
Caledonian
Rolling Stock Cables
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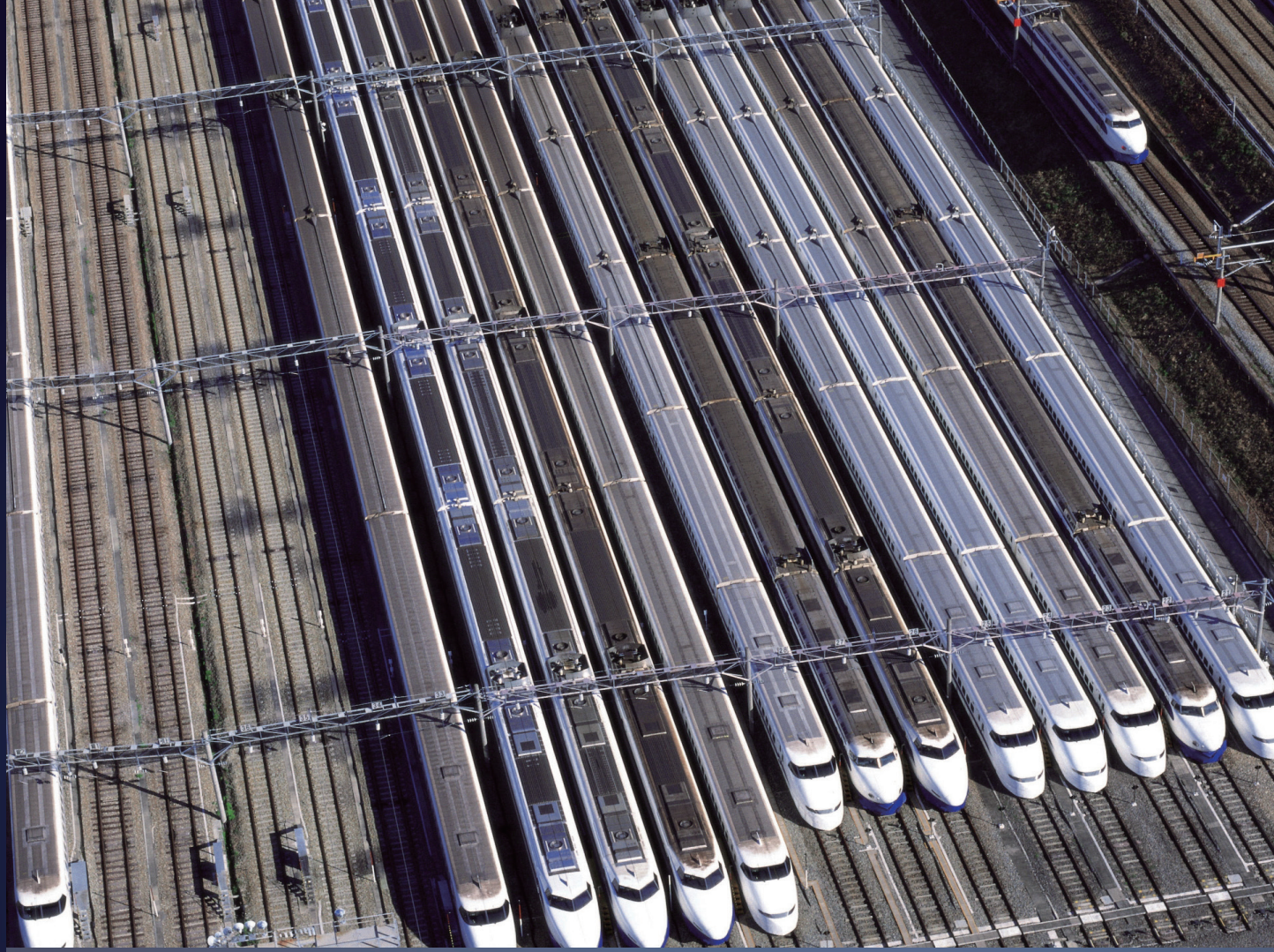
ADDISON



Caledonian & Addison, established in 1978, produced a wide range of copper and fiber optic cables for communication, power and electronics in its 2 plants in UK and 5 plants in China, with turnover exceeding USD 40 million in Yr 2004. Caledonian products are sold in more than 35 countries around the globe.

Our extensive global network of manufacturing facilities gives us significant scale and the flexibility to fulfill our customer requirements. This global presence provides design and consultancy solutions that are combined with core cable manufacturing and logistics services, and vertically integrated with our E commerce technologies, to optimize customer operations by lowering costs and reducing time to market.

Caledonian & Addison has been respected for its high standards of quality, excellent service level, competitive pricing and a unique and innovative spirit. With our latest technologies, we are both inspired and well-positioned to meet the changing needs of our customers. We have the resources to diversify and to enhance our product lines and services. We understand the need for change and with our accurate planning we are ready for the future and the promise of new marketing opportunities. Our tradition of growth through excellence is assured.


INTERNATIONAL FIRST CERTIFICATION

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CERTIFICATE

Caledonian Cables Limited

20-22 Wenlock Road London N1 7GU England
Novus Seahami Spectrum 7 Spectrum Business Park Seaham SR7 7tt, England

IFC Global Certification confirms that the above-named organization's management system has been assessed and complies with the requirements of the following standard.

Standard:

ISO 9001:2015

Scope:

Manufacture, desing, supply, installation, assembly, commissioning, testing and maintenance of LV/MV/HV energy cables, data cables, instrumentation cables, telecommunication cables, fibre optic cables, railway cables, rolling stock cables, photovoltaic cables, marine cables, cabling system, cable accessories, ABC, AAC, ACSR, AAAC, power and distribution transformers, switchgears, communication systems, IT systems

Initial Date	: 1.02.2024
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Expiry Date	: 31.01.2027
Certificate No	: IFC-Q-2-24-2084

Approval

IFC GLOBAL SERTİFİKASYON MUAYENE VE EĞİTİM HİZMETLERİ ANONİM ŞİRKETİ

Our Design Centers work closely with customers to constantly improve its standard range of products and technologies and to develop customized, country and industry-specific solutions. Caledonian has established an extensive network of design, manufacturing, and logistics facilities in the world's major markets to serve the growing outsourcing needs of both multinational and regional customers.

CONTENTS

Rolling Stock Cable

This catalog covers rolling stock for underground, mass transit lines and tramlines as well as diesel and regional trains. The increasing need to reduce both volume and weight has lead to the development of miniaturized cables, as well as high temperature cables with enhanced performance. This leads to highly stressed materials being used in the harsh environment of rolling stock. Caledonian & Addison provides a full range of products from Medium Voltage to Low Voltage cables, and from Standard Wall, Medium Wall to Thin Wall designs. The materials used have been specially developed to improve mechanical and thermal properties, fire performance and extended life using advanced technologies, such as electron beam irradiation and silan.

New challenges in the rolling stock industry must be met due to long-awaited equipment upgrades, booming freight traffic and high-speed train projects, and the growing need for conventional subways, fully-automated metros,and light-rail suburban vehicles worldwide. Caledonian & Addison manufactures a complete range of rolling stock cables and components, meeting national and international standards, we supply wide range of rolling stock cables from 300V to 6kV in cross section area of 0.5mmsq to 400mmsq covering diverse railway standards. All cables meet strict technical requirements in terms of electrical safety, fire-performance (low-smoke and toxicity, continuous operation in the event of fire).

As an OEM, Caledonian rolling stock cables provide our railway customers with future headroom by meeting the following European Norms (EN) and international standards :

- EN 50264 European railway standard
- EN 50382 European railway standard
- NF F 63826 French railway standard
- BS 6853 British railway standard
- NF F 16 101 French railway standard
- EN 50306 European railway standard
- NF F 63808 French railway standard
- NF F 63827 French railway standard
- DIN 5510-2 German railway standard
- UIC (International Union of Railways) 895

CENELEC Standard

According to CENELEC standards, railway rolling stock cables are designed to meet the following critical requirements:

1) 2 levels of low temperature: -25 °C and -40 °C
2) 2 levels of fluid resistance: Mineral oil resistant, or mineral oil/fuel resistant
3) 3 levels of hazard: HL1, HL2, HL3

Low temperature, mineral oil resistant	(-25 °C, IRM 902)	A	B	C
Extra low temperature, mineral oil resistant	(-40°C, IRM 902)	D	E	F
Low temperature, mineral oil and fuel resistant	(-25 °C, IRM 902, IRM 903)	G	H	J
Extra low temperature, mineral oil and fuel resistant	(-40 °C, IRM 902, IRM 903)	K	L	M
Extra low temperature, not mineral oil and fuel resistant	(-40 °C)	O	O	O

Caledonian rolling stock cables, branded as FIREROL, are mainly classified as follows:

EN 50264

Caledonian standard wall and medium wall rolling stock cables conform to EN 50264 for use in power cars(The corresponding French railway standard is NF F 63826), diesel-electric locomotives, electric and diesel multiple units EMU / DMU, high-capacity rails, mono rail and light rail vehicles, sleeping cars and passenger coaches. FIREROL is a kind of widely used rolling stock cables.

Application:

- FIREROL wires combine the advantages of small size, lightweight, high oil resistance, halogen free, high mechanical properties. They are recommended for installation in railway vehicles (locomotives, trains, trolleybuses...).
- A 120°C conductor temperature is allowed for a 20000 hours cumulative working time.
- The external sheath is mineral oil and fuel oil resistant, ozone and UV resistant.

Conductors:

Flexible stranded tinned copper class 5 according to IEC 60228 with optional separator tape. Conductor temperature +90 °C

Standard:

EN 50264-1: General requirements applicable to cables, including detailed requirement for the insulating and sheathing materials

Standard wall rolling stock cables having special fire performance

EN50264-2 = pr EN50264-2-1	Standard wall single core cables with crosslinked elastomeric insulation 0.6/1kV Unscreened, unsheathed 1mm²-400mm² FRL-SW-1SU 1.8/3kV Unscreened, unsheathed 1mm²-400mm² FRL-SW-3SU 1.8/3kV Unscreened, sheathed 1mm²-400mm² FRL-SW-3S 3.6/6kV Unscreened, sheathed 1mm²-400mm² FRL-SW-6S
EN50264-3 = pr EN50264-2-2	Standard wall multicore cables with crosslinked elastomeric insulation 300/500V Unscreened or screened 1/1.5/2.5 mm² (2-40 Cores) FRL-SW-05M / FRL-SW-05M-OS 0.6/1kV Unscreened or screened 1 mm²-50 mm² (2,3,4 Cores) FRL-SW-1M / FRL-SW-1M-OS
Insulation Compounds:	Crosslinked halogen free rubber EI 101 (for A, B, C), EI 102 (for D, E, F), EI 103 (for G, H, J), EI 104 (for K, L, M) and EI 105 (for O, EPDM compound)
Sheathing Compounds:	Special crosslinked halogen free black rubber type: EM 101 (for A, B, C), EM 102 (for D, E, F), EM 103 (for G, H, J), EM 104 (for K, L, M)

Medium wall rolling stock cables having special fire performance

pr EN50264-3-1:	Medium wall single core cable with crosslinked elastomeric insulation 0.6/1kV Unscreened, unsheathed 1mm²-400mm² FRL-MW-1SU 1.8/3kV Unscreened, unsheathed 1mm²-400mm² FRL-MW-3SU 1.8/3kV Unscreened, sheathed 1mm²-400mm² FRL-MW-3S 3.6/6kV Unscreened, sheathed 1mm²-400mm² FRL-MW-6S
pr EN50264-3-2:	Medium wall multicore cables with crosslinked elastomeric insulation 300/500V Unscreened or screened 1/1.5/2.5 mm² (2-40 Cores) FRL-MW-05M / FRL-SW-05M-OS 0.6/1kV Unscreened or screened 1 mm²-50 mm² (2,3,4 Cores) FRL-MW-1M / FRL-SW-1M-OS
Insulation Compounds:	Crosslinked halogen free black rubber EI 106 (for A, B, C), EI 107 (for D, E, F), EI 108 (for G, H, J), EI 109 (for K, L, M) and EI 110 (for O, EPDM compound)
Sheathing Compounds:	Special crosslinked halogen free rubber type: EM 101 (for A, B, C), EM 102 (for D, E, F), EM 103 (for G, H, J), EM 104 (for K, L, M)

EN 50306

Caledonian thin wall rolling stock cables conform to EN 50306 (The corresponding French railway standard is NF F 63808) are ozone resistant, acid and alkali resistant, mineral oil, fuel oil and UV light resistant. Anti-termite cables and anti-rodent cables can also be offered upon customer request.

Application:

- FIREROL thin wall rolling stock cables combine the advantages of small size, lightweight, high oil resistance, halogen free, high mechanical properties. They are recommended for installation in railway vehicles (locomotives, trains, trolleybuses...).
- A 120 °C conductor temperature is allowed for a 20000 hours cumulative working time.
- The external sheath is mineral oil and fuel oil resistant, ozone and UV resistant.

Conductors:

Flexible stranded tinned copper class 5 according to IEC 60228 with optional separator tape. Conductor temperature +90/105 °C or +105/125 °C

Insulation:

Crosslinked halogen free polyethylene or polymer

Sheathing:

Cables sheathed with special S1 and S2 compounds (described in EN 50306-1) or EN 50264 sheathing compounds (EM 101. EM 102. EM 103 and EM 104)

Standard:

EN 50306-1: General requirements applicable to cables, including detailed requirement for the insulating and sheathing materials

Thin wall rolling stock cables having special fire performance

EN 50306-2:	Thin wall single core rolling stock cables 300/500V Unscreened 0.5mm²-2.5 mm² FRL-TW-05SU
EN 50306-3:	Thin wall single core and multicore (pairs, triads, and quads) screened rolling stock cables 300/500V Screened 0.5mm²-2.5 mm² (1-4 Cores) FRL-TW-05S-OS or FRL-TW-05M-OS
EN 50306-4:	Thin wall multicore and multipair rolling stock cables Unscreened, sheathed for either exposed or protected wiring 0.5mm²-2.5mm² (2-48 Cores) FRL-TW-05M-SW, FRL-TW-05M-ESW Screened, sheathed for either exposed or protected wiring 0.5mm²-2.5mm² (2-8 Cores) FRL-TW-05M-SW-OS, FRL-TW-05M-ESW-OS Screened, sheathed for either exposed or protected wiring 0.5mm²-1.5mm² (2-7 Pairs/Cores) FRL-TW-05MP-SW-IOS, FRL-TW-05MP-ESW-IOS

EN 50382

Caledonian high temperature rolling stock cables conform to EN 50382 standard (The corresponding French railway standard is NF F 63827) is characterized by its lightweight and small size which provide high flexibility and easy handling required for high-speed train cable applications. High temperature cables imply higher current capacity for the same cross-section. The higher the continuous temperature load, the longer the life time of the cable at a given working temperature. Caledonian high temperature cable allow greater safety margins and higher current capacity, with the following features:

- Low weight cable
- Low size cable
- Thin wall cable
- Wide operating temperature range (+125 °C down to -60 °C)
- Low smoke density (>90% light transmission)
- Short circuit cable and Earth fault-proof cables (>250 °C)

Conductors:

For 120 °C class : Flexible stranded tinned copper
For 150 °C class : Flexible plain annealed copper
Class 5 (or class 6 on request) according to IEC 60228 with optional separator tape

Braiding:

Optional textile braid (for reinforced versions)

Insulation:

Type EI 111 or EI 112 (if sheathed) cross-linked halogen free silicone rubber

Sheathing:

Low temperature, oil resistant, ozone and UV resistant
For 120 °C class : special cross-linked black rubber type EM106 according to EN 50382-1
For 150 °C class : special cross-linked black silicone rubber type EM 107 according to EN 50382-1

Minimum Bending Radius:

Dynamic use : 5 to 8 x outer diameter
Static use : 4 x outer diameter

Standard:

EN 50382-1: General requirements applicable to cables, including detailed requirement for the insulating and sheathing materials

High temperature rolling stock cables having special fire performance

EN 50382-2	Single core, silicon rubber insulated cables for +120 °C and +150 °C 1.8/3 kV unscreened, unsheathed with or without textile braid 1.5mm²-400mm² FRL-HT-3SU 1.8/3 kV unscreened, sheathed with or without textile braid 1.5mm²-400mm² FRL-HT-3S 3.6/6 kV unscreened, unsheathed with or without textile braid 2.5mm²-400mm² FRL-HT-6SU 3.6/6 kV unscreened, sheathed with or without textile braid 2.5mm²-400mm² FRL-HT-6S

Cable design in accordance with EN 50264 & EN 50306

Cable Make Up

Conductors:

Tinned fine copper strands according to VDE 0295 / IEC 60228 class 5 are generally used for railway cables. For nominal cross section of over 50mmsq, 0.41mm strand wire may be used instead of 0.51mm as stipulated in IEC 60228. The IEC 60228 class 5 enhances flexibility and the ease of handling, thus lengthening the product life of the cable. These class 5 conductors are extremely flexible, and easy-to-install in the compact rolling stock environment.

Insulation and Outer Sheath:

Crosslinked polyolefine copolymer or EPR will generally be used for insulation whereas electron-beam cross-linked elastomer is employed for sheathing. Cross-linked elastomer compounds offer very good durability that can resist heat, oil, vibration, chemical aggression, etc.

Electrical Characteristics

Nominal Voltage:

Nominal voltage of a cable refers to the reference voltage for which the cable is intended to be used. In EN 50264. applicable to power cables, different voltage ranges ranging from 0.6/1 kV, 1.8/3 kV to 3.6/6 kV are defined. For each of these voltage ranges, specific insulation thickness requirements are also stipulated in this standard. The operating voltage should not exceed the corresponding max. nominal voltage allowed.

Current Carrying Capacity:

Current carrying capacity is defined as the amperage a conductor can carry before melting either the conductor or the insulation. There are many factors which will limit the amount of current that can be passed through a wire. These major determining factors are:

① Conductor Size:

The larger the circular mil area, the greater the current carrying capacity. The amount of heat generated should never exceed the maximum temperature rating of the insulation.

② Ambient Temperature:

The higher the ambient temperature, the less heat required to reach the max.temperature rating of the insulation.

③ Conductor Number:

Heat dissipation is lessened as the number of individually insulated conductors, bundled together, is increased.

④ Installation Conductors:

Restricting the heat dissipation by installing the conductors in conduit, duct, trays or raceways lessens the current carrying capacity. This restriction can be alleviated somewhat by using proper ventilation methods, forced air cooling, etc.

According to EN 50343. “Railway applications - Rolling stock – Rules for installation of cabling” current carrying capacity are based on max. conductor temperatures of 90°C and 150 °C defined in 3 b. The ambient temperature is 45 °C. The following table shows the current carrying capacities for a cable installed in mid air.

Current carrying capacity for cables in accordance with EN 50264

Nominal Cross Section of Copper Conductor mm^2	Current Carrying Capacity Conductor Temp. 90 °C (Max.) Ambient Temp. 45 °C I [A]	Current Carrying Capacity Conductor Temp. 150 °C (Max.) Ambient Temp. 45 °C I [A]
0.5	14	-
0.75	16	-
1	20	-
1.5	25	-
2.5	33	46
4	46	64
6	60	84
10	85	119
16	110	154
25	150	211
35	190	267
50	240	337

Nominal Cross Section of Copper Conductor mm²	Current Carrying Capacity Conductor Temp. 90 °C (Max.) Ambient Temp. 45 °C I [A]	Current Carrying Capacity Conductor Temp. 150 °C (Max.) Ambient Temp. 45 °C I [A]
70	300	422
95	360	506
120	425	598
150	490	689
185	560	788
240	675	950
300	775	1091
400	950	1337

⑤ Ambient Temperature

External conditions such as ambient temperature and some external factors such as bundling, installation must be taken into account when determining actual current carrying capacity. The following tables show the corresponding k1 modification factors depending on an ambient temperature differing from 45 °C. Current carrying capacity decreases or increases depending on these factors.

