12/20 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 12 multimode fibres OM2 50/125, PCP rubber

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

Frequently asked questions

What is FC-MRT-P-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 3×95+3G16+2×2.5+12G50?
The outer diameter is 74.5 to 79.0 mm and the minimum bending radius in moving or reeling operation is 988 mm (12.5 × D).

What minimum reel core diameter is needed for 3×95+3G16+2×2.5+12G50?
At least 1,976 mm, which is twice the minimum bending radius of 988 mm. A larger core diameter extends cable life.

What current rating applies to 3×95+3G16+2×2.5+12G50 on a cable reel?
The rated current in free air at 30 °C ambient is 278 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-P-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-P-PFM: 25, 35, 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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Technical and commercial contacts

Anhui FeiChun Special Cable Co., Ltd.
International Business Department
Park No. 1, Private Science and Technology Park, Hefei National Economic and Technological Development Zone, Hefei, Anhui, China
Technical support: Tech@feichuncables.com
Mining and heavy industry: mining@feichuncables.com
Zihao Yang, Global Sales Manager: zihao.yang@feichuncables.com
WhatsApp: +86 138 5512 3218
Web: www.feichuncables.com

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