HIGH-FLEX MV REELING CABLE · PORT CRANES | FIBRE-OPTIC HYBRID | 6/10 kV | 10 sizes | PCP rubber | 2×12E9

FC-PMR (N)TSCGEWÖU-F2 6/10 kV

MV Power and Fibre-Optic Hybrid Reeling Cable 6/10 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, PCP (polychloroprene) rubber sheath 5GM5. 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-PMR (N)TSCGEWÖU-F2 is a high-flex medium-voltage reeling cable rated 6/10 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 + 24 single-mode fibres G.652.D in two elements. Each power core has a class 5 copper conductor, semi-conductive layers, EPR insulation 3.4 mm thick and its own tinned-copper braid screen; inner and outer sheaths are polychloroprene (PCP/CR) rubber compound 5GM5 to DIN VDE 0207-21, flame-retardant, resistant to oil, weather and ozone. 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
- Remote-controlled and automated cranes that send PLC, video and remote-operation data over single-mode fibre through the 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 supply of ship-to-shore cranes, shore connections and electrified yard equipment through a cable reel

Design

Three individually screened power cores and three split PE conductors in the interstices. Each core has an inner and outer semi-conductive layer and its own tinned-copper braid screen, so the electric field stays inside the core insulation and the cores can be terminated with standard MV accessories. The cable contains two optical elements (24 single-mode fibres G.652.D in two elements). Single-mode fibres carry the crane data, video and remote-operation links over the full length of the terminal with very low attenuation, so a single reel cable can connect the crane to the terminal operating system without intermediate repeaters.

10 sizes	6/10 kV	+90 °C	PCP rubber
Cross-section 25 – 300 mm²	Rated voltage U_0/U	Maximum conductor temperature	Sheath: PCP rubber

Key features

- Fine-wire class 5 copper conductors and a very short core lay length for repeated reeling
- 24 single-mode fibres G.652.D in two elements 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)

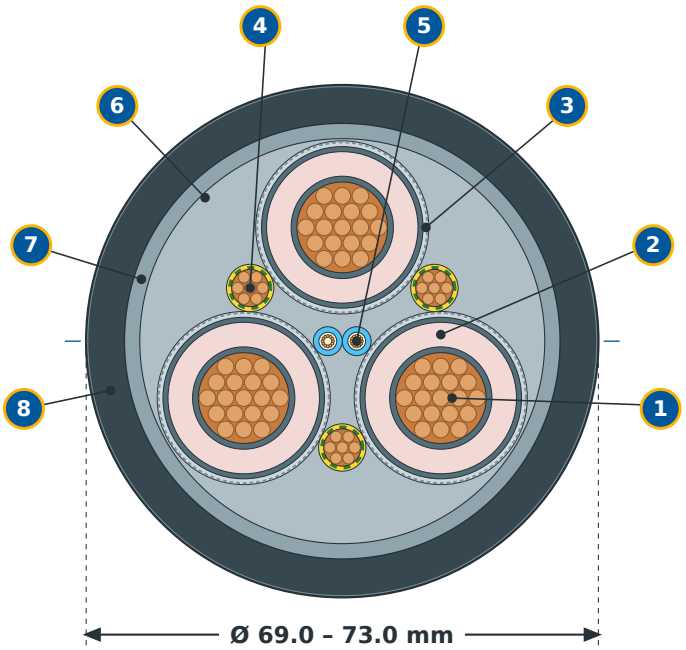
- PCP rubber sheath with proven weather, ozone and oil resistance
- PCP rubber sheath 5GM5 in the DIN VDE 0250 (N)SHTÖU / (N)TSCGEWÖU tradition
- Flame retardant to IEC 60332-1-2

02 Construction

FEICHUN · CROSS-SECTION A–A · 6/10 kV

FC-PMR (N)TSCGEWÖU-F2

Sample size 3×95+3G16+2×12E9 · 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	Optical element	24 single-mode fibres G.652.D in two elements; gel-filled loose tube, aramid strength members
6	Filler and binder tape	Halogen-free compound, polyester tape
7	Inner sheath	Halogen-free polymer compound
8	Outer sheath	Polychloroprene (PCP/CR) rubber compound 5GM5 to DIN VDE 0207-21, flame-retardant, resistant to oil, weather and ozone