Max. conductor temperature 90 °C

Temperature °C	10	20	30	40	45	50	60	70
k1	1.33	1.25	1.15	1.05	1	0.94	0.82	0.66

Max. conductor temperature 150 °C

Temperature °C	-50	–30	–10	10	30	45	60	80	100	120
k1	1.38	1.3	1.23	1.15	1.06	1	0.92	0.81	0.69	0.53

Physical Characteristics

Temperatures and Overload Temperatures:

EN 50264 defines two overload categories for cables at 90 °C and 150 °C : 160 °C/50 h for 90 °C and 250 °C /50 h for 150 °C. This means that for a period of less than or equal to 50 hours, increased conductor temperatures can be withstood, while the operability of the cables remains unimpaired. This has the advantage that short-time temperature increases can be identified and more serious damage such as fires can be prevented.

Environmental Conditions:

Cables are suitable for fixed installation in rail vehicles down to – 40 °C and are resistant to oil according to EN 50305. EN 60811-2-1. UIC 895 and resistant to fuel according to EN 50305, EN 60811-2-1, UIC 895.

Fire Performance

EN 50264 and EN 50306 only describe cables and wires made from halogen free materials that minimise the risk of damage to persons and property. These materials refer to hazard levels 1 – 4 as defined in EN 45545-1 (fire protection on railway vehicles). These levels define the degree of possibility of personal injury as the result of a fire. Amongst other things, they also form the basis of the requirements for materials used in rail vehicles.

Halogen Free:

The test is for determination of the amount of halogen acid gas, other than the hydrofluoric acid evolved during combustion of compound. When tested in accordance with IEC 60754-1, the hydrochloric acid yield should be less than 0.5% (5mg/g) for LSOH compound.

Corrosivity:

Corrosive gases produced in case of fire cause damage to vehicles and facilities and therefore should be avoided. According to EN 50267-2-2, a material is not corrosive if its combustion gases meet the stipulated target values for conductivity (≤ 10s/mm) and pH value (≥ 4.3).
This is equivalent to IEC 61034.

Toxicity:

In accordance with EN 50305- 9.2. or NFC-20454 a toxicity index (ITC) is calculated following analysis and titration of combustion gases.
The aforementioned hazard levels require that certain toxicity indices are not exceeded.

The toxicity indices for power cables listed in the following table are derived from EN 50264.

The required toxicity indices for cables and wires, depending on hazard level, in accordance with EN 50264 are displayed in the following table:

HL	ITC
HL 1	not specified
HL 2 / HL 3	5 (Max.)

The required toxicity indices for cables and wires, depending on hazard level, in accordance with EN 50306 (thin wall) are displayed in the following table:

HL	ITC	
	Insulation and Sheath S1	EM101-104 and Sheath S2
HL 1	not stipulated	not stipulated
HL 2 / HL 3	10 (Max.)	5 (Max.)

Toxic Fumes:

Naval standard NES713 burns a set amount of material and analyses the gases given off. The volume of each gas is multiplied by the toxicity index for each gas. The toxicity index for each gas are added together to give an overall toxicity index for the material. LFH materials should have a toxicity index max.of 10.

Flame Retardance:

In accordance with EN 50265- 2-1 or IEC 60332-1, testing is carried out for a single insulated wire or cable. The specimen is deemed to have passed this test, if after burning has ceased, the charred or affected position does not reach within 50mm of the lower edge of the top clamp.

In accordance EN 50266-2-4, EN 50305 9.1 and IEC 60332-3, testing is carried out for bunched cables. A gas burner flame is applied to the bottom of a vertically arranged conductor bundle in a test furnace. Following completion of the flame test, the specimen consisting of 3.5m, is deemed to have met the requirements, if after burning has ceased, the extent of charred or affected portion does not reach a height exceeding 2.5m above the bottom edge of the burner.

Smoke Density:

For smoke density testing, the cube test is employed according to EN 50268-2-1 or IEC 61034. The 3 metre cube test measures the generation of smoke from electric cables during fire. A light beam emitted from a window is projected across the enclosure of a photo cell connected to a recorder at the opposite window.

The recorder is adjusted to register from 0 % for complete obscuration to 100 % luminous transmission. A 1 metre cable sample is placed in the centre of the enclosure and then subjected to fire. The minimum light transmission of the smoke is then measured.

The following table shows the minimum percentages of light transmission depending on hazard level:

HL	Light Transmission
HL 1	not specified
HL 2 / HL 3	60 %

BS 6853

In 1999 BS 6853 was introduced in UK and whose highest categories are probably the most demanding in the world. BS 6853 covers both smoke emission testing and flammability testing. BS 6853 also introduced the concept of an R-Index, which is a single number quantification of the toxic gas risk associated with composite materials for use in railway rolling stock. The R-Indices are split into the following categories:

Category 1a Trains which predominantly use tunnels R < 1.0

Category 1b Trains which use tunnels, but infrequently R < 1.6

Category 2 Trains which run, predominantly, overground R < 3.6

The R-Index is generated by analysing eight gases of combustion, for which critical concentrations have been established by NIOSH/OSHA and reported as IDLH (Immediately Dangerous to Life and Health) values.

Toxicity is the most important factor to address during the cable design. Toxicity limit for the UK and France are identical because both require the same test method for elastomers (NF X 70-100). The only difference is that the U.K.'s specification requires an addendum for nitrous oxides. Toxicity limits for French and the U.K. standards are developed from the IDLH values published in the National Institute for Occupational Safety and Health (NIOSH) Guide. IDLH (Immediately Dangerous to Life or Health) values are calculated based on levels of gas in a particular atmosphere for 30 minutes that would pose an immediate risk U.K.'s BS 6853 specification is the most stringent, closely followed by the French, and finally the Germany introduced the toxicity test in 2009.

Gases	U.K. (mg/m^3) BS 6853	French (mg/m^3) NF X 70-100	U.S. (ppm) SMP 800C
CO	1,400	1,750	3,500
CO_2	73,000	90,000	90,000

Gases	U.K. (mg/m³) BS 6853	French (mg/m³) NF X 70-100	U.S. (ppm) SMP 800C
HCl	76	150	500
HBr	101	170	100
HCN	56	55	100
HF	25	17	100
NO/NO_2	38		100
SO_2	270	260	100

NF F 16-101/2

In France the French Railway's standard NFF 16-101/2 combines reaction to fire, (M rating), with smoke and toxicity, (F rating), to provide a true FST evaluation of the fire safe properties of a composite material.
As with the UK BS 6853 standard, the M/F rating required in NFF 16-101 is dependent on the type of rolling stock, the extent to which it uses tunnels and the position and orientation of the composite part in the vehicle.

Test Methods

The standard comprises the following test methods:

Flammability
NF-EN 60695-2 Glowing Wire at 850+/-15 °C and 960+/-15 °C
NF-EN ISO 4589-2 Oxygen index determination
Smoke Density
NFX 10-702 Smoke density determination
Toxicity
NFX 70-100 Pyrolysis and combustion gas analysis

M Rating

M rating refers for the fire resistance classification of the materials to be used in the transportation industry
This classification rates the material in five categories:
M0: incombustible
M1: non flammable
M2: burns with difficulty
M4: easily inflammable
M5: very easily inflammable

I/F Rating

I/F rating refers to ignition resistance and fume classification of non metallic electrical components used in the underground transporation industry.

Test Description

1. Ignition

The ignition characteristics is determined by a combination of glow wire test (GWT) and oxygen index.
The material under test is categorized in the following tables:

I Class	Oxygen Index	Glow Wire
I0	≥70	No ignition at 960 °C
I1	≥45	No ignition at 960 °C
I2	≥32	No ignition at 850 °C
I3	≥28	Ignition does not persist at 850°C after glow wire is withdrawn
I4	≥20	
NC	<20	(Not classified)

2. Fume Composition

The parameters tested are fume opacity and analysis of pyrolysis as well as combustion gases.
All 3 parameters are used to calculate the Smoke Index (SI) which in turns determines the fume class F as follows:

F Class	S.I Values
F0	≤ 5
F1	≤20
F2	≤40
F3	≤80
F4	≤120
F5	>120

Classification

Each material will receive I/F rating, the smaller the number, the better. Unfortunately, good I and good F are difficult to achieve: low I values frequently means addition of fire retardant packages which in turns leads to high F values. Consequently, 4 overall I/F performance classes are defined as follows:

	I0	I1	I2	I3	I4	I5
F0	IV	IV	IV	II	I	I
F1	IV	IV	IV	II	I	I
F2	IV	IV	III	II	I	I
F3	IV	III	III	I	I	I
F4	IV	III	I	I	I	I
F5	IV	I	I	I	I	I

I	Performance class 1, least demanding
II	Performance class 2
III	Performance class 3
IV	Performance class 4, most demanding

DIN 5510-2

DIN 5510-2 is the latest rolling stock standard adopted in Germany. This relates to preventive fire protection in railway vehicles. Part 2 of this standard defines the fire behaviour and fire side effects of materials and parts, classification, requirement and test methods. DIN 5510-2 determines the fire classification of railway vehicle material and structure by burning behaviour, smoke density, dropping behaviour and toxic. This classification is then used to determine requirement on the combustion characteristics and fire side effects for the materials and components used in the vehicles.

The main related tests are as follows:

Smoke & Toxicity Test: EN 5659-2
Test for Vertical flame spread of vertically mounted bundled wires and cables: DIN 50266-2-4; DIN 50266-2-5
Smoke Density Test: DIN EN 61034-2
Test for Vertical flame propagation for a single insulated wire and cable: DIN EN 60332-1-2

EN 45545

En 45545 is a new EU standard used to replace the existing national regulations for fire safety in trains and track-guided vehicles. This new standard constitutes a harmonising of the existing national standards based on the highest common denominator – and will therefore represent a stiffening of the fire safety regulations applied in the individual countries. The new standard divides railway vehicles into four operation categories. As seen below, it particularly targets safety in connection with tunnels and bridges.

Category	Services	Infrastructure
1	Mainline, regional, urban and suburban	Operation not determined by underground sections, tunnels and/or elevated structures
2	Urban and suburban	Operation determined by underground sections, tunnels and/or elevated structures with walkways or other means for safe side evacuation from the vehicles
3	Mainline and regional	Operation determined by underground sections, tunnels and/or elevated structures with walkways or other means for safe side evacuation from the vehicles
4	Mainline, regional, urban and suburban	Mainline, regional, urban and suburban operation determined by underground sections, tunnels and/or elevated structures without any means for safe side evacuation from the vehicles

The standard also establishes four hazard levels that determine the requirements for protection against fire and smoke formation.

Category	Design Category			
	Standard Vehicles	Automatic vehicles having no emerhency trained staff on board	Double-decked vehicles	Sleeping and couchette cars double decked or single decked
1	HL 1	HL 1	HL 1	HL 2
2	HL 2	HL 2	HL 2	HL2
3	HL 2	HL 2	HL 2	HL 3
4	HL 3	HL 3	HL 3	HL 3

Ordering Code

FRL-A-B-C-D-E-F-G

A- Wall Type
SW=Standard Wall; MW=Medium Wall
TW=Thin Wall; HT=High Temperature

B- Voltage Type
05=300/500 V; 1=0.6/1KV
3=1.8/3KV; 6=3.6/6KV

C- Core Type
S=Single Core; M=Multicore; MP=Multi Pair

D- Insulation or Sheath Type
U=Unsheathed; SW=Standard Wall Sheath
ESW=Exposed Standard Wall Sheath; RI=Reinforced Insulation; EF=Extra-Flexible

E- Screen Type
OS=Overall Screen; IOS=Individual & Overall Screen

F- Number of Cores and Pairs
10C=10 Cores

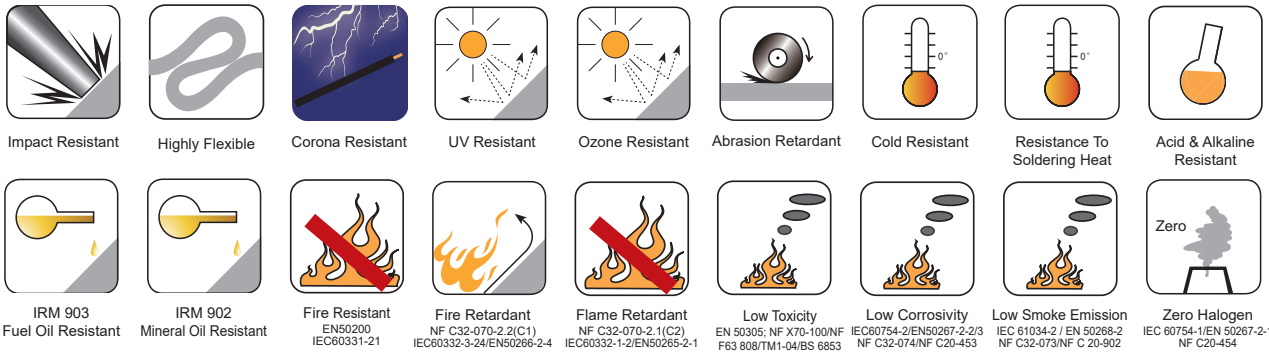
G- Cross Section Areas
1.5=1.5mm^2

EN 50305

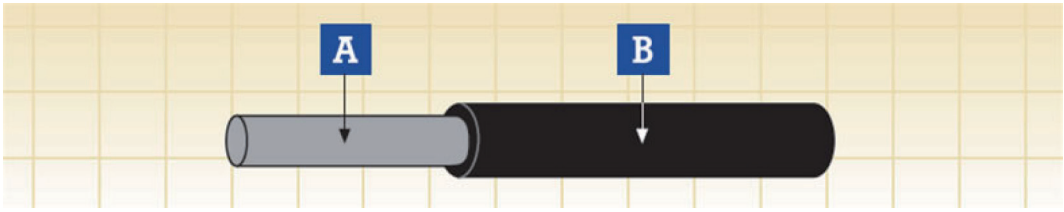
Special test are stipulated in EN 50305 for each European railway rolling stock.

Below is the test method for the rolling stock cables to En 50264 and EN 50306 and EN 50382 :

For Standard Wall and Medium Wall Cables according to EN 50264	
Ageing Test at 120 °C	
Fluid Resistance:	IRM 902 for mineral oil resistance
	IRM 903 for fuel resistance
	N oxalic acid
	N sodium hydroxide
Test at Low Temperature:	-25 °C or -40 °C
Fire Propagation:	Single core test EN 50265-2-1 (IEC 60332-1) Bundle core test EN 50266-2-4 (IEC 60332-3C) + EN 50305
Toxicity Test	Toxicity EN 50305
Smoke Density Test:	Low smoke EN 50268-2 (IEC 61034)
Halogen Test:	Acid and toxic gases EN 50267-2-1/8-2-2 (IEC 60754-1&2)
Electrical Test:	Dielectric test and direct current stability test at +85 °C
For Thin Wall Cables according to EN 50306	
Standard Wall Tests Plus	
Long Term Ageing Test:	(20.000 h at +125 °C) EN 50305
Notch Propagation Test:	EN 50305
Abrasion Test:	EN 50305
For High Temperature Cables according to EN 50382	
Standard Wall Tests Plus	
Ageing Test	For silicon insulation at +200 °C and long term sheath ageing test (20.000 h at +140 °C)



FIREROL Standard Wall Single Core Unsheathed Cables 0.6/1 kV or 1.8/3 kV EN 50264-2-1 (FRL-SW-1SU/FRL-SW-3SU)



A. Conductor B. Insulation

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 104)

Electrical & Mechanical Properties

Nominal Voltage	0.6/1 kV or 1.8/3 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-SW-1SU 0.6/1 kV

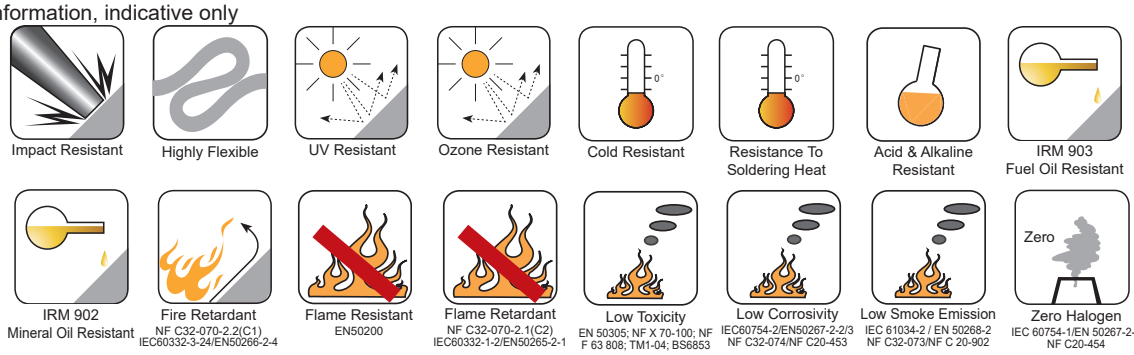
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.0	1.25	0.8	2.8	3.2	18	20	65	0.65
1.5	1.5	0.8	3.0	3.5	20	13.7	55	0.55
2.5	1.95	0.8	3.4	3.9	30	8.21	50	0.5
4.0	2.5	0.8	3.9	4.6	50	5.09	40	0.4
6.0	3.0	0.9	4.6	5.4	70	3.39	35	0.35
10	3.9	1.1	5.8	6.8	130	1.95	30	0.3
16	5.0	1.1	7.2	8.5	170	1.24	30	0.3
25	6.4	1.3	8.6	10.0	260	0.795	30	0.3
35	7.7	1.3	10.2	11.5	350	0.565	25	0.25
50	9.2	1.5	11.6	13.5	500	0.393	25	0.25
70	11.0	1.5	13.3	15.5	690	0.277	20	0.2
95	12.5	1.6	14.9	17.4	910	0.210	20	0.2
120	14.2	1.6	16.5	19.3	1120	0.164	20	0.2
150	15.8	1.9	18.5	21.7	1430	0.132	15	0.15
185	17.5	1.9	20.1	23.6	1720	0.108	15	0.15
240	20.1	2.1	22.9	25.8	2290	0.0817	15	0.15
300	22.5	2.2	25.4	29.7	2810	0.0654	10	0.1
400	25.8	2.3	28.7	33.6	3690	0.0495	10	0.1

(a) = for information, indicative onlyNote: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-3SU 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	2.5	6.2	7.3	70	13.70	120	1.2
2.5	1.95	2.5	6.6	7.8	90	8.21	100	1.0
4.0	2.5	2.5	7.1	8.4	110	5.09	90	0.9
6.0	3.0	2.5	7.6	8.9	130	3.39	80	0.8
10	3.9	2.5	8.4	9.9	190	1.95	65	0.65
16	5.0	2.5	9.5	11.1	250	1.24	55	0.55
25	6.4	2.5	10.8	12.7	330	0.795	45	0.45
35	7.7	2.5	12.0	14.1	430	0.565	40	0.4
50	9.2	2.5	13.4	15.7	570	0.393	35	0.35
70	11.0	2.5	15.1	17.7	760	0.277	30	0.3
95	12.5	2.7	16.9	19.8	980	0.210	30	0.3
120	14.2	2.7	18.5	21.7	1210	0.164	25	0.25
150	15.8	2.7	20.0	23.4	1500	0.132	20	0.2
185	17.5	2.7	21.6	25.3	1800	0.1080	20	0.2
240	20.1	2.7	24.1	28.2	2360	0.0817	20	0.2
300	22.5	2.7	26.3	30.8	2840	0.0654	15	0.15
400	25.8	2.9	29.8	34.9	3800	0.0495	15	0.15

(a) = for information, indicative only



FIREROL Standard Wall Single Core Unsheathed & Fire Resistant Cables 0.6/1 kV or 1.8/3 kV EN 50264-2-1 (FRL-SW-1SU-PH15/30/60，FRL-SW-3SU-PH15/30/60)

A. Conductor B. Insulation

Application

-Used as power cable and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

Mica tape+LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 104)

Electrical & Mechanical Properties

Nominal Voltage	0.6/1 kV or 1.8/3 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3
EN50200	PH15, PH30, PH60

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16
EN 50200:2006	Resistance to fire of unprotected small cable for use in emergency circuits. 5 classifications are defined: PH 15,30 60, 90 or 120 90 mins.

FRL-SW-1SU-PH15/30/60 0.6/1 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.0	1.25	0.8	2.8	3.2	18	20	65	0.65
1.5	1.5	0.8	3.0	3.5	20	13.7	55	0.55
2.5	1.95	0.8	3.4	3.9	30	8.21	50	0.5
4.0	2.5	0.8	3.9	4.6	50	5.09	40	0.4
6.0	3.0	0.9	4.6	5.4	70	3.39	35	0.35
10	3.9	1.1	5.8	6.8	130	1.95	30	0.3
16	5.0	1.1	7.2	8.5	170	1.24	30	0.3
25	6.4	1.3	8.6	10.0	260	0.795	30	0.3
35	7.7	1.3	10.2	11.5	350	0.565	25	0.25
50	9.2	1.5	11.6	13.5	500	0.393	25	0.25
70	11.0	1.5	13.3	15.5	690	0.277	20	0.2
95	12.5	1.6	14.9	17.4	910	0.210	20	0.2
120	14.2	1.6	16.5	19.3	1120	0.164	20	0.2
150	15.8	1.9	18.5	21.7	1430	0.132	15	0.15
185	17.5	1.9	20.1	23.6	1720	0.108	15	0.15
240	20.1	2.1	22.9	25.8	2290	0.0817	15	0.15
300	22.5	2.2	25.4	29.7	2810	0.0654	10	0.1
400	25.8	2.3	28.7	33.6	3690	0.0495	10	0.1

(a) = for information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-3SU-PH15/30/60 1.8/3 kV

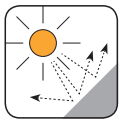
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	2.5	6.2	7.3	70	13.70	120	1.2
2.5	1.95	2.5	6.6	7.8	90	8.21	100	1.0
4.0	2.5	2.5	7.1	8.4	110	5.09	90	0.9
6.0	3.0	2.5	7.6	8.9	130	3.39	80	0.8
10	3.9	2.5	8.4	9.9	190	1.95	65	0.65
16	5.0	2.5	9.5	11.1	250	1.24	55	0.55
25	6.4	2.5	10.8	12.7	330	0.795	45	0.45
35	7.7	2.5	12.0	14.1	430	0.565	40	0.4
50	9.2	2.5	13.4	15.7	570	0.393	35	0.35
70	11.0	2.5	15.1	17.7	760	0.277	30	0.3
95	12.5	2.7	16.9	19.8	980	0.210	30	0.3
120	14.2	2.7	18.5	21.7	1210	0.164	25	0.25
150	15.8	2.7	20.0	23.4	1500	0.132	20	0.2
185	17.5	2.7	21.6	25.3	1800	0.1080	20	0.2
240	20.1	2.7	24.1	28.2	2360	0.0817	20	0.2
300	22.5	2.7	26.3	30.8	2840	0.0654	15	0.15
400	25.8	2.9	29.8	34.9	3800	0.0495	15	0.15

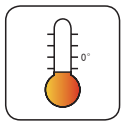
(a) = for information, indicative only


Impact Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903 Fuel Oil Resistant


IRM 902 Mineral Oil Resistant


Fire Retardant NF C32-070-2.2(C1) IEC60332-3-24/EN50266-2-4


Flame Resistant EN50200


Flame Retardant NF C32-070-2.1(C2) IEC60332-1-2/EN50265-2-1

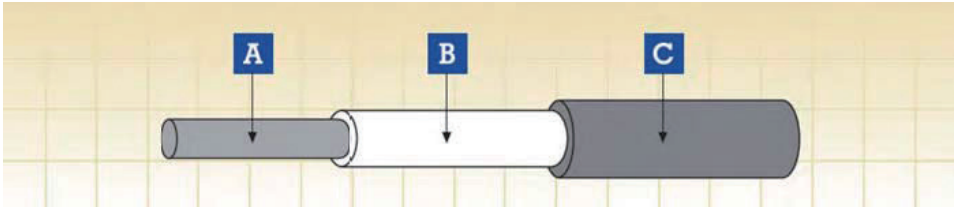

Low Toxicity EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity IEC60754-2/EN50267-2-2/3 NF C32-074/NF C20-453


Low Smoke Emission IEC 61034-2 / EN 50268-2 NF C32-073/NF C 20-902

Zero Halogen IEC 60754-1/EN 50267-2-1 NF C20-454

FIREROL Standard Wall Single Core Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50264-2-1 (FRL-SW-3S/FRL-SW-6S)



A. Conductor B. Insulation C. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 104)

Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN 45545-2	Requirement for fire behavior of matreial & components R15/R16

FRL-SW-3S 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	1.4	6.7	7.8	80	13.70	960	9.6
2.5	1.95	1.3	1.4	7.1	8.3	100	8.21	850	8.5
4.0	2.5	1.3	1.4	7.6	8.9	120	5.09	750	7.5
6.0	3.0	1.3	1.4	8.1	9.5	140	3.39	670	6.7
10	3.9	2.2	1.4	10.6	12.4	250	1.95	550	5.5
16	5.0	2.2	1.4	11.7	13.6	310	1.24	450	4.5
25	6.4	2.2	1.4	13.0	15.2	410	0.795	390	3.9
35	7.7	2.2	1.4	14.2	16.5	520	0.565	350	3.5
50	9.2	2.2	1.4	15.6	18.3	660	0.393	300	3.0
70	11.0	2.2	1.5	17.5	20.5	880	0.277	260	2.6
95	12.5	2.4	1.6	19.6	22.3	1130	0.210	250	2.5
120	14.2	2.4	1.6	21.1	24.6	1370	0.164	220	2.2
150	15.8	2.4	1.7	22.7	26.6	1690	0.132	210	2.1
185	17.5	2.4	1.7	24.0	28.1	2000	0.1080	200	2.0
240	20.1	2.4	1.8	27.0	31.6	2620	0.0817	180	1.8
300	22.5	2.4	1.9	29.4	34.4	3140	0.0654	170	1.7
400	25.8	2.6	2.0	32.7	38.3	4140	0.0495	150	1.5

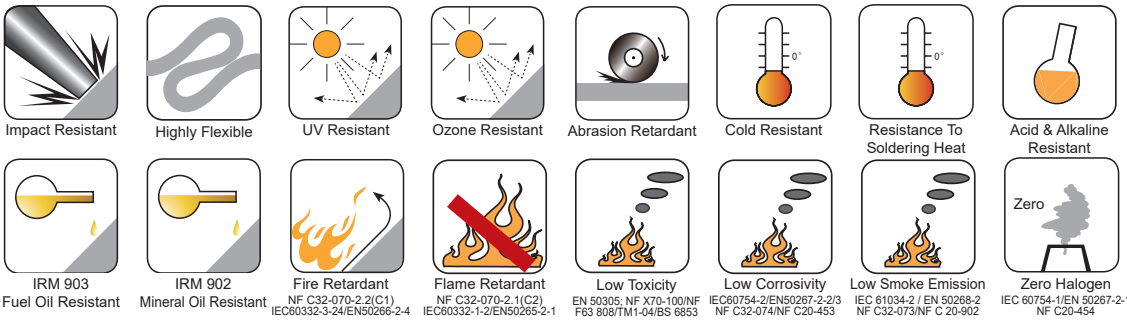
(a) = for information, indicative only Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-6S 3.6/6 kV

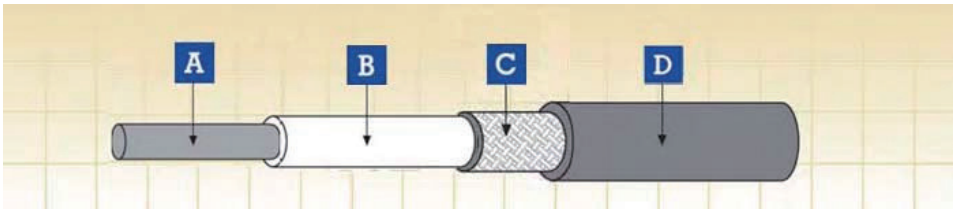
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	3.0	1.4	10.5	12.3	170	8.21	1300	13
4.0	2.5	3.0	1.4	11.0	12.9	190	5.09	1150	11.5
6.0	3.0	3.0	1.4	11.5	13.4	230	3.39	1050	10.5
10	3.9	3.0	1.4	12.3	14.4	300	1.95	850	8.5
16	5.0	3.0	1.4	13.3	15.6	360	1.24	710	7.1
25	6.4	3.0	1.4	14.7	17.2	450	0.795	630	6.3
35	7.7	3.0	1.4	15.9	18.6	560	0.565	550	5.5
50	9.2	3.0	1.5	17.5	20.5	720	0.393	500	5.0
70	11.0	3.0	1.5	19.2	22.4	930	0.277	430	4.3
95	12.5	3.0	1.6	20.8	24.3	1160	0.210	400	4.0
120	14.2	3.1	1.7	22.7	26.6	1430	0.164	360	3.6
150	15.8	3.1	1.7	24.2	28.4	1740	0.132	340	3.4
185	17.5	3.2	1.8	26.2	30.7	2080	0.108	330	3.3
240	20.1	3.4	1.9	29.2	34.2	2730	0.0817	300	3.0
300	22.5	3.4	1.9	31.5	36.9	3230	0.0654	250	2.5
400	25.8	3.4	2.0	34.8	40.7	4210	0.0495	230	2.3

(a) = for information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Standard Wall Single Core Screened & Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50264-2-1 (FRL-SW-3S-OS/FRL-SW-6S-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 104)

Overal Screen

Tinned annealed copper wires

Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN 45545-2	Requirement for fire behavior of matreial & components R15/R16

FRL-SW-3S-OS 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Min. Wire Diameter of Screen	Weight	Max. Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.			20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	1.4	7.1	78.2	0.16	99	13.70	960	9.6
2.5	1.95	1.3	1.4	7.5	8.7	0.16	120	8.21	850	8.5
4.0	2.5	1.3	1.4	8.1	9.4	0.21	150	5.09	750	7.5
6.0	3.0	1.3	1.4	8.6	10.0	0.21	175	3.39	670	6.7
10	3.9	2.2	1.4	11.1	12.9	0.21	290	1.95	550	5.5
16	5.0	2.2	1.4	12.3	14.2	0.26	370	1.24	450	4.5
25	6.4	2.2	1.4	13.6	15.8	0.26	480	0.795	390	3.9
35	7.7	2.2	1.4	14.95	17.25	0.31	610	0.565	350	3.5
50	9.2	2.2	1.4	16.35	19.05	0.31	770	0.393	300	3.0
70	11.0	2.2	1.5	18.25	21.25	0.31	1010	0.277	260	2.6
95	12.5	2.4	1.6	10.35	23.05	0.31	1270	0.210	250	2.5
120	14.2	2.4	1.6	21.85	25.35	0.31	1530	0.164	220	2.2
150	15.8	2.4	1.7	23.45	27.35	0.31	1870	0.132	210	2.1
185	17.5	2.4	1.7	24.75	28.85	0.31	2190	0.1080	200	2.0
240	20.1	2.4	1.8	27.75	32.35	0.31	2830	0.0817	180	1.8
300	22.5	2.4	1.9	30.15	35.15	0.31	3375	0.0654	170	1.7
400	25.8	2.6	2.0	33.45	39.05	0.31	4400	0.0495	150	1.5

(a) = for information, indicative only Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

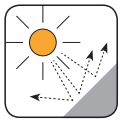
FRL-SW-6S-OS 3/6 kV

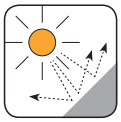
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Min. Wire Diameter of Screen	Weight	Max. Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.			20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	3.0	1.4	10.9	12.7	0.16	200	8.21	1300	13
4.0	2.5	3.0	1.4	11.4	13.3	0.16	225	5.09	1150	11.5
6.0	3.0	3.0	1.4	12.0	13.9	0.21	280	3.39	1050	10.5
10	3.9	3.0	1.4	12.8	14.9	0.21	355	1.95	850	8.5
16	5.0	3.0	1.4	13.8	16.1	0.21	420	1.24	710	7.1
25	6.4	3.0	1.4	15.3	17.8	0.26	540	0.795	630	6.3
35	7.7	3.0	1.4	16.5	19.2	0.26	658	0.565	550	5.5
50	9.2	3.0	1.5	18.25	21.25	0.31	850	0.393	500	5.0
70	11.0	3.0	1.5	19.95	23.15	0.31	1080	0.277	430	4.3
95	12.5	3.0	1.6	21.55	25.05	0.31	1320	0.210	400	4.0
120	14.2	3.1	1.7	23.45	27.35	0.31	1600	0.164	360	3.6
150	15.8	3.1	1.7	24.95	28.15	0.31	1930	0.132	340	3.4
185	17.5	3.2	1.8	26.95	31.45	0.31	2290	0.108	330	3.3
240	20.1	3.4	1.9	29.95	34.95	0.31	2970	0.0817	300	3.0
300	22.5	3.4	1.9	32.25	37.65	0.31	3565	0.0654	250	2.5
400	25.8	3.4	2.0	35.55	41.45	0.31	4620	0.0495	230	2.3

(a) = for information, indicative only


Impact Resistant

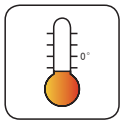

Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903 Fuel Oil Resistant


IRM 902 Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

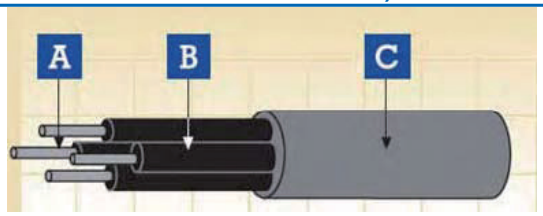

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Standard Wall Multicore Unscreened Cables 300/500 V or 0.6/1 kV EN 50264-2-2 (FRL-SW-05M/FRL-SW-1M)



A. Conductor B. Insulation C. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 105)

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN 45545-2	Requirement for fire behavior of matreial & components R15/R16

FRL-SW-05M 300/500 V

Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Diameter of Core (a)		Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		Min.	Max.		20 °C	EI 105 20 °C	EI 101-EI 104 20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	Kg/km	Ω/km	MΩ x km	MΩ x km
2x1	1.2	0.6	2.4	2.8	1.4	7.2	8.5	100	20.0	140	70
4x1	1.25	0.6	2.4	2.8	1.4	8.2	9.6	130	20.0	140	70
7x1		0.6	2.4	2.8	1.4	9.6	11.2	180	20.0	140	70
9x1		0.6	2.4	2.8	1.4	11.5	13.4	220	20.0	140	70
12x1		0.6	2.4	2.8	1.4	12.3	14.4	280	20.0	140	70
19x1		0.6	2.4	2.8	1.4	14.5	16.6	400	20.0	140	70
24x1		0.6	2.4	2.8	1.5	16.7	19.6	530	20.0	140	70
32x1		0.6	2.4	2.8	1.6	18.5	21.7	660	20.0	140	70
37x1		0.6	2.4	2.8	1.6	19.2	22.4	720	20.0	140	70
40x1		0.6	2.4	2.8	1.6	19.9	23.3	750	20.0	140	70
4x1.5	1.5	0.7	2.8	3.3	1.4	9.2	10.8	170	13.7	120	60
7x1.5		0.7	2.8	3.3	1.4	10.9	12.8	250	13.7	120	60
9x1.5		0.7	2.8	3.3	1.4	13.1	15.3	310	13.7	120	60
12x1.5		0.7	2.8	3.3	1.4	14.0	16.4	400	13.7	120	60
19x1.5		0.7	2.8	3.3	1.5	16.5	19.4	570	13.7	120	60
24x1.5		0.7	2.8	3.3	1.6	19.5	22.8	760	13.7	120	60
32x1.5		0.7	2.8	3.3	1.7	21.5	25.2	940	13.7	120	60
37x1.5		0.7	2.8	3.3	1.7	22.4	26.2	1040	13.7	120	60
4x2.5	1.95	0.8	3.4	4.0	1.4	10.7	12.5	240	8.21	90	45
7x2.5		0.8	3.4	4.0	1.4	12.7	14.9	360	8.21	90	45
9x2.5		0.8	3.4	4.0	1.5	15.6	18.3	450	8.21	90	45
12x2.5		0.8	3.4	4.0	1.5	16.7	19.6	590	8.21	90	45
19x2.5		0.8	3.4	4.0	1.6	19.7	23.1	860	8.21	90	45
24x2.5		0.8	3.4	4.0	1.8	23.5	27.5	1150	8.21	90	45

(a) = For information, indicative only Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-1M 0.6/1 kV

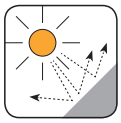
Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Diameter of Core (a)		Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		Min.	Max.			EI 105	EI 101-EI 104
									20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	Kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES											
1.5	1.5	0.8	3.0	3.5	1.4	8.5	9.9	140	13.7	150	75
2.5	1.95	0.8	3.4	3.9	1.4	9.3	10.9	180	8.21	130	65
4	2.5	0.8	3.9	4.6	1.4	10.3	12.1	230	5.09	110	55
6	3.0	0.9	4.6	5.4	1.4	11.8	13.9	300	3.39	90	45
10	3.9	1.1	5.8	6.8	1.4	14.3	16.7	480	1.95	85	45
16	5.0	1.1	7.2	8.5	1.5	16.5	19.4	630	1.24	70	35
25	6.4	1.3	8.6	10.0	1.6	20.1	23.5	920	0.795	65	35
35	7.7	1.3	10.2	11.5	1.7	22.7	26.6	1200	0.565	60	30
50	9.2	1.5	11.6	13.5	1.9	26.7	31.2	1670	0.393	55	30
THREE CORES											
1.5	1.5	0.8	3.0	3.5	1.4	8.9	10.5	160	13.7	150	75
2.5	1.95	0.8	3.4	3.9	1.4	9.9	11.6	210	8.21	130	65
4	2.5	0.8	3.9	4.6	1.4	11.0	12.9	270	5.09	110	55
6	3.0	0.9	4.6	5.4	1.4	12.5	14.6	360	3.39	90	45
10	3.9	1.1	5.8	6.8	1.5	15.3	17.9	600	1.95	85	45
16	5.0	1.1	7.2	8.5	1.6	17.8	20.8	790	1.24	70	35
25	6.4	1.3	8.6	10.0	1.7	21.6	25.3	1170	0.795	65	35
35	7.7	1.3	10.2	11.5	1.8	24.4	28.6	1530	0.565	60	30
50	9.2	1.5	11.6	13.5	1.9	28.2	33.3	2120	0.393	55	30
FOUR CORES											
1.5	1.5	0.8	3.0	3.5	1.4	9.7	11.3	190	13.7	150	75
2.5	1.95	0.8	3.4	3.9	1.4	10.7	12.5	250	8.21	130	65
4	2.5	0.8	3.9	4.6	1.4	11.9	14.0	330	5.09	110	55
6	3.0	0.9	4.6	5.4	1.4	13.7	16.1	450	3.39	90	45
10	3.9	1.1	5.8	6.8	1.5	16.9	19.8	740	1.95	85	45
16	5.0	1.1	7.2	8.5	1.6	19.6	22.9	980	1.24	70	35
25	6.4	1.3	8.6	10.0	1.8	24.1	28.2	1460	0.795	65	35
3X35+25	7.7/6.4	1.3/1.3	10.2/8.6	11.5/10.0	1.9	28.5	34.2	1610	0.565/0.795	60	30
3X50+25	9.2/6.4	1.5/1.3	11.6/8.6	13.5/10.0	2.0	33.4	40.0	2230	0.393/0.795	55	30

(a)= For information, indicative only


Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

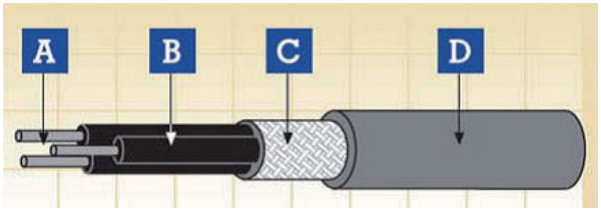

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Standard Wall Multicore Overall Screened Cables 300/500 V or 0.6/1 kV EN 50264-2-2 (FRL-SW-05M-OS/FRL-SW-1M-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 105)

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN 45545-2	Requirement for fire behavior of matreial & components R15/R16