The drawing shows size 3×95+3G16+2×12E9. 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
Optical element	Two elements: 24 single-mode fibres G.652.D in two elements, 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	Polychloroprene (PCP/CR) rubber compound 5GM5 to DIN VDE 0207-21, flame-retardant, resistant to oil, weather and ozone

Optical fibre data

Fibre type	Single-mode E9/125 µm, ITU-T G.652.D / IEC 60793-2-50 B-652.D, low water peak
Attenuation, cabled	≤ 0.40 dB/km at 1310 nm; ≤ 0.30 dB/km at 1550 nm
Mode-field diameter	9.2 ± 0.4 µm at 1310 nm
Typical link reach	1 Gbit/s and 10 Gbit/s Ethernet up to 10 km (1000BASE-LX, 10GBASE-LR)
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 polychloroprene (PCP/CR) rubber outer sheath, compound type 5GM5 to DIN VDE 0207-21, is the classic sheath of DIN VDE 0250 reeling and trailing cables of the (N)SHTÖU and (N)TSCGEWÖU type. It is heavy-duty, flame-retardant and highly resistant to weather, ozone, UV radiation and mineral oil, and keeps its elasticity on the reel down to −25 °C in motion. Polychloroprene contains halogen; where halogen-free cables are specified, select the HFFR rubber or PUR version of the same construction.

03 Electrical, Thermal and Mechanical Characteristics

Electrical data

Rated voltage U_0/U	6/10 kV AC
Test voltage	15 kV AC, 5 min
Maximum operating voltage, DC	9/18 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	No (PCP rubber sheath)
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 – 6/10 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+2×12E9	FC-MV186-001	6.2	55.0	58.5	732	3,800	1,500	0.780	121	3.58
3×35+3G6+2×12E9	FC-MV186-002	7.8	58.0	61.5	768	4,320	2,100	0.554	149	5.00
3×50+3G10+2×12E9	FC-MV186-003	9.6	61.0	65.0	812	5,130	3,000	0.386	186	7.15
3×70+3G16+2×12E9	FC-MV186-004	11.1	65.0	69.0	862	6,170	4,200	0.272	230	10.01
3×95+3G16+2×12E9	FC-MV186-005	12.6	69.0	73.0	912	7,250	5,700	0.206	278	13.59
3×120+3G25+2×12E9	FC-MV186-006	14.8	72.0	76.5	956	8,500	7,200	0.161	322	17.16
3×150+3G25+2×12E9	FC-MV186-007	16.0	76.0	80.5	1,006	9,690	9,000	0.129	370	21.45
3×185+3G35+2×12E9	FC-MV186-008	17.7	80.0	85.0	1,062	11,320	11,100	0.106	422	26.45
3×240+3G50+2×12E9	FC-MV186-009	20.2	85.5	90.5	1,132	13,770	14,400	0.0801	497	34.32
3×300+3G50+2×12E9	FC-MV186-010	22.4	90.5	96.0	1,200	15,970	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
3×25+3G6+2×12E9	58.5	732	1,464	1,230	380.0	97	74	59	50
3×35+3G6+2×12E9	61.5	768	1,536	1,520	432.0	119	91	73	61
3×50+3G10+2×12E9	65.0	812	1,624	2,060	513.0	149	113	91	76
3×70+3G16+2×12E9	69.0	862	1,724	2,800	617.0	184	140	113	94
3×95+3G16+2×12E9	73.0	912	1,824	3,500	725.0	222	170	136	114
3×120+3G25+2×12E9	76.5	956	1,912	4,450	850.0	258	196	158	132
3×150+3G25+2×12E9	80.5	1,006	2,012	5,290	969.0	296	226	181	152
3×185+3G35+2×12E9	85.0	1,062	2,124	6,530	1,132.0	338	257	207	173
3×240+3G50+2×12E9	90.5	1,132	2,264	8,450	1,377.0	398	303	244	204
3×300+3G50+2×12E9	96.0	1,200	2,400	10,110	1,597.0	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-PMR (N)TSCGEWÖU-F2 covers 10 sizes. The smallest, 3×25+3G6+2×12E9, has an outer diameter of up to 58.5 mm and weighs about 3,800 kg/km; the largest, 3×300+3G50+2×12E9, has an outer diameter of up to 96.0 mm and weighs about 15,970 kg/km, 4.2 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 732 mm to 1,200 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+2×12E9 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+2×12E9 with 370 A.