FRL-SW-05M-OS 300/500 V

Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Diameter of Core (b)		Min. Wire Diameter of Screen	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 105	EI 101-EI 104
										20 °C	20 °C	20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2x1	1.25	0.6	2.4	2.8	0.16	1.4	8.1	9.5	110	20.0	140	70
4x1		0.6	2.4	2.8	0.16	1.4	9.0	10.6	150	20.0	140	70
7x1		0.6	2.4	2.8	0.16	1.4	10.4	12.2	210	20.0	140	70
9x1		0.6	2.4	2.8	0.21	1.4	12.5	14.6	290	20.0	140	70
12x1		0.6	2.4	2.8	0.21	1.4	13.3	15.6	330	20.0	140	70
19x1		0.6	2.4	2.8	0.26	1.5	15.7	18.4	490	20.0	140	70
24x1		0.6	2.4	2.8	0.26	1.6	18.1	21.2	630	20.0	140	70
32x1		0.6	2.4	2.8	0.26	1.6	19.7	23.1	760	20.0	140	70
37x1		0.6	2.4	2.8	0.26	1.7	20.7	24.2	840	20.0	140	70
40x1		0.6	2.4	2.8	0.26	1.7	21.4	25.1	910	20.0	140	70
4x1.5	1.5	0.7	2.8	3.3	0.16	1.4	10.1	11.8	200	13.7	120	60
7x1.5		0.7	2.8	3.3	0.21	1.4	11.9	14.0	290	13.7	120	60
9x1.5		0.7	2.8	3.3	0.21	1.4	14.1	16.5	380	13.7	120	60
12x1.5		0.7	2.8	3.3	0.21	1.5	15.8	18.5	450	13.7	120	60
19x1.5		0.7	2.8	3.3	0.26	1.5	17.8	20.8	660	13.7	120	60
24x1.5		0.7	2.8	3.3	0.26	1.6	20.7	24.2	850	13.7	120	60
32x1.5		0.7	2.8	3.3	0.26	1.7	22.7	26.6	1050	13.7	120	60
37x1.5		0.7	2.8	3.3	0.26	1.7	23.6	27.6	1160	13.7	120	60
4x2.5	1.95	0.8	3.4	4.0	0.21	1.4	11.8	13.9	280	8.21	90	45
7x2.5		0.8	3.4	4.0	0.21	1.4	13.7	16.1	400	8.21	90	45
9x2.5		0.8	3.4	4.0	0.26	1.5	16.8	19.7	560	8.21	90	45
12x2.5		0.8	3.4	4.0	0.26	1.5	18.0	21.1	660	8.21	90	45
19x2.5		0.8	3.4	4.0	0.26	1.6	21.1	24.6	950	8.21	90	45
24x2.5		0.8	3.4	4.0	0.26	1.8	24.7	28.9	1260	8.21	90	45

(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-1M-OS 0.6/1 kV

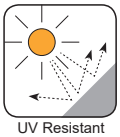
Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Diameter of Core (b)		Min. Wire Diameter of Screen	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 105	EI 101-EI 104
										20 °C	20 °C	20 °C
mm²	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES												
1.5	1.5	0.8	3.0	3.5	0.16	1.4	9.3	10.9	150	13.7	150	75
2.5	1.95	0.8	3.4	3.9	0.16	1.4	10.2	11.9	180	8.21	130	65
4	2.5	0.8	3.9	4.6	0.21	1.4	11.5	13.4	240	5.09	110	55
6	3.0	0.9	4.6	5.4	0.21	1.4	12.9	15.1	300	3.39	90	45

Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Diameter of Core (b)		Min. Wire Diameter of Screen	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 105	EI 101-EI 104
										20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
10	3.9	1.1	5.8	6.8	0.21	1.5	15.5	18.2	460	1.95	85	45
16	5.0	1.1	7.2	8.5	0.26	1.5	17.9	20.9	610	1.24	70	35
25	6.4	1.3	8.6	10.0	0.26	1.7	21.6	25.3	830	0.795	65	35
35	7.7	1.3	10.2	11.5	0.31	1.8	24.4	28.6	1130	0.565	60	30
50	9.2	1.5	11.6	13.5	0.31	1.9	28.2	33.0	1500	0.393	55	30
THREE CORES												
1.5	1.5	0.8	3.0	3.5	0.16	1.4	9.8	11.4	180	13.7	150	75
2.5	1.95	0.8	3.4	3.9	0.16	1.4	10.7	12.5	220	8.21	130	65
4	2.5	0.8	3.9	4.6	0.21	1.4	12.0	14.1	300	5.09	110	55
6	3.0	0.9	4.6	5.4	0.21	1.4	13.6	16.0	380	3.39	90	45
10	3.9	1.1	5.8	6.8	0.26	1.5	16.7	19.6	620	1.95	85	45
16	5.0	1.1	7.2	8.5	0.26	1.6	19.1	22.3	800	1.24	70	35
25	6.4	1.3	8.6	10.0	0.26	1.7	22.9	26.8	1140	0.795	65	35
35	7.7	1.3	10.2	11.5	0.31	1.8	26.0	30.5	1500	0.565	60	30
50	9.2	1.5	11.6	13.5	0.31	2.0	30.3	35.4	2050	0.393	55	30
FOUR CORES												
1.5	1.5	0.8	3.0	3.5	0.16	1.4	10.5	12.3	210	13.7	150	75
2.5	1.95	0.8	3.4	3.9	0.21	1.4	11.8	13.9	280	8.21	130	65
4	2.5	0.8	3.9	4.6	0.21	1.4	13.1	15.3	360	5.09	110	55
6	3.0	0.9	4.6	5.4	0.21	1.4	14.9	17.4	470	3.39	90	45
10	3.9	1.1	5.8	6.8	0.26	1.6	18.4	21.6	780	1.95	85	45
16	5.0	1.1	7.2	8.5	0.26	1.7	21.1	24.6	1020	1.24	70	35
25	6.4	1.3	8.6	10.0	0.31	1.8	25.6	29.9	1490	0.795	65	35
3X35+25	7.7/6.4	1.3/1.3	10.2/8.6	11.5/10.0	0.31	1.9	30.0	35.1	1820	0.565/0.795	60	30
3X50+25	9.2/6.4	1.5/1.3	11.6/8.6	13.5/10.0	0.31	2.1	34.9	40.8	2480	0.393/0.795	55	30

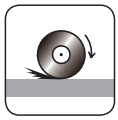
(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

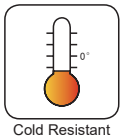

Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

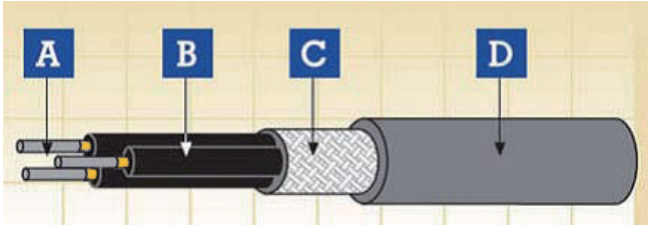

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Standard Wall Multicore Overall Screened & Fire Resistant Cables 300/500 V or 0.6/1 kV EN 50264-2-2 (FRL-SW-05M-OS-AS+PH15/30/60, FRL-SW-1M-OS-AS+-PH15/30/60)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control p anels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

Mica tape+LSZH elastomeric compound as defined in EN 50264-1 (EI 101 to EI 105)

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3
EN 50200: 2006	PH15, PH30, PH60

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index

IEC60331-21 — The circuit integrity test under fire of cables rated 0.6/1.0kV and below

EN 45545-2 — Requirement for fire behavior of matreial & components R15/R16

EN 50200: 2006 — Resistance to fire of unprotected small cable for use in emergency circuits 5 classifications are defined: PH 15,30,60, 90 or 120mins

FRL-SW-05M-OS-AS+ PH15/30/60 300/500 V

Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Diameter of Core (b)		Min. Wire Diameter of Screen	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 105	EI 101-EI 104
										20 °C	20 °C	20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2x1	1.25	0.6	2.7	3.1	0.16	1.4	8.3	9.8	129	20.0	140	70
4x1		0.6	2.7	3.1	0.16	1.4	9.2	10.9	188	20.0	140	70
7x1		0.6	2.7	3.1	0.16	1.4	10.6	12.5	275	20.0	140	70
9x1		0.6	2.7	3.1	0.21	1.4	12.7	14.9	360	20.0	140	70
12x1		0.6	2.7	3.1	0.21	1.4	13.5	15.9	445	20.0	140	70
19x1		0.6	2.7	3.1	0.26	1.5	15.9	18.7	665	20.0	140	70
24x1		0.6	2.7	3.1	0.26	1.6	18.3	21.5	832	20.0	140	70
32x1		0.6	2.7	3.1	0.26	1.6	19.9	23.4	1043	20.0	140	70
37x1		0.6	2.7	3.1	0.26	1.7	20.9	24.5	1181	20.0	140	70
40x1		0.6	2.7	3.1	0.26	1.7	21.6	25.4	1263	20.0	140	70
4x1.5	1.5	0.7	3.0	3.5	0.16	1.4	10.3	12.1	244	13.7	120	60
7x1.5		0.7	3.0	3.5	0.21	1.4	12.1	14.3	380	13.7	120	60
9x1.5		0.7	3.0	3.5	0.21	1.4	14.3	16.8	476	13.7	120	60
12x1.5		0.7	3.0	3.5	0.21	1.5	16.0	18.8	604	13.7	120	60
19x1.5		0.7	3.0	3.5	0.26	1.5	18.0	21.1	895	13.7	120	60
24x1.5		0.7	3.0	3.5	0.26	1.6	20.9	24.5	1120	13.7	120	60
32x1.5		0.7	3.0	3.5	0.26	1.7	22.9	26.9	1430	13.7	120	60
37x1.5		0.7	3.0	3.5	0.26	1.7	23.8	27.9	1610	13.7	120	60
4x2.5	1.95	0.8	3.6	4.2	0.21	1.4	12.0	14.2	330	8.21	90	45
7x2.5		0.8	3.6	4.2	0.21	1.4	13.9	16.4	500	8.21	90	45
9x2.5		0.8	3.6	4.2	0.26	1.5	17.0	20.0	670	8.21	90	45
12x2.5		0.8	3.6	4.2	0.26	1.5	18.2	21.4	830	8.21	90	45
19x2.5		0.8	3.6	4.2	0.26	1.6	21.3	24.9	1200	8.21	90	45
		0.8	3.6	4.2	0.26	1.8	24.9	28.9	1560	8.21	90	45

(a)= One earth conductor (green/yellow) can be included upon request

(b)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-SW-1M-OS-AS+ PH15/30/60 0.6/1 kV

Number and Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Diameter of Core (b)		Min. Wire Diameter of Screen	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 105	EI 101-EI 104
										20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES												
1.5	1.5	0.8	3.3	3.8	0.16	1.4	9.5	11.2	166	13.7	150	75
2.5	1.95	0.8	3.7	4.2	0.16	1.4	10.4	12.2	207	8.21	130	65
4	2.5	0.8	4.2	4.9	0.21	1.4	11.7	13.7	273	5.09	110	55
6	3.0	0.9	4.9	5.7	0.21	1.4	13.1	15.4	351	3.39	90	45
10	3.9	1.1	6.1	7.1	0.21	1.5	15.7	18.5	515	1.95	85	45
16	5.0	1.1	7.5	8.8	0.26	1.5	18.1	21.2	710	1.24	70	35
25	6.4	1.3	8.9	10.3	0.26	1.7	21.8	25.6	1035	0.795	65	35
35	7.7	1.3	10.5	11.8	0.31	1.8	24.6	28.9	1339	0.565	60	30
50	9.2	1.5	11.9	13.8	0.31	1.9	28.4	33.3	1810	0.393	55	30
THREE CORES												
1.5	1.5	0.8	3.3	3.8	0.16	1.4	10.0	11.7	205	13.7	150	75
2.5	1.95	0.8	3.7	4.2	0.16	1.4	10.9	12.8	261	8.21	130	65
4	2.5	0.8	4.2	4.9	0.21	1.4	12.2	14.4	349	5.09	110	55
6	3.0	0.9	4.9	5.7	0.21	1.4	13.8	16.3	457	3.39	90	45
10	3.9	1.1	6.1	7.1	0.26	1.5	16.9	19.9	704	1.95	85	45
16	5.0	1.1	7.5	8.8	0.26	1.6	19.3	22.6	960	1.24	70	35
25	6.4	1.3	8.9	10.3	0.26	1.7	23.1	27.1	1400	0.795	65	35
35	7.7	1.3	10.5	11.8	0.31	1.8	26.2	30.8	1827	0.565	60	30
50	9.2	1.5	11.9	13.8	0.31	2.0	30.5	35.7	2513	0.393	55	30
FOUR CORES												
1.5	1.5	0.8	3.3	3.8	0.16	1.4	10.7	12.6	248	13.7	150	75
2.5	1.95	0.8	3.7	4.2	0.21	1.4	12.0	14.2	335	8.21	130	65
4	2.5	0.8	4.2	4.9	0.21	1.4	13.3	15.6	430	5.09	110	55
6	3.0	0.9	4.9	5.7	0.21	1.4	15.1	17.7	570	3.39	90	45
10	3.9	1.1	6.1	7.1	0.26	1.6	18.6	21.9	896	1.95	85	45
16	5.0	1.1	7.5	8.8	0.26	1.7	21.3	24.9	1200	1.24	70	35
25	6.4	1.3	8.9	10.3	0.31	1.8	25.8	30.2	1815	0.795	65	35
3X35+25	7.7/6.4	1.3/1.3	10.5/8.9	11.8/10.3	0.31	1.9	30.2	35.4	2200	0.565/0.795	60	30
3X50+25	9.2/6.4	1.5/1.3	11.9/8.9	13.8/10.3	0.31	2.1	35.1	41.1	2600	0.393/0.795	55	30

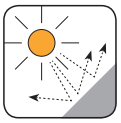
(a)= One earth conductor (green/yellow) can be included upon request

(b)= For information, indicative only

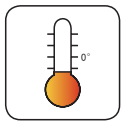
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Impact Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903 Fuel Oil Resistant


IRM 902 Mineral Oil Resistant


Fire Retardant NF C32-070-2.2(C1) IEC60332-3-24/EN50266-2-4

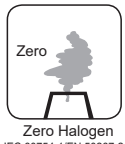

Flame Resistant IEC60331-21


Flame Retardant NF C32-070-2.1(C2) IEC60332-1-2/EN50265-2-1


Low Toxicity EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853

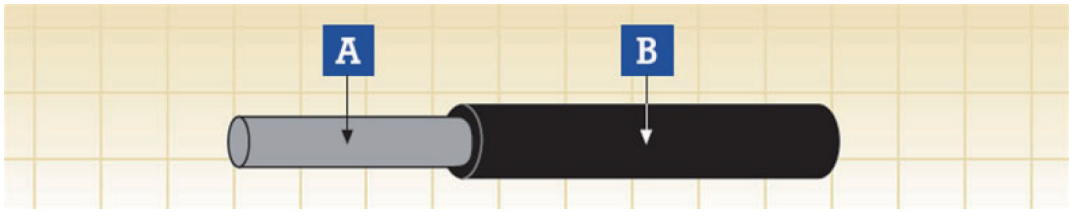

Low Corrosivity IEC60754-2/EN50267-2-2/3 NF C32-074/NF C20-453


Low Smoke Emission IEC 61034-2 / EN 50268-2 NF C32-073/NF C 20-902



Zero Halogen IEC 60754-1/EN 50267-2-1 NF C20-454

FIREROL Medium Wall Single Core Unsheathed Cables 0.6/1 kV or 1.8/3 kV EN 50264-3-1 (FRL-MW-1SU/FRL-MW-3SU)



A. Conductor B. Insulation

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 109)

Electrical & Mechanical Properties

Nominal Voltage	0.6/1 kV or 1.8/3 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	
For 0.6/1KV Cables	Fixed installation: 3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm) Flexible installation: 6 x Overall Diameter (D<12mm); 8 x Overall Diameter (D>12mm)
For 1.8/3KV Cables	Fixed installation: 5 x Overall Diameter (D<12mm); 6 x Overall Diameter (D>12mm) Flexible installation: 10 x Overall Diameter (D<12mm); 12 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free

EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101

EN 45545-2

Low Corrosivity (Acidity & Conductivity)

Low Toxicity
Smoke Index

Requirement for fire behavior of matreial & components
R15/R16

FRL-MW-1SU 0.6/1 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.0	1.25	0.6	2.4	2.8	10	20	11.4	0.114
1.5	1.5	0.7	2.8	3.3	20	13.7	11.0	0.110
2.5	1.95	0.7	3.2	3.8	30	8.21	9.1	0.091
4	2.5	0.7	3.8	4.4	50	5.09	7.5	0.075
6	3.0	0.7	4.2	5.0	60	3.39	6.5	0.065
10	3.9	0.7	5.1	5.9	110	1.95	5.2	0.052
16	5.0	0.7	6.1	7.2	160	1.24	4.2	0.042
25	6.4	0.9	7.8	9.1	240	0.795	4.1	0.041
35	7.7	0.9	9.0	10.6	330	0.565	3.5	0.035
50	9.2	1.0	10.6	12.4	460	0.393	3.3	0.033
70	11.0	1.1	12.5	14.6	660	0.277	3.0	0.030
95	12.5	1.1	13.9	16.3	860	0.210	2.7	0.027
120	14.2	1.2	15.7	18.4	1080	0.164	2.7	0.027
150	15.8	1.4	17.6	20.6	1370	0.132	2.7	0.027
185	17.5	1.6	19.6	22.9	1690	0.108	2.6	0.026
240	20.1	1.7	22.2	26.0	2230	0.0817	2.6	0.026
300	22.5	1.8	24.6	28.8	2780	0.0654	2.4	0.024
400	25.8	2.0	28.1	32.9	3740	0.0495	2.4	0.024

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-MW-3SU 1.8/3 kV

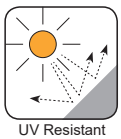
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	2.0	5.3	6.2	50	13.7	21.0	0.210
2.5	1.95	2.0	5.7	6.7	60	8.21	18.0	0.180
4	2.5	2.0	6.2	7.3	80	5.09	15.5	0.155
6	3.0	2.0	6.7	7.8	100	3.39	13.7	0.137
10	3.9	2.0	7.5	8.8	150	1.95	11.5	0.115
16	5.0	2.0	8.6	10.0	220	1.24	9.5	0.095
25	6.4	2.0	9.9	11.6	290	0.795	7.9	0.079
35	7.7	2.0	11.1	13.0	390	0.565	6.8	0.068
50	9.2	2.0	12.5	14.6	530	0.393	5.9	0.059
70	11.0	2.0	14.2	16.6	720	0.277	5.0	0.050
95	12.5	2.2	16.0	18.7	940	0.210	4.5	0.045
120	14.2	2.2	17.6	20.6	1160	0.164	4.0	0.040
150	15.8	2.2	19.1	22.3	1440	0.132	3.7	0.037
185	17.5	2.4	20.9	24.4	1760	0.108	3.4	0.034
240	20.1	2.4	23.7	27.5	2350	0.0817	3.0	0.030
300	22.5	2.4	25.6	30.1	2820	0.0654	2.7	0.027
400	25.8	2.6	29.2	34.2	3730	0.0495	2.4	0.024

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Impact Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant

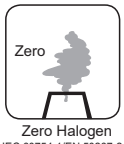

Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305: NF X70-100/NF F63 808/TM1-04/BS 6853

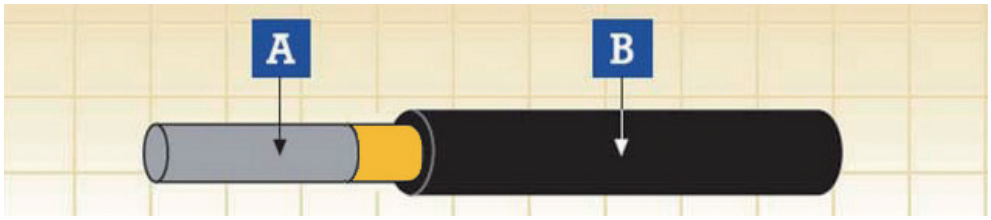

Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902



Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Medium Wall Single Core Unsheathed & Fire Resistant 0.6/1 kV or 1.8/3 kV EN 50264-3-1 (FRL-MW-1SU-PH15/30/60, FRL-MW-3SU-PH15/30/60)



A. Conductor B. Insulation

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

Mica tape+LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 109)

Electrical & Mechanical Properties

Nominal Voltage	0.6/1 kV or 1.8/3 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 10 x Overall Diameter (D<12mm); 12 x Overall Diameter (D>12mm) Flexible installation: 20 x Overall Diameter (D<12mm); 25 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3
EN 50200: 2006	PH15,30,60

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity

NF F 63 808; BS6853; NF F 16 101
IEC60331-21

Smoke Index
The circuit integrity test under fire of cables rated 0.6/1.0kV and below

EN45545-2

Requirement for fire behavior of materials & components R15/R16

EN50200: 2006

Resistance to fire of unprotected small cable for use in emergency circuits 5 classficitions are defines: PH15, 30, 60, 90 or 120 mins.

FRL-MW-1SU-PH15/30/60 0.6/1 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.0	1.25	0.6	2.6	3.1	15	20	11.4	0.114
1.5	1.5	0.7	3.0	3.6	24	13.7	11.0	0.110
2.5	1.95	0.7	3.4	4.1	36	8.21	9.1	0.091
4	2.5	0.7	4.0	4.7	54	5.09	7.5	0.075
6	3.0	0.7	4.4	5.3	76	3.39	6.5	0.065
10	3.9	0.7	5.3	6.2	121	1.95	5.2	0.052
16	5.0	0.7	6.3	7.5	184	1.24	4.2	0.042
25	6.4	0.9	8.0	9.4	289	0.795	4.1	0.041
35	7.7	0.9	9.2	10.9	395	0.565	3.5	0.035
50	9.2	1.0	10.8	12.7	563	0.393	3.3	0.033
70	11.0	1.1	12.7	14.9	796	0.277	3.0	0.030
95	12.5	1.1	14.1	16.6	1032	0.210	2.7	0.027
120	14.2	1.2	15.9	18.7	1318	0.164	2.7	0.027
150	15.8	1.4	17.8	20.9	1650	0.132	2.7	0.027
185	17.5	1.6	19.8	23.2	2018	0.108	2.6	0.026
240	20.1	1.7	22.4	26.3	2649	0.0817	2.6	0.026
300	22.5	1.8	24.8	29.1	3291	0.0654	2.4	0.024
400	25.8	2.0	28.3	33.2	3850	0.0495	2.4	0.024

(a)= For information, indicative only

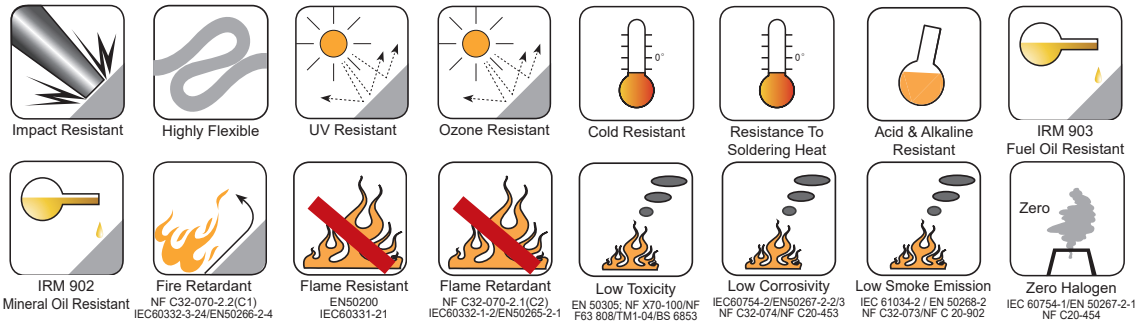
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-MW-3SU-PH15/30/60 1.8/3 kV

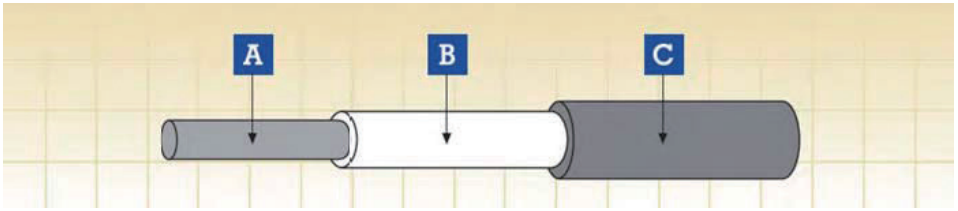
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	2.0	5.5	6.5	56	13.7	21.0	0.210
2.5	1.95	2.0	5.9	7.0	71	8.21	18.0	0.180
4	2.5	2.0	6.4	7.6	90	5.09	15.5	0.155
6	3.0	2.0	69	8.1	114	3.39	13.7	0.137
10	3.9	2.0	7.7	9.1	165	1.95	11.5	0.115
16	5.0	2.0	8.8	10.3	235	1.24	9.5	0.095
25	6.4	2.0	10.1	11.9	320	0.795	7.9	0.079
35	7.7	2.0	11.3	13.3	440	0.565	6.8	0.068
50	9.2	2.0	12.7	14.9	610	0.393	5.9	0.059
70	11.0	2.0	14.4	16.9	850	0.277	5.0	0.050
95	12.5	2.2	16.2	19.0	1110	0.210	4.5	0.045
120	14.2	2.2	17.8	20.9	1400	0.164	4.0	0.040
150	15.8	2.2	19.3	22.6	1710	0.132	3.7	0.037
185	17.5	2.4	21.1	24.7	2110	0.108	3.4	0.034
240	20.1	2.4	23.9	27.8	2750	0.0817	3.0	0.030
300	22.5	2.4	25.8	30.4	3300	0.0654	2.7	0.027
400	25.8	2.6	29.4	34.5	3900	0.0495	2.4	0.024

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Medium Wall Single Core Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50264-3-1 (FRL-MW-3S/FRL-MW-6S)



A. Conductor B. Insulation C. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 109)

Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 5 x Overall Diameter (D<12mm); 6 x Overall Diameter (D>12mm) Flexible installation: 10 x Overall Diameter (D<12mm); 12 x Overall Diameter (D>12mm)
	Chemical & Environmental Properties
EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-MW-3S 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max.Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	0.8	5.7	6.7	60	13.7	21.8	0.218
2.5	1.95	1.3	0.8	6.0	7.0	70	8.21	18.8	0.188
4	2.5	1.3	0.8	6.5	7.6	90	5.09	16.2	0.162
6	3.0	1.3	0.8	7.0	8.1	110	3.39	14.4	0.144
10	3.9	1.5	0.8	8.2	9.6	170	1.95	12.8	0.128
16	5.0	1.5	0.8	9.2	10.8	240	1.24	10.7	0.107
25	6.4	1.8	1.0	11.5	13.4	350	0.795	10.3	0.103
35	7.7	1.8	1.0	12.7	14.9	450	0.565	8.9	0.089
50	9.2	1.8	1.0	14.1	16.5	590	0.393	7.8	0.078
70	11.0	1.8	1.0	15.8	18.5	790	0.277	6.7	0.067
95	12.5	2.2	1.0	18.0	21.0	1050	0.210	6.5	0.065
120	14.2	2.2	1.0	19.6	22.9	1270	0.164	6.1	0.061
150	15.8	2.2	1.2	21.4	25.1	1590	0.132	5.8	0.058
185	17.5	2.4	1.2	23.4	27.4	1900	0.108	5.6	0.056
240	20.1	2.4	1.2	25.9	30.3	2490	0.0817	5.0	0.050
300	22.5	2.4	1.2	28.1	32.9	3010	0.0654	4.5	0.045
400	25.8	2.6	1.4	32.0	37.4	3980	0.0495	4.4	0.044

(a)= For information, indicative only

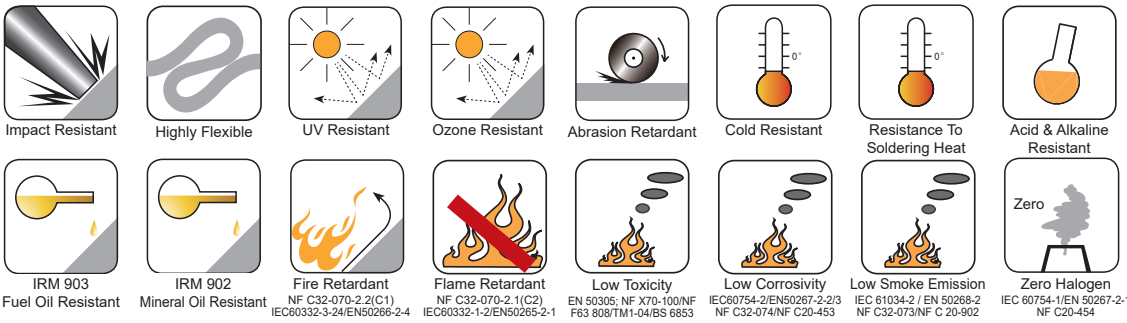
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-MW-6S 3.6/6 kV

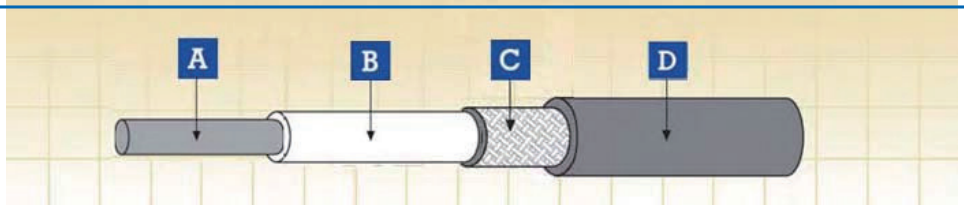
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max.Conductor Resistance	Min. Insulation Resistance	
				Min.	Max.		20°C	20°C	90°C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	2.6	0.8	8.6	10.1	120	8.21	24.6	0.246
4	2.5	2.6	0.8	9.1	10.7	140	5.09	21.6	0.216
6	3.0	2.6	0.8	9.6	11.2	165	3.39	19.5	0.195
10	3.9	2.6	0.8	10.4	12.2	220	1.95	16.7	0.167
16	5.0	2.6	0.8	11.5	13.4	290	1.24	14.2	0.142
25	6.4	2.9	1.0	13.7	16.1	430	0.795	13.1	0.131
35	7.7	2.9	1.0	14.9	17.5	540	0.565	11.6	0.116
50	9.2	2.9	1.0	16.4	19.1	670	0.393	10.2	0.102
70	11.0	2.9	1.0	18.0	21.1	880	0.277	8.9	0.089
95	12.5	2.9	1.0	19.5	22.8	1100	0.210	8.0	0.080
120	14.2	2.9	1.2	21.4	25.1	1380	0.164	7.5	0.075
150	15.8	2.9	1.2	22.9	26.8	1660	0.132	6.9	0.069
185	17.5	3.2	1.2	25.1	29.4	2010	0.108	6.7	0.067
240	20.1	3.4	1.4	28.3	33.1	2670	0.0817	6.4	0.064
300	22.5	3.4	1.4	30.6	35.8	3170	0.0654	5.9	0.059
400	25.8	3.4	1.4	33.7	39.4	4150	0.0495	5.2	0.052

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Medium Wall Single Core Screened & Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50264-3-1 (FRL-MW-3S-OS/FRL-MW-6S-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 109)

Overal Screen

Tinned annealed copper wires

Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EM 104)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 5 x Overall Diameter (D<12mm); 6 x Overall Diameter (D>12mm) Flexible installation: 10 x Overall Diameter (D<12mm); 12 x Overall Diameter (D>12mm)
	Chemical & Environmental Properties
EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)

EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101
EN45545-2

Low Toxicity
Smoke Index
Requirement for fire behavior of materials & components
R15/R16

FRL-MW-3S-OS 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Screen Wire Diameter	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
					Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	0.16	0.8	6.6	7.6	103	13.7	21.8	0.218
2.5	1.95	1.3	0.16	0.8	6.9	8.1	123	8.21	18.8	0.188
4	2.5	1.3	0.21	0.8	7.5	8.8	157	5.09	16.2	0.162
6	3.0	1.3	0.21	0.8	7.9	9.4	189	3.39	14.4	0.144
10	3.9	1.5	0.21	0.8	9.1	10.8	264	1.95	12.8	0.128
16	5.0	1.5	0.26	0.8	10.2	12.0	359	1.24	10.7	0.107
25	6.4	1.8	0.26	1.0	12.1	14.2	510	0.795	10.3	0.103
35	7.7	1.8	0.31	1.0	13.3	15.2	650	0.565	8.9	0.089
50	9.2	1.8	0.31	1.0	14.7	16.8	846	0.393	7.8	0.078
70	11.0	1.8	0.31	1.0	16.6	19.3	1130	0.277	6.7	0.067
95	12.5	2.2	0.31	1.0	18.7	21.1	1436	0.210	6.5	0.065
120	14.2	2.2	0.31	1.0	20.6	23.0	1765	0.164	6.1	0.061
150	15.8	2.2	0.31	1.2	22.0	25.3	2128	0.132	5.8	0.058
185	17.5	2.4	0.31	1.2	24.0	29.0	2541	0.108	5.6	0.056
240	20.1	2.4	0.31	1.2	26.8	30.5	3244	0.0817	5.0	0.050
300	22.5	2.4	0.31	1.2	29.2	33.0	3934	0.0654	4.5	0.045
400	25.8	2.6	0.31	1.4	32.9	38.0	5078	0.0495	4.4	0.044

(a)= For information, indicative only

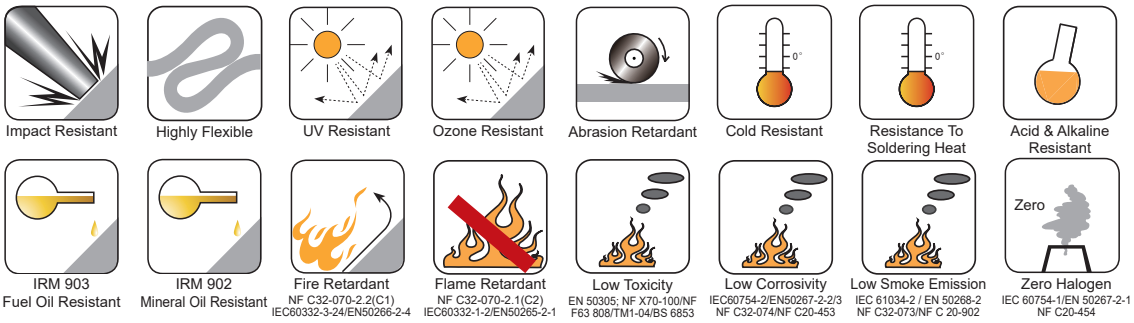
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-MW-6S-OS 3.6/6 kV

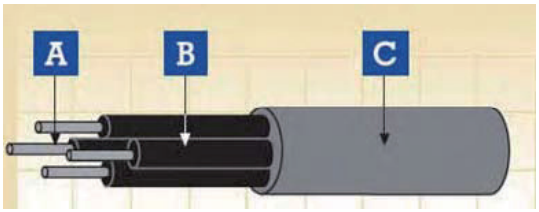
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Screen Wire Diameter	Min. Mean Thickness of Sheath	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
					Min.	Max.		20 °C	20 °C	90 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	2.6	0.16	0.8	9.6	10.7	120	8.21	24.6	0.246
4	2.5	2.6	0.21	0.8	10.1	11.3	140	5.09	21.6	0.216
6	3.0	2.6	0.21	0.8	10.6	12.0	165	3.39	19.5	0.195
10	3.9	2.6	0.21	0.8	11.5	13.0	220	1.95	16.7	0.167
16	5.0	2.6	0.26	0.8	12.6	14.0	290	1.24	14.2	0.142
25	6.4	2.9	0.26	1.0	14.4	16.4	430	0.795	13.1	0.131
35	7.7	2.9	0.31	1.0	15.6	18.1	540	0.565	11.6	0.116
50	9.2	2.9	0.31	1.0	17.2	19.7	670	0.393	10.2	0.102
70	11.0	2.9	0.31	1.0	18.9	21.7	880	0.277	8.9	0.089
95	12.5	2.9	0.31	1.0	20.5	23.4	1100	0.210	8.0	0.080
120	14.2	2.9	0.31	1.2	22.1	25.7	1380	0.164	7.5	0.075
150	15.8	2.9	0.31	1.2	23.8	27.4	1660	0.132	6.9	0.069
185	17.5	3.2	0.31	1.2	26.0	30.0	2010	0.108	6.7	0.067
240	20.1	3.4	0.31	1.4	29.0	33.7	2670	0.0817	6.4	0.064
300	22.5	3.4	0.31	1.4	31.4	36.4	3170	0.0654	5.9	0.059
400	25.8	3.4	0.31	1.4	34.8	40.0	4150	0.0495	5.2	0.052

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Medium Wall Multicore Unscreened Cables 300/500 V or 0.6/1 kV EN 50264-3-2 (FRL-MW-05M/FRL-MW-1M)



A. Conductor B. Insulation C. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EI 104)

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EI 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 4 x Overall Diameter (D<12mm); 5 x Overall Diameter (D>12mm) Flexible installation: 8 x Overall Diameter (D<12mm); 10 x Overall Diameter (D>12mm)
	Chemical & Environmental Properties
EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-MW-05M 300/500 V

Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min. Acc.to EN	Max. Acc.to EN		Min.	Max.			EI 110	EI 106/7/8/9
									20 °C	20 °C	20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2 x 1	1.25	0.4	2.0	2.4	0.6	5.3	6.2	40	20.0	15.0	7.5
4 x 1	1.25	0.4	2.0	2.4	0.6	6.1	7.2	70	20.0	15.0	7.5
7 x 1	1.25	0.4	2.0	2.4	0.7	7.5	8.7	120	20.0	15.0	7.5
9 x 1	1.25	0.4	2.0	2.4	0.7	9.1	10.6	160	20.0	15.0	7.5
12 x 1	1.25	0.4	2.0	2.4	0.7	9.8	11.5	190	20.0	15.0	7.5
19 x 1	1.25	0.4	2.0	2.4	0.8	11.7	13.7	290	20.0	15.0	7.5
24 x 1	1.25	0.4	2.0	2.4	1.0	14.1	16.5	390	20.0	15.0	7.5
32 x 1	1.25	0.4	2.0	2.4	1.0	15.5	18.2	490	20.0	15.0	7.5
37 x 1	1.25	0.4	2.0	2.4	1.0	16.1	18.9	550	20.0	15.0	7.5
40 x 1	1.25	0.4	2.0	2.4	1.0	16.7	19.6	600	20.0	15.0	7.5
4 x 1.5	1.5	0.5	2.4	2.9	0.7	7.3	8.6	110	13.7	14.0	7.0
7 x 1.5	1.5	0.5	2.4	2.9	0.7	8.7	10.2	170	13.7	14.0	7.0
9 x 1.5	1.5	0.5	2.4	2.9	0.8	10.9	12.7	230	13.7	14.0	7.0
12 x 1.5	1.5	0.5	2.4	2.9	0.8	11.8	13.8	280	13.7	14.0	7.0
19 x 1.5	1.5	0.5	2.4	2.9	1.0	14.2	16.6	440	13.7	14.0	7.0
24 x 1.5	1.5	0.5	2.4	2.9	1.0	16.6	19.5	560	13.7	14.0	7.0
32 x 1.5	1.5	0.5	2.4	2.9	1.2	18.7	21.9	720	13.7	14.0	7.0
37 x 1.5	1.5	0.5	2.4	2.9	1.2	19.5	22.8	820	13.7	14.0	7.0
4 x 2.5	1.95	0.5	2.9	3.4	0.7	8.3	9.8	150	8.21	13.0	6.5
7 x 2.5	1.95	0.5	2.9	3.4	0.8	10.2	11.9	240	8.21	13.0	6.5
9 x 2.5	1.95	0.5	2.9	3.4	1.0	12.9	15.1	350	8.21	13.0	6.5
12 x 2.5	1.95	0.5	2.9	3.4	1.0	13.9	16.3	420	8.21	13.0	6.5
19 x 2.5	1.95	0.5	2.9	3.4	1.0	16.3	19.1	640	8.21	13.0	6.5
24 x 2.5	1.95	0.5	2.9	3.4	1.2	19.6	22.9	840	8.21	13.0	6.5