Type designation cores × mm²	Apparent power at 10 kV MVA (1 layer)	Winding capacity m
3×25+3G6+2×12E9	1.68	745
3×35+3G6+2×12E9	2.06	625
3×50+3G10+2×12E9	2.58	515
3×70+3G16+2×12E9	3.19	410
3×95+3G16+2×12E9	3.85	310
3×120+3G25+2×12E9	4.46	235
3×150+3G25+2×12E9	5.13	230
3×185+3G35+2×12E9	5.85	145
3×240+3G50+2×12E9	6.89	75
3×300+3G50+2×12E9	7.91	–

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
ITU-T G.652.D / IEC 60793-2-50	Single-mode optical fibres
IEC 60794-1-21	Optical cables – mechanical test methods
DIN VDE 0207-21	Sheath compound 5GM5 (polychloroprene)
IEC 60811-404	Mineral oil immersion test

Routine and type tests

- AC voltage test on every reel length (routine test): 15 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)
- 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-PMR (N)TSCGEWÖU-F2 [cross-section] 6/10 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-PMR (N)TSCGEWÖU-F2	FeiChun series and sheath system
Core configuration	3×95+3G16+2×12E9	Number × cross-section (mm²) of the screened power cores, split PE conductors (G) and pilot or optical elements
Rated voltage	6/10 kV	U_0/U, AC
Length and packing	500 m, steel reel	Delivery length in one piece; reel type on request

Order example: FC-PMR (N)TSCGEWÖU-F2 3×95+3G16+2×12E9 6/10 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-F2 6/10 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, PUR
- FC-PMR (N)TSCGEWÖU-PF2 6/10 kV – 3 screened power cores + 3 split PE conductors + 2 pilot cores 2×2.5 mm² + 24 single-mode fibres G.652.D in two elements, PCP rubber
- FC-PMR (N)TSCGEWÖU 6/10 kV – 3 screened power cores + 3 split PE conductors, PCP rubber
- FC-PMR (N)TSCGEWÖU-F2 1.8/3 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, PCP rubber
- FC-MRT-PA-F2 6/10 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, PUR low-temp
- FC-PMR (N)TSCGEWÖU-F6 6/10 kV – 3 screened power cores + 3 split PE conductors + 6 single-mode fibres G.652.D, PCP rubber
- FC-PMR (N)TSCGEWÖU-F2 3.6/6 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, PCP rubber
- FC-MRT-C-F2 6/10 kV – 3 screened power cores + 3 split PE conductors + 24 single-mode fibres G.652.D in two elements, CSP rubber

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

Frequently asked questions

What is FC-PMR (N)TSCGEWÖU-F2 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+2×12E9?
The outer diameter is 69.0 to 73.0 mm and the minimum bending radius in moving or reeling operation is 912 mm (12.5 × D).

What minimum reel core diameter is needed for 3×95+3G16+2×12E9?
At least 1,824 mm, which is twice the minimum bending radius of 912 mm. A larger core diameter extends cable life.

What current rating applies to 3×95+3G16+2×12E9 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-PMR (N)TSCGEWÖU-F2 contain?
24 single-mode fibres G.652.D in two elements. 1 Gbit/s and 10 Gbit/s Ethernet up to 10 km (1000BASE-LX, 10GBASE-LR).

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?
No. The PCP rubber sheath contains halogen. If halogen-free cables are required, select the HFFR rubber or PUR version of the same construction.

Which cross-sections are available?
FC-PMR (N)TSCGEWÖU-F2: 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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