(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

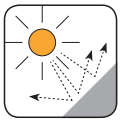
FRL-MW-1M 0.6/1 kV

Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min. Acc.to EN	Max. Acc.to EN		Min.	Max.			EI 110	EI 106/7/8/9
									20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES											
1.5	1.5	0.7	2.8	3.3	0.70	7.2	9.0	70	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.70	8.0	10.0	100	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.70	9.1	11.3	130	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	0.80	10.1	12.4	170	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	1.00	12.5	15.4	290	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	1.00	14.9	18.4	390	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	1.20	18.7	23.0	590	0.795	7.3	3.6
35	7.7	0.9	9.0	10.6	1.20	21.2	25.9	790	0.565	6.7	3.3
50	9.2	1.0	10.6	12.4	1.40	25.1	30.7	1140	0.393	6.3	3.1
THREE CORES											
1.5	1.5	0.7	2.8	3.3	0.70	7.7	9.5	100	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.70	8.5	10.5	130	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.70	9.7	12.0	180	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	0.80	10.7	13.2	250	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	1.00	13.3	16.5	410	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	1.00	16.0	19.6	570	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	1.20	20.0	24.7	850	0.795	7.3	3.6
35	7.7	0.9	9.0	10.6	1.40	23.0	28.2	1160	0.565	6.7	3.3
50	9.2	1.0	10.6	12.4	1.60	26.3	32.2	1680	0.393	6.3	3.1
FOUR CORES											
1.5	1.5	0.7	2.8	3.3	0.70	8.5	10.5	120	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.70	9.4	11.6	170	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.80	10.9	13.4	240	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	1.00	12.2	14.9	330	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	1.00	14.7	18.2	540	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	1.20	18.0	22.1	750	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	1.40	22.6	27.6	1140	0.795	7.3	3.6
3 x 35+25	7.7/6.4	0.9/0.9	9.0/7.8	10.6/9.1	1.40	25.7	31.2	1490	0.565/0.795	6.7	3.3
3 x 50+25	9.2/6.4	1.0/0.9	10.6/7.8	12.4/9.1	1.60	30.0	36.5	2110	0.393/1.795	6.3	3.1

(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only


Corona Resistant


Highly Flexible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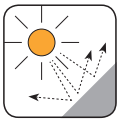
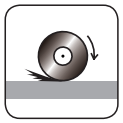
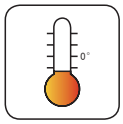
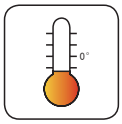

Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

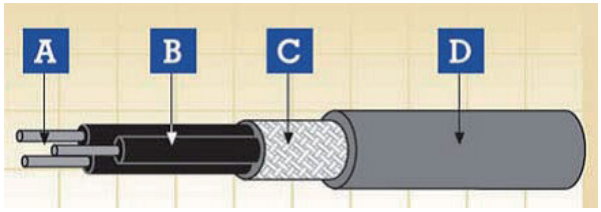

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Medium Wall Multicore Overall Screened Cables 300/500 V or 0.6/1 kV EN 50264-3-2 (FRL-MW-05M-OS/FRL-MW-1M-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 110)

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EI 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C /-40 °C (fixed installation)
Bending Radius	Fixed installation: 4 x Overall Diameter (D<12mm); 5 x Overall Diameter (D>12mm) Flexible installation: 8 x Overall Diameter (D<12mm); 10 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;	Low Corrosivity (Acidity & Conductivity)

NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101
EN45545-2

Low Toxicity
Smoke Index
Requirement for fire behavior of materials & components
R15/R16

FRL-MW-05M-OS 300/500 V

Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.		EI 110	EI 106/7/8/9	
										20 °C	20 °C	20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2x1	1.25	0.4	2.0	2.4	0.16	0.6	6.0	7.1	70	20.0	15.0	7.5
4x1	1.25	0.4	2.0	2.4	0.16	0.7	7.0	8.2	110	20.0	15.0	7.5
7x1	1.25	0.4	2.0	2.4	0.16	0.7	8.2	9.6	150	20.0	15.0	7.5
9x1	1.25	0.4	2.0	2.4	0.21	0.8	10.2	11.9	220	20.0	15.0	7.5
12x1	1.25	0.4	2.0	2.4	0.21	0.8	10.9	12.7	260	20.0	15.0	7.5
19x1	1.25	0.4	2.0	2.4	0.26	1.0	13.2	15.4	400	20.0	15.0	7.5
24x1	1.25	0.4	2.0	2.4	0.26	1.0	15.2	17.8	500	20.0	15.0	7.5
32x1	1.25	0.4	2.0	2.4	0.26	1.0	16.6	19.4	610	20.0	15.0	7.5
37x1	1.25	0.4	2.0	2.4	0.26	1.0	17.2	20.1	670	20.0	15.0	7.5
40x1	1.25	0.4	2.0	2.4	0.26	1.2	18.2	21.3	740	20.0	15.0	7.5
4x1.5	1.5	0.5	2.4	2.9	0.16	0.7	8.0	9.4	140	13.7	14.0	7.0
7x1.5	1.5	0.5	2.4	2.9	0.21	0.7	9.6	11.3	220	13.7	14.0	7.0
9x1.5	1.5	0.5	2.4	2.9	0.21	1.0	12.1	14.2	290	13.7	14.0	7.0
12x1.5	1.5	0.5	2.4	2.9	0.21	1.0	13.0	15.2	360	13.7	14.0	7.0
19x1.5	1.5	0.5	2.4	2.9	0.26	1.0	15.3	17.9	540	13.7	14.0	7.0
24x1.5	1.5	0.5	2.4	2.9	0.26	1.2	18.1	21.2	700	13.7	14.0	7.0
32x1.5	1.5	0.5	2.4	2.9	0.26	1.2	19.8	23.2	860	13.7	14.0	7.0
37x1.5	1.5	0.5	2.4	2.9	0.26	1.2	20.5	24.0	960	13.7	14.0	7.0
4x2.5	1.95	0.5	2.9	3.4	0.21	0.7	9.2	10.8	200	8.21	13.0	6.5
7x2.5	1.95	0.5	2.9	3.4	0.21	0.8	11.1	13.0	310	8.21	13.0	6.5
9x2.5	1.95	0.5	2.9	3.4	0.26	1.0	13.9	16.3	440	8.21	13.0	6.5
12x2.5	1.95	0.5	2.9	3.4	0.26	1.0	15.0	17.5	520	8.21	13.0	6.5
19x2.5	1.95	0.5	2.9	3.4	0.26	1.2	17.8	20.8	770	8.21	13.0	6.5
24x2.5	1.95	0.5	2.9	3.4	0.26	1.2	20.6	24.1	970	8.21	13.0	6.5

(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

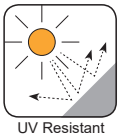
FRL-MW-1M-OS 0.6/1 kV

Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 110	EI 106/7/8/9
										20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES												
1.5	1.5	0.7	2.8	3.3	0.16	0.70	7.9	9.9	90	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.16	0.70	8.7	10.7	120	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.21	0.80	10.2	12.7	170	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	0.21	0.80	10.9	13.6	210	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	0.21	1.00	13.4	16.6	320	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	0.26	1.00	16.0	19.8	470	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	0.26	1.20	19.8	24.6	690	0.795	7.3	3.6
35	7.7	0.9	9.0	10.6	0.31	1.40	22.8	27.9	940	0.565	6.7	3.3
50	9.2	1.0	10.6	12.4	0.31	1.40	26.4	32.3	1260	0.393	6.3	3.1
THREE CORES												
1.5	1.5	0.7	2.8	3.3	0.16	0.70	8.4	10.4	120	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.16	0.70	9.2	11.4	160	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.21	0.80	10.8	13.3	230	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	0.21	0.80	11.6	14.3	300	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	0.26	1.00	14.4	18.0	500	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	0.26	1.20	17.4	21.3	680	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	0.26	1.20	21.3	26.1	970	0.795	7.3	3.6
35	7.7	0.9	9.0	10.6	0.31	1.40	24.5	29.8	1330	0.565	6.7	3.3
50	9.2	1.0	10.6	12.4	0.31	1.60	28.3	34.6	1820	0.393	6.3	3.1
FOUR CORES												
1.5	1.5	0.7	2.8	3.3	0.16	0.70	9.1	11.3	150	13.7	21.0	10.5
2.5	1.95	0.7	3.2	3.8	0.21	0.80	10.4	12.9	220	8.21	17.2	8.6
4	2.5	0.7	3.8	4.4	0.21	0.80	11.8	14.5	290	5.09	14.2	7.1
6	3.0	0.7	4.2	5.0	0.21	1.00	13.1	16.1	400	3.39	12.2	6.1
10	3.9	0.7	5.1	5.9	0.26	1.00	15.9	19.5	640	1.95	9.8	4.9
16	5.0	0.7	6.1	7.2	0.26	1.20	19.3	23.6	860	1.24	7.9	3.9
25	6.4	0.9	7.8	9.1	0.31	1.40	24.0	29.3	1290	0.795	7.3	3.6
3x35+25	7.7/6.4	0.9/0.9	9.0/7.8	10.6/9.1	0.31	1.4	26.9	32.9	1910	0.565/0.795	6.7	3.3
3x50+25	9.2/6.4	1.0/0.9	10.6/7.8	12.4/9.1	0.31	1.6	31.5	38.2	2560	0.393/0.795	6.3	3.1

(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only

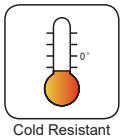

Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

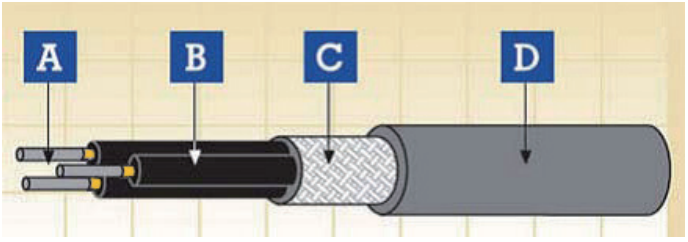

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Medium Wall Multicore Overall Screened & Fire Resistant Cables 300/500 V or 0.6/1 kV EN 50264-3-2(FRL-MW-05M-OS-AS+-PH15/30/60, FRL-MW-1M-OS-AS+-PH15/30/60)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor.
-Used in control, auxillary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.c.

Construction

Conductor

Flexible tinned annealed copper wires, stranded as per HD 383 (IEC 60228) class 5

Insulation

Mica tape+LSZH elastomeric compound as defined in EN 50264-1 (EI 106 to EI 110)

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH elastomeric compound as defined in EN 50264-1 (EM 101 to EI 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V or 0.6/1 kV
Max. Conductor Temperature	90 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C /-40 °C (fixed installation)
Bending Radius	Fixed installation: 10 x Overall Diameter (D<12mm); 12 x Overall Diameter (D>12mm) Flexible installation: 20 x Overall Diameter (D<12mm); 25 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3
EN50200	PH15, PH30, PH60

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
IEC60331-21	The circuit integrity test under fire of cables rated 0.6/1.0kV and below
EN45545-2	Requirement for fire behavior of materials & components R15/R16
EN 50200: 2006	Resistance to fire of unprotected small cable for use in emergency circuits 5 classifications are defined: PH 15,30,60, 90 or 120mins

FRL-MW-05M-OS-AS+ -PH15/30/60 300/500 V

Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 110	EI 106/7/8/9
										20 °C	20 °C	20 °C
n x mm²	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
2 x 1	1.25	0.4	2.24	2.64	0.16	0.6	6.24	7.34	81	20.0	15.0	7.5
4 x 1	1.25	0.4	2.24	2.64	0.16	0.7	7.24	8.44	132	20.0	15.0	7.5
7 x 1	1.25	0.4	2.24	2.64	0.16	0.7	8.44	9.84	203	20.0	15.0	7.5
9 x 1	1.25	0.4	2.24	2.64	0.21	0.8	10.44	12.14	275	20.0	15.0	7.5
12 x 1	1.25	0.4	2.24	2.64	0.21	0.8	11.14	12.94	346	20.0	15.0	7.5
19 x 1	1.25	0.4	2.24	2.64	0.26	1.0	13.44	15.64	538	20.0	15.0	7.5
24 x 1	1.25	0.4	2.24	2.64	0.26	1.0	15.44	18.04	667	20.0	15.0	7.5
32 x 1	1.25	0.4	2.24	2.64	0.26	1.0	16.84	19.64	846	20.0	15.0	7.5
37 x 1	1.25	0.4	2.24	2.64	0.26	1.0	17.44	20.34	953	20.0	15.0	7.5
40 x 1	1.25	0.4	2.24	2.64	0.26	1.2	18.44	21.54	1044	20.0	15.0	7.5
4 x 1.5	1.5	0.5	2.64	3.14	0.16	0.7	8.24	9.64	180	13.7	14.0	7.0
7 x 1.5	1.5	0.5	2.64	3.14	0.21	0.7	9.84	11.54	295	13.7	14.0	7.0
9 x 1.5	1.5	0.5	2.64	3.14	0.21	1.0	12.34	14.44	395	13.7	14.0	7.0
12 x 1.5	1.5	0.5	2.64	3.14	0.21	1.0	13.24	15.44	497	13.7	14.0	7.0
19 x 1.5	1.5	0.5	2.64	3.14	0.26	1.0	15.54	18.14	750	13.7	14.0	7.0
24 x 1.5	1.5	0.5	2.64	3.14	0.26	1.2	18.34	21.44	955	13.7	14.0	7.0
32 x 1.5	1.5	0.5	2.64	3.14	0.26	1.2	20.04	23.44	1215	13.7	14.0	7.0
37 x 1.5	1.5	0.5	2.64	3.14	0.26	1.2	20.74	24.24	1372	13.7	14.0	7.0
4 x 2.5	1.95	0.5	3.14	3.64	0.21	0.7	9.44	11.04	249	8.21	13.0	6.5
7 x 2.5	1.95	0.5	3.14	3.64	0.21	0.8	11.34	13.24	398	8.21	13.0	6.5
9 x 2.5	1.95	0.5	3.14	3.64	0.26	1.0	14.14	16.54	539	8.21	13.0	6.5
12 x 2.5	1.95	0.5	3.14	3.64	0.26	1.0	15.24	17.74	681	8.21	13.0	6.5
19 x 2.5	1.95	0.5	3.14	3.64	0.26	1.2	18.04	21.04	1027	8.21	13.0	6.5
24 x 2.5	1.95	0.5	3.14	3.64	0.26	1.2	20.84	24.34	1278	8.21	13.0	6.5

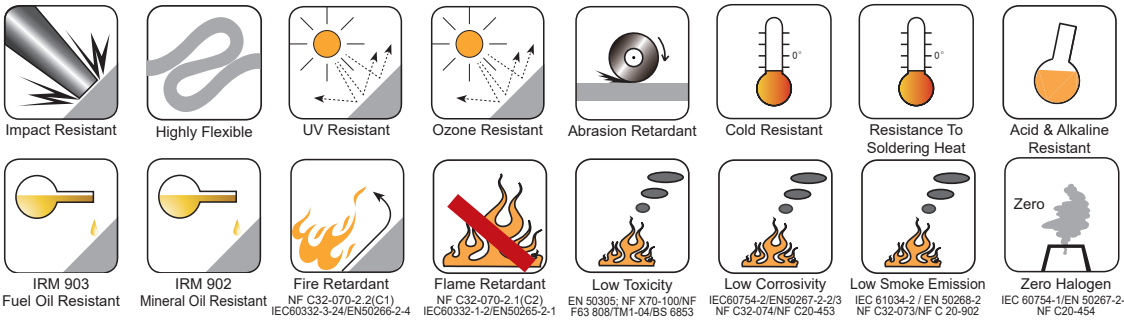
(a)= One earth conductor (green/yellow) can be included upon request
(b)= For information, indicative only
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-MW-1M-OS-AS+ -PH15/30/600.6/1 kV

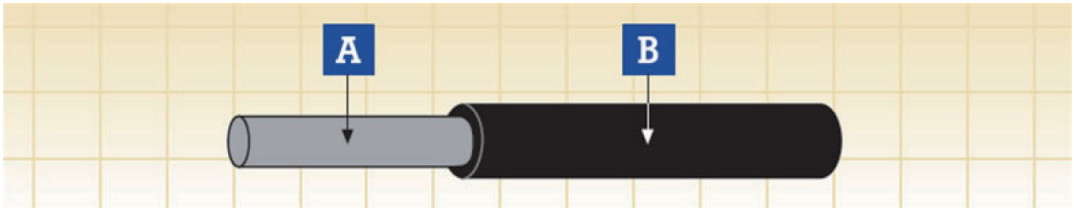
Nominal Cross-Sectional Area (a)	Conductor Diameter (b)	Min. Mean Thickness of Insulation	Core Dimensions		Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max. Conductor Resistance	Min. Insulation Resistance	
			Min.	Max.			Min.	Max.			EI 110	EI 106/7/8/9
										20 °C	20 °C	20 °C
mm^2	mm	mm	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	MΩ x km	MΩ x km
TWO CORES												
1.5	1.5	0.7	3.04	3.54	0.16	0.70	8.14	10.14	121	13.7	21.0	10.5
2.5	1.95	0.7	3.44	4.04	0.16	0.70	8.94	10.94	157	8.21	17.2	8.6
4	2.5	0.7	4.04	4.64	0.21	0.80	10.44	12.94	224	5.09	14.2	7.1
6	3.0	0.7	4.44	5.24	0.21	0.80	11.14	13.84	287	3.39	12.2	6.1
10	3.9	0.7	5.34	6.14	0.21	1.00	13.64	16.84	424	1.95	9.8	4.9
16	5.0	0.7	6.34	7.44	0.26	1.00	16.24	20.04	606	1.24	7.9	3.9
25	6.4	0.9	8.04	9.34	0.26	1.20	20.04	24.84	909	0.795	7.3	3.6
35	7.7	0.9	9.24	10.84	0.31	1.40	23.04	28.14	1213	0.565	6.7	3.3
50	9.2	1.0	10.84	12.64	0.31	1.40	26.64	32.54	1631	0.393	6.3	3.1
THREE CORES												
1.5	1.5	0.7	3.04	3.54	0.16	0.70	8.64	10.64	156	13.7	21.0	10.5
2.5	1.95	0.7	3.44	4.04	0.16	0.70	9.44	11.64	207	8.21	17.2	8.6
4	2.5	0.7	4.04	4.64	0.21	0.80	11.04	13.54	295	5.09	14.2	7.1
6	3.0	0.7	4.44	5.24	0.21	0.80	11.84	14.54	384	3.39	12.2	6.1
10	3.9	0.7	5.34	6.14	0.26	1.00	14.64	18.24	593	1.95	9.8	4.9
16	5.0	0.7	6.34	7.44	0.26	1.20	17.64	21.54	848	1.24	7.9	3.9
25	6.4	0.9	8.04	9.34	0.26	1.20	21.54	26.34	1251	0.795	7.3	3.6
35	7.7	0.9	9.24	10.84	0.31	1.40	24.74	30.04	1674	0.565	6.7	3.3
50	9.2	1.0	10.84	12.64	0.31	1.60	28.54	34.84	2309	0.393	6.3	3.1
FOUR CORES												
1.5	1.5	0.7	3.04	3.54	0.16	0.70	9.34	11.54	194	13.7	21.0	10.5
2.5	1.95	0.7	3.44	4.04	0.21	0.80	10.64	13.14	280	8.21	17.2	8.6
4	2.5	0.7	4.04	4.64	0.21	0.80	12.04	14.74	371	5.09	14.2	7.1
6	3.0	0.7	4.44	5.24	0.21	1.00	13.34	16.34	503	3.39	12.2	6.1
10	3.9	0.7	5.34	6.14	0.26	1.00	16.14	19.74	752	1.95	9.8	4.9
16	5.0	0.7	6.34	7.44	0.26	1.20	19.54	23.84	1082	1.24	7.9	3.9
25	6.4	0.9	8.04	9.34	0.31	1.40	24.24	29.54	1666	0.795	7.3	3.6
3x35+25	7.7/6.4	0.9/0.9	9.24/8.04	10.84/9.34	0.31	1.40	27.14	33.14	2152	0.565/0.795	6.7	3.3
3x50+25	9.2/6.4	1.0/0.9	10.84/8.04	12.64/9.34	0.31	1.60	31.74	38.44	2946	0.393/0.795	6.3	3.1

(a)= One earth conductor (green/yellow) can be included upon request

(b)= For information, indicative only Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Single Core Unsheathed Cables 300/500 V EN 50306-2 (FRL-TW-05SU)



A. Conductor B. Insulation

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C /105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (fixed installation)); 5 x Overall Diameter (flexible installation)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

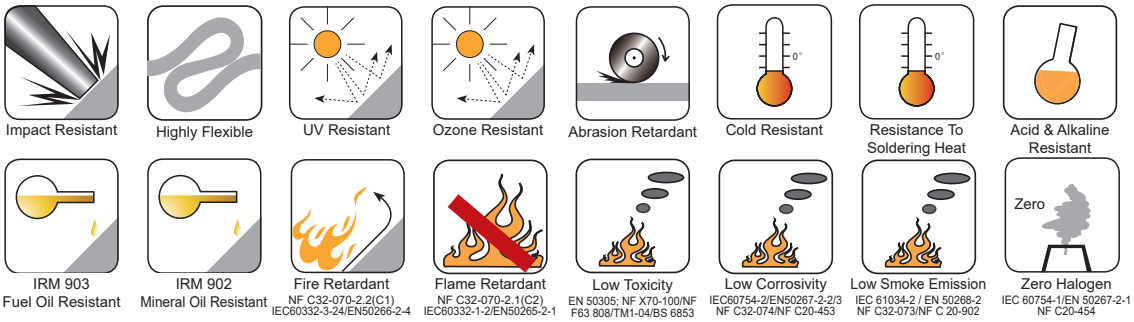
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-TW-05SU 300/500 V

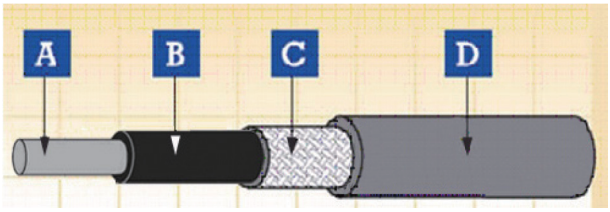
Nominal Cross-Sectional Area	Number X Nominal Diameter of Wire	Diameter		Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance
mm²	n x mm	Min.	Max.		Min.	Max.		20 °C
		mm	mm	mm	mm	mm	kg/km	mm
0.5	19 x 0.18	0.80	0.95	0.18	1.15	1.45	7	40.1
0.75	37 x 0.16(a)	1.00	1.15	0.18	1.35	1.65	8	26.7
1.0	37 x 0.18(a)	1.10	1.30	0.18	1.45	1.80	10	20.0
1.5	37 x 0.23(a)	1.45	1.65	0.22	1.95	2.30	20	13.7
2.5	37 x 0.30(a)	1.85	2.15	0.28	2.50	2.85	25	8.21

(a) =This cable may be supplied in 19 strand conductor providing all product performance requirements in the specification are met

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Single Core Screened & Sheathed Cables 300/500 V EN 50306-3 (FRL-TW-05S-OS)



A Conductor B. Insulation C. Screen D. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH special compound (S1 & S2)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C /105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C /-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

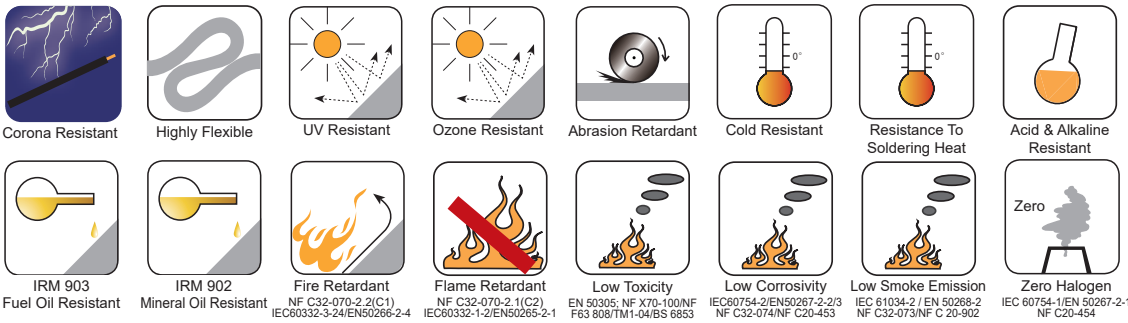
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

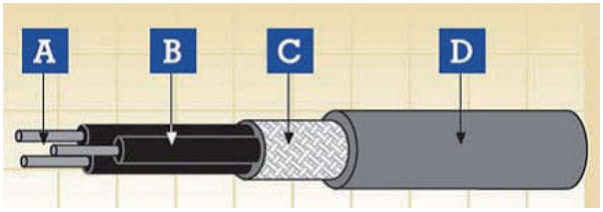
FRL-TW-05S-OS 300/500 V

Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm^2	mm	mm	mm	kg/km
1 x 0.5	0.20	2.3	2.8	10
1 x 0.75	0.20	2.5	3.0	20
1 x 1	0.20	2.7	3.2	25
1 x 1.5	0.20	3.1	3.6	30
1 x 2.5	0.20	3.6	4.4	40

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Overall Screened Cables 300/500 V EN 50306-3 (FRL-TW-05M-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH special compound (S1 & S2)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm) Flexible installation: 5 x Overall Diameter (D<12mm); 6 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

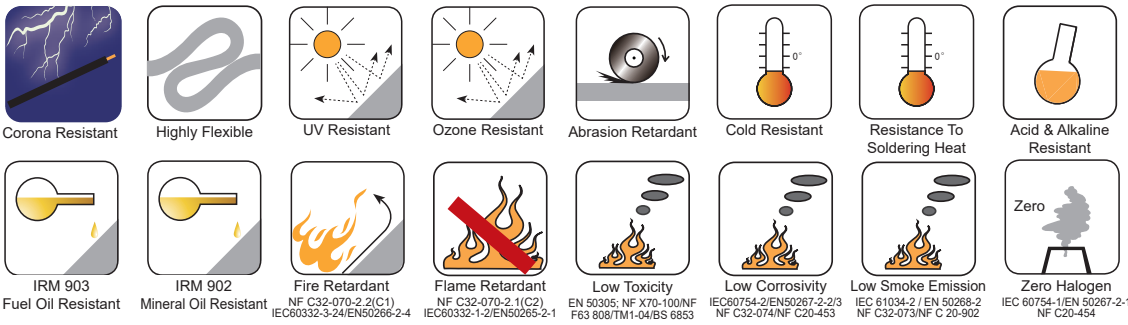
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

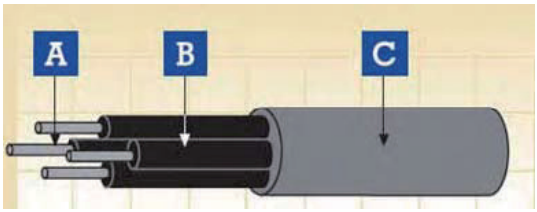
FRL-TW-05M-OS 300/500 V

Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm^2	mm	mm	mm	kg/km
2 x 0.5	0.20	3.5	4.3	28
3 x 0.5	0.20	3.7	4.5	35
4 x 0.5	0.20	4.0	5.0	40
2 x 0.75	0.20	3.9	4.7	35
3 x 0.75	0.20	4.0	5.0	40
4 x 0.75	0.20	4.5	5.5	60
2 x 1	0.20	4.2	5.2	40
3 x 1	0.20	4.5	5.5	55
4 x 1	0.20	5.0	6.0	70
2 x 1.5	0.20	5.1	6.1	60
3 x 1.5	0.20	5.4	6.4	80
4 x 1.5	0.20	6.0	7.0	100
2 x 2.5	0.20	6.4	7.4	90
3 x 2.5	0.20	6.8	7.8	120
4 x 2.5	0.20	7.5	8.5	140

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Cables with Standard Wall Sheath 300/500 V EN 50306-4 (FRL-TW-05M-SW)



A. Conductor B. Insulation C. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Sheath

LSZH special compound (S2. EM101- EM104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	Fixed installation: 3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm) Flexible installation: 5 x Overall Diameter (D<12mm); 6 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;	Low Corrosivity (Acidity & Conductivity)

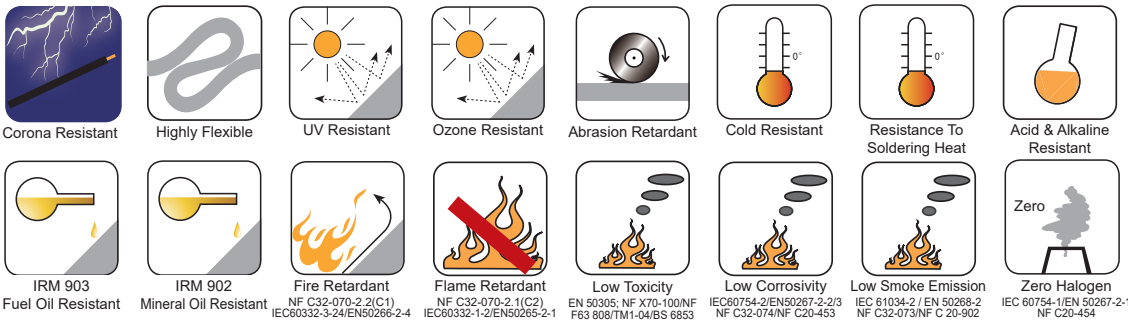
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101
EN45545-2

Low Toxicity
Smoke Index
Requirement for fire behavior of materials & components
R15/R16

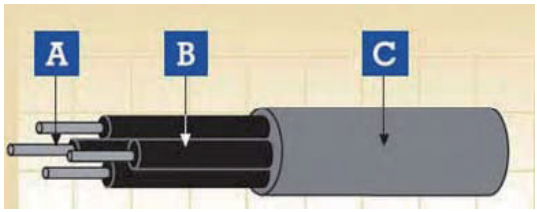
FRL-TW-05M-SW 300/500 V

Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm²	mm	mm	mm	kg/km
4 0.5	0.42	4.1	5.1	30
7 x 0.5	0.42	4.9	5.9	50
13 x 0.5	0.56	7.3	8.3	100
19 x 0.5	0.56	8.1	9.1	140
37 x 0.5	0.56	10.8	12.0	250
4 x 0.75	0.42	4.6	5.6	40
7 x 0.75	0.42	5.5	6.5	70
13 x 0.75	0.56	8.2	9.2	130
19 x 0.75	0.56	9.0	10.2	180
37 x 0.75	0.56	12.2	13.4	340
48 x 0.75	0.56	13.9	15.5	440
4 x 1.0	0.42	4.9	5.9	50
7 x 1.0	0.42	6.0	7.0	90
13 x 1.0	0.56	8.7	9.9	160
19 x 1.0	0.56	9.8	11.0	230
37 x 1.0	0.56	13.3	14.5	430
4 x 1.5	0.42	6.0	7.0	80
7 x 1.5	0.56	7.7	9.8	140
13 x 1.5	0.56	10.7	11.9	250
19 x 1.5	0.56	12.0	13.2	350
37 x 1.5	0.56	16.2	17.8	650
2 x 2.5	0.56	6.7	7.7	70
3 x 2.5	0.56	7.7	8.1	110
4 x 2.5	0.56	7.9	8.9	140

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Cables with Exposed Standard Wall Sheath 300/500 V
EN 50306-4 (FRL-TW-05M-ESW)



A. Conductor B. Insulation C. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Outer Sheath

LSZH special compound (S2. EM101-EM104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

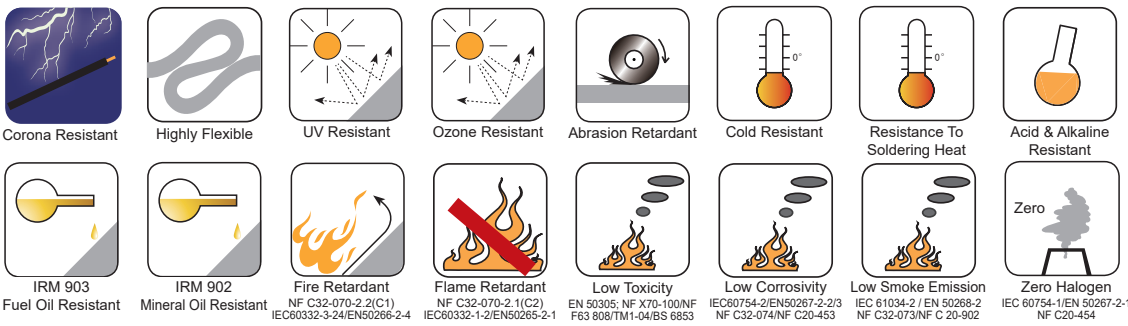
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

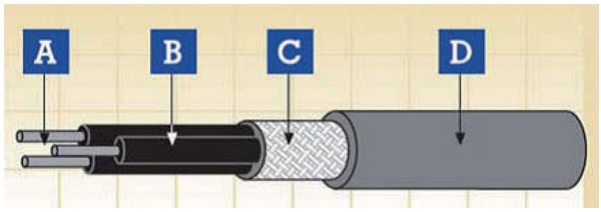
FRL-TW-05M-ESW 300/500 V

Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm^2	mm	mm	mm	kg/km
4 x 0.5	1.0	5.5	6.5	50
7 x 0.5	1.0	6.3	7.3	70
13 x 0.5	1.0	8.3	9.3	120
19 x 0.5	1.0	9.0	10.2	150
37 x 0.5	1.0	12.3	13.5	290
4 x 0.75	1.0	6.0	7.0	60
7 x 0.75	1.0	6.9	7.9	90
13 x 0.75	1.0	9.1	10.3	150
19 x 0.75	1.0	10.0	11.2	200
37 x 0.75	1.0	13.2	14.4	360
48 x 0.75	1.0	14.8	16.4	460
4 x 1.0	1.0	6.3	7.3	70
7 x 1.0	1.0	7.3	8.3	110
13 x 1.0	1.0	9.7	10.9	180
19 x 1.0	1.0	10.7	11.9	250
37 x 1.0	1.0	14.0	15.6	450
4 x 1.5	1.0	7.4	8.4	100
7 x 1.5	1.0	8.6	9.8	150
13 x 1.5	1.0	11.7	12.9	270
19 x 1.5	1.0	13.0	14.2	370
37 x 1.5	1.0	17.2	18.8	690
2 x 2.5	1.0	7.7	8.7	90
3 x 2.5	1.0	8.1	9.1	120
4 x 2.5	1.0	8.8	10.0	150

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Overall Screened Cables with Standard Wall Sheath 300/500 V
EN 50306-4 (FRL-TW-05M-SW-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor
Tinned annealed copper wires as defined in EN 50306-2
Insulation
LSZH special compound
Overal Screen
Tinned annealed copper wires
Outer Sheath
LSZH special compound as defined in EN 50264-1 (S2. EM 101 - EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

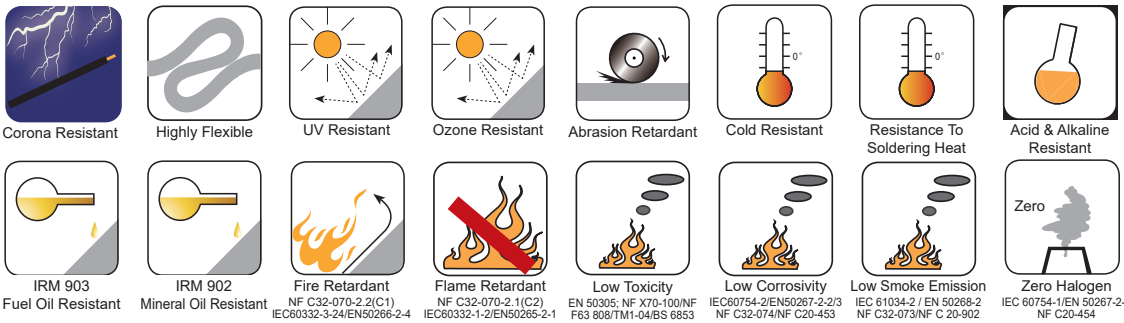
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

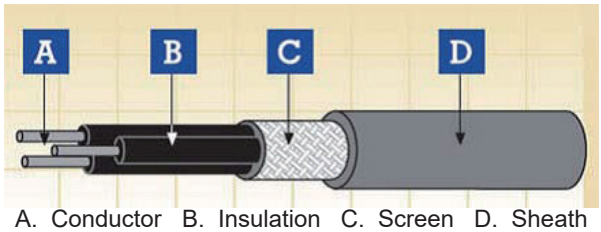
FRL-TW-05M-SW-OS 300/500 V

Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm^2	mm	mm	mm	kg/km
2 x 0.5	0.42	4.1	5.1	30
3 x 0.5	0.42	4.3	5.3	40
4 x 0.5	0.42	4.7	5.7	50
6 x 0.5	0.42	5.5	6.5	70
8 x 0.5	0.42	6.0	7.0	90
2 x 0.75	0.42	4.5	5.5	40
3 x 0.75	0.42	4.7	5.7	50
4 x 0.75	0.42	5.2	6.2	60
6 x 0.75	0.42	6.1	7.1	90
8 x 0.75	0.42	6.6	7.6	110
2 x 1.0	0.42	4.7	5.7	50
3 x 1.0	0.42	5.1	6.0	60
4 x 1.0	0.42	5.5	6.5	80
6 x 1.0	0.42	6.6	7.6	110
8 x 1.0	0.56	7.7	8.7	140
2 x 1.5	0.42	5.7	6.7	70
3 x 1.5	0.42	6.0	7.0	90
4 x 1.5	0.42	6.6	7.6	100
6 x 1.5	0.56	8.3	9.3	160
8 x 1.5	0.56	8.9	10.1	200
2 x 2.5	0.56	7.3	8.3	100
3 x 2.5	0.56	7.7	8.7	130
4 x 2.5	0.56	8.4	9.6	160

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Overall Screened Cables with Exposed Standard Wall Sheath
300/500 V
EN 50306-4 (FRL-TW-05M-ESW-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor
Tinned annealed copper wires as defined in EN 50306-2
Insulation
LSZH special compound
Overal Screen
Tinned annealed copper wires
Outer Sheath
LSZH special compound as defined in EN 50264-1 (S2. EM 101 - EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

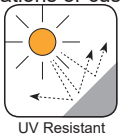
FRL-TW-05M-ESW-OS 300/500 V

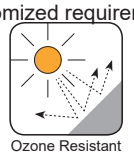
Number of Cores and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
n x mm²	mm	mm	mm	kg/km
2 x 0.5	1.0	5.5	6.5	50
3 x 0.5	1.0	5.7	6.7	55
4 x 0.5	1.0	6.1	7.1	60
6 x 0.5	1.0	6.9	7.9	90
8 x 0.5	1.0	7.5	8.5	110
2 x 0.75	1.0	5.9	6.9	60
3 x 0.75	1.0	6.2	7.2	70
4 x 0.75	1.0	6.5	7.5	80
6 x 0.75	1.0	7.5	8.5	110
8 x 0.75	1.0	8.2	9.2	130
2 x 1.0	1.0	6.2	7.2	60
3 x 1.0	1.0	6.5	7.5	80
4 x 1.0	1.0	6.9	7.9	90
6 x 1.0	1.0	8.0	9.0	130
8 x 1.0	1.0	8.6	9.8	160
2 x 1.5	1.0	7.1	8.1	90
3 x 1.5	1.0	7.4	8.4	110
4 x 1.5	1.0	8.0	9.0	130
6 x 1.5	1.0	9.2	10.4	170
8 x 1.5	1.0	10.2	11.4	220
2 x 2.5	1.0	8.3	9.3	120
3 x 2.5	1.0	8.6	9.8	150
4 x 2.5	1.0	9.4	10.6	180

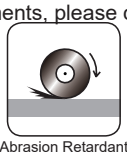
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

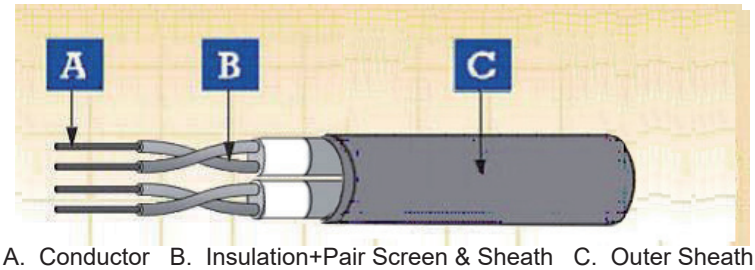

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Thin Wall Multipair Individually Screened and Sheathed Cables with Standard Wall Overall Sheath 300/500 V EN 50306-4 (FRL-TW-05MP-SW-IS)



A. Conductor B. Insulation+Pair Screen & Sheath C. Outer Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Tinned annealed copper wires as defined in EN 50306-2

Insulation

LSZH special compound

Pair Screen

Individual screened and sheathed; Screened according to EN 50306-3; Sheathed according to EN 50306-3 (S1. S2)

Pair Identification

Pairs numbered according to EN 50306-4

Outer Sheath

LSZH special compound (S2. EM 101 - EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables

EN 50268-2; IEC 61034-2; NF C 32-073 ;
NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074;
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101
EN45545-2

Low Smoke Emission

Halogen Free

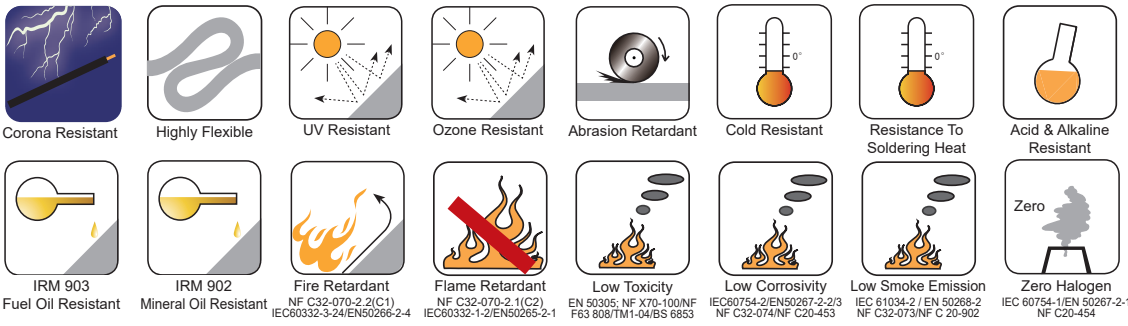
Low Corrosivity (Acidity & Conductivity)

Low Toxicity
Smoke Index
Requirement for fire behavior of materials & components
R15/R16

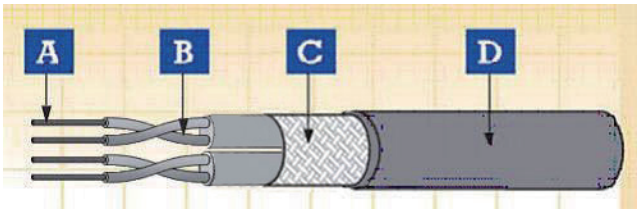
FRL-TW-05MP-SW-IS 300/500 V

Number of Pairs and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
N x n x mm²	mm	mm	mm	kg/km
2 x 2 x 0.5	0.56	9.0	10.2	90
3 x 2 x 0.5	0.56	9.6	10.8	120
4 x 2 x 0.5	0.56	10.7	11.9	160
7 x 2 x 0.5	0.56	13.0	14.2	240
2 x 2 x 0.75	0.56	9.8	11.0	90
3 x 2 x 0.75	0.56	10.5	11.7	150
4 x 2 x 0.75	0.56	11.6	12.8	180
7 x 2 x 0.75	0.56	14.0	15.6	290
2 x 2 x 1.0	0.56	10.2	11.6	110
3 x 2 x 1.0	0.56	10.9	12.1	160
4 x 2 x 1.0	0.56	12.1	13.3	200
7 x 2 x 1.0	0.56	14.6	16.2	330
2 x 2 x 1.5	0.56	12.2	13.4	150
3 x 2 x 1.5	0.56	13.1	14.3	230
4 x 2 x 1.5	0.56	14.3	15.9	290
7 x 2 x 1.5	0.56	17.6	19.2	490

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multipair Overall Screen Cables with Standrad Wall Sheath
300/500 V
EN 50306-4 (FRL-TW-05MP-SW-OS)



A. Conductor B. Insulation C. Overall Screen D. Outer Sheath

Application

-Used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor.
-Used in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor
Tinned annealed copper wires as defined in EN 50306-2

Insulation
LSZH special compound

Pair Identification
Pairs numbered according to EN 50306-4

Overall Screen
Tinned annealed copper wires

Outer Sheath
LSZH special compound (S2, EM 101 - EM 104)

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Max. Conductor Temperature	90 °C/105 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	10 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1,HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ;	Low Smoke Emission

NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074;
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101
EN45545-2

Halogen Free

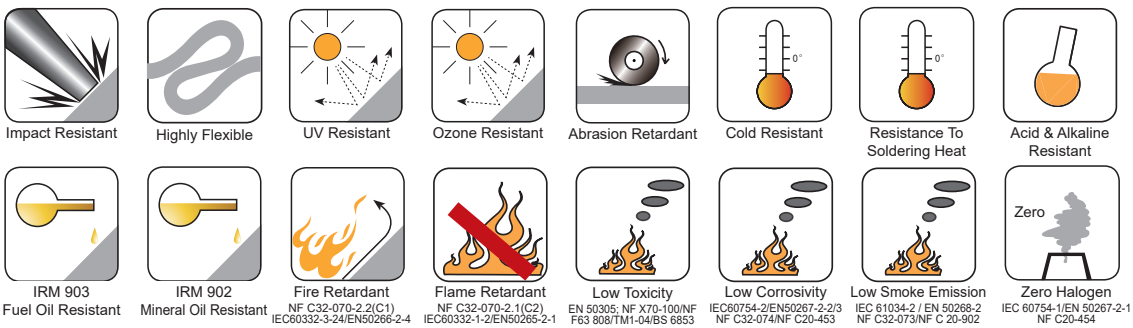
Low Corrosivity (Acidity & Conductivity)

Low Toxicity
Smoke Index
Requirement for fire behavior of materials & components
R15/R16

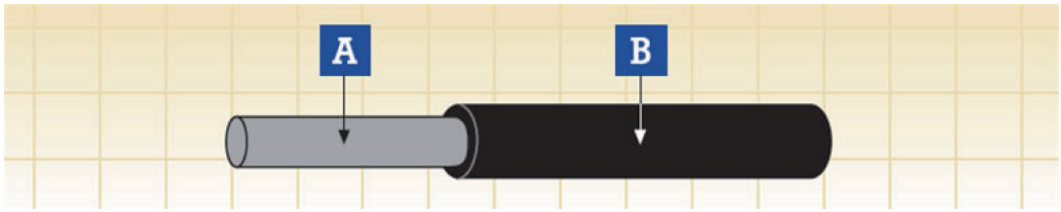
FRL-TW-05MP-ESW-OS 300/500 V

Number of Pairs and Nominal Cross Section	Min. Thickness of Sheath at any Point	Overall Diameter		Weight
		Min.	Max.	
N x n x mm²	mm	mm	mm	kg/km
2 x 2 x 0.5	0.56	6.6	7.9	61
3 x 2 x 0.5	0.56	7.0	8.1	78
4 x 2 x 0.5	0.56	7.7	8.7	96
7 x 2 x 0.5	0.56	9.0	10.6	146
2 x 2 x 0.75	0.56	7.1	9.0	80
3 x 2 x 0.75	0.56	7.7	9.2	103
4 x 2 x 0.75	0.56	9.0	10.0	128
7 x 2 x 0.75	0.56	10.8	11.8	200
2 x 2 x 1.0	0.56	7.8	9.5	95
3 x 2 x 1.0	0.56	8.3	9.7	125
4 x 2 x 1.0	0.56	9.1	10.3	156
7 x 2 x 1.0	0.56	11.0	12.4	247
2 x 2 x 1.5	0.56	9.8	11.2	126
3 x 2 x 1.5	0.56	10.4	11.4	168
4 x 2 x 1.5	0.56	11.6	12.6	212
7 x 2 x 1.5	0.56	14.0	15.3	340

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL High Temperature Single Core Unsheathed Cables 1.8/3 kV or 3.6/6 kV EN 50382-2 (FRL-HT-3SU/FRL-HT-6SU)



A. Conductor B. Insulation

Construction

Conductor

Flexible tinned annealed copper wires (red copper only for 150 °C core temperature) class 5 according to HD 383

Insulation

Silicon rubber according to EN 50382-1 (EI 111)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	120 °C/150 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-HT-3SU 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
						Tinned Conductor	Plain Conductor		
			Min.	Max.		20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	2.5	6.3	7.3	50	13.7	13.3	970	1.90
2.5	1.95	2.5	6.7	7.8	70	8.21	7.98	840	1.60
4	2.5	2.5	7.2	8.4	80	5.09	4.95	720	1.40
6	3.0	2.5	7.7	9.0	100	3.39	3.30	650	1.30
10	3.9	2.5	8.5	10.0	160	1.95	1.91	540	1.00
16	5.0	2.5	9.6	11.2	210	1.24	1.21	460	0.90
25	6.4	2.5	10.9	12.7	290	0.795	0.780	380	0.70
35	7.7	2.5	12.1	14.1	380	0.565	0.554	330	0.60
50	9.2	2.5	13.5	15.8	520	0.393	0.386	290	0.50
70	11.0	2.5	15.2	17.8	720	0.277	0.272	250	0.50
95	12.5	2.7	17.0	19.9	930	0.210	0.206	230	0.40
120	14.2	2.7	18.6	21.7	1140	0.164	0.161	210	0.40
150	15.8	2.7	20.1	23.5	1430	0.132	0.129	190	0.30
185	17.5	2.7	21.7	25.4	1720	0.108	0.106	170	0.30
240	20.1	2.7	24.1	28.2	2270	0.0817	0.0801	150	0.30
300	22.5	2.7	26.4	30.9	2750	0.0654	0.0641	140	0.20
400	25.8	2.9	29.9	34.9	3730	0.0495	0.0486	130	0.20

(a)= For information, indicative only

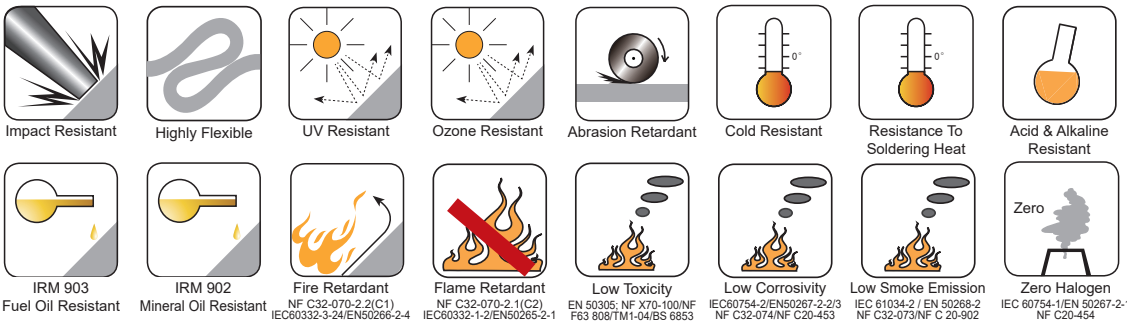
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-HT-6SU 3.6/6 kV

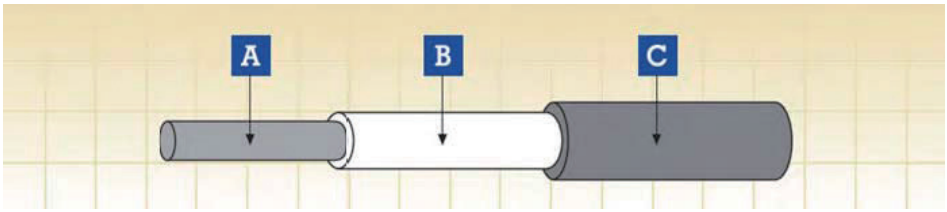
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
						Tinned Conductor	Plain Conductor		
			Min.	Max.		20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	3.0	7.6	8.9	80	8.21	7.98	920	1.80
4	2.5	3.0	8.1	9.5	100	5.09	4.95	800	1.60
6	3.0	3.0	9.0	10.6	120	3.39	3.30	750	1.50
10	3.9	3.0	9.5	11.1	180	1.95	1.91	610	1.20
16	5.0	3.0	10.5	12.3	230	1.24	1.21	520	1.00
25	6.4	3.0	11.8	13.8	310	0.795	0.780	430	0.80
35	7.7	3.0	13.0	15.2	410	0.565	0.554	380	0.70
50	9.2	3.0	14.4	16.9	550	0.393	0.386	330	0.60
70	11.0	3.0	16.1	18.9	740	0.277	0.272	280	0.50
95	12.5	3.0	17.5	20.5	940	0.210	0.206	260	0.50
120	14.2	3.1	19.3	22.6	1170	0.164	0.161	240	0.40
150	15.8	3.1	20.8	24.4	1460	0.132	0.129	220	0.40
185	17.5	3.2	22.6	26.5	1760	0.108	0.106	200	0.40
240	20.1	3.4	25.4	29.8	2340	0.0817	0.0801	190	0.30
300	22.5	3.4	27.7	32.4	2820	0.0654	0.0641	170	0.30
400	25.8	3.4	30.8	36.0	3780	0.0495	0.0486	150	0.30

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL High Temperature Single Core Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50382-2 (FRL-HT-3S/FRL-HT-6S)



A. Conductor B. Insulation C. Sheath

Construction

Conductor

Flexible tinned annealed copper wires(red copper only for 150 °C core temperature)class 5 according to HD 383

Insulation

Silicon rubber according to EN 50382-1 (EI 112)

Outer Sheath

LSZH elastomeric compound according to EN 50382-1 (EM 105, EM 106 or EM 107)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	120 °C/150 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-HT-3S 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Average Sheath Thickness	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
				Min.	Max.		Tinned Conductor	Plain Conductor		
							20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	1.4	6.8	7.9	70	13.7	13.3	670	1.30
2.5	1.95	1.3	1.4	7.2	8.4	80	8.21	7.98	570	1.10
4	2.5	1.3	1.4	7.7	9.0	100	5.09	4.95	480	0.90
6	3.0	1.3	1.4	8.2	9.6	120	3.39	3.30	420	0.80
10	3.9	1.5	1.4	9.4	11.0	190	1.95	1.91	380	0.70
16	5.0	1.5	1.4	10.5	12.2	240	1.24	1.21	310	0.60
25	6.4	1.8	1.4	12.3	14.4	340	0.795	0.780	300	0.60
35	7.7	1.8	1.4	13.6	15.9	440	0.565	0.554	250	0.50
50	9.2	1.8	1.4	15.0	17.5	580	0.393	0.386	220	0.40
70	11.0	1.8	1.5	16.8	19.7	780	0.277	0.272	200	0.40
95	12.5	2.2	1.5	19.0	22.2	1020	0.210	0.206	190	0.40
120	14.2	2.2	1.6	20.8	24.3	1270	0.164	0.161	180	0.30
150	15.8	2.2	1.6	22.3	26.1	1560	0.132	0.129	160	0.30
185	17.5	2.4	1.7	24.5	28.6	1890	0.108	0.106	160	0.30
240	20.1	2.4	1.8	27.1	31.7	2480	0.0817	0.0801	140	0.20
300	22.5	2.4	1.9	29.5	34.6	2990	0.0654	0.0641	120	0.20
400	25.8	2.6	2.0	33.2	38.9	4010	0.0495	0.0486	120	0.20

(a)= For information, indicative only

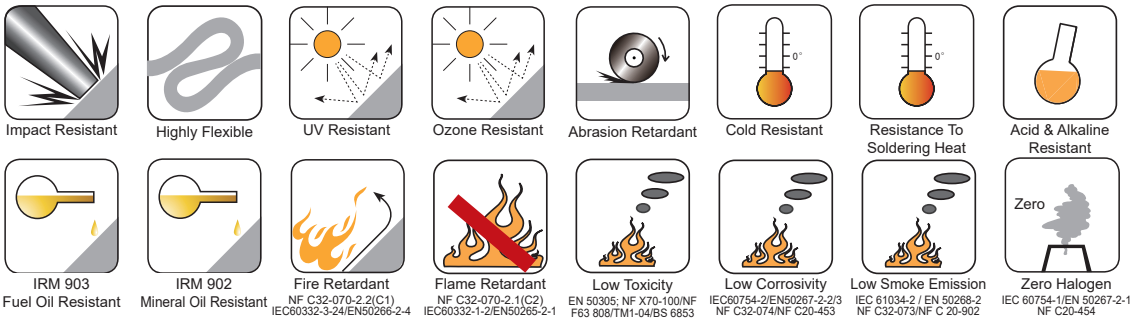
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-HT-6S 3.6/6 kV

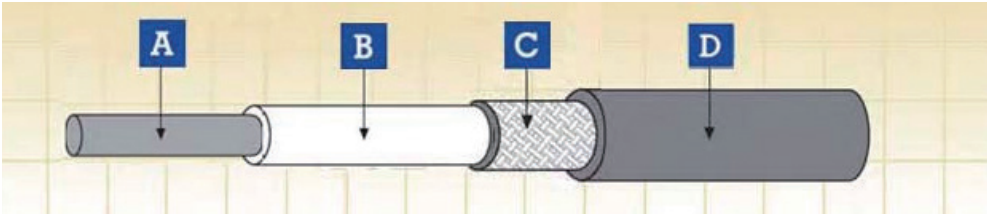
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Average Sheath Thickness	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
				Min.	Max.		Tinned Conductor	Plain Conductor		
							20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	2.6	1.4	9.9	11.6	130	8.21	7.98	870	1.70
4	2.5	2.6	1.4	10.4	12.2	150	5.09	4.95	750	1.50
6	3.0	2.6	1.4	10.9	12.8	180	3.39	3.30	670	1.30
10	3.9	2.6	1.4	11.8	13.8	240	1.95	1.91	570	1.10
16	5.0	2.6	1.4	12.8	15.0	300	1.24	1.21	480	0.90
25	6.4	2.9	1.4	14.7	17.2	410	0.795	0.780	430	0.80
35	7.7	2.9	1.4	15.9	18.6	510	0.565	0.554	380	0.70
50	9.2	2.9	1.5	17.5	20.5	660	0.393	0.386	330	0.60
70	11.0	2.9	1.5	19.2	22.4	870	0.277	0.272	280	0.50
95	12.5	2.9	1.6	20.8	24.3	1100	0.210	0.206	250	0.50
120	14.2	2.9	1.6	22.4	26.2	1330	0.164	0.161	230	0.40
150	15.8	2.9	1.7	24.1	28.2	1640	0.132	0.129	210	0.40
185	17.5	3.2	1.8	26.4	30.9	1990	0.108	0.106	210	0.40
240	20.1	3.4	1.9	29.4	34.4	2620	0.0817	0.0801	190	0.30
300	22.5	3.4	1.9	31.7	37.1	3120	0.0654	0.0641	170	0.30
400	25.8	3.4	2.0	35.0	40.9	4150	0.0495	0.0486	150	0.30

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL High Temperature Single Core Screened & Sheathed Cables 1.8/3 kV or 3.6/6 kV EN 50382-2 (FRL-HT-3S-OS/FRL-HT-6S-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Construction

Conductor

Flexible tinned annealed copper wires(red copper only for 150 °C core temperature)class 5 according to HD 383

Insulation

Silicon rubber according to EN 50382-1 (EI 112)

Overal Screen

Tinned annealed copper wires

Outer Sheath

LSZH elastomeric compound according to EN 50382-1 (EM 105, EM 106 or EM 107)

Electrical & Mechanical Properties

Nominal Voltage	1.8/3 kV or 3.6/6 kV
Max. Conductor Temperature	120 °C/150 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C/-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-HT-3S-OS 1.8/3 kV

Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
								Tinned Conductor	Plain Conductor		
					Min.	Max.		20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
1.5	1.5	1.3	0.16	1.4	6.8	7.9	113	13.7	13.3	670	1.30
2.5	1.95	1.3	0.16	1.4	7.2	8.4	134	8.21	7.98	570	1.10
4	2.5	1.3	0.21	1.4	7.7	9.0	171	5.09	4.95	480	0.90
6	3.0	1.3	0.21	1.4	8.2	9.6	205	3.39	3.30	420	0.80
10	3.9	1.5	0.21	1.4	9.4	11.0	283	1.95	1.91	380	0.70
16	5.0	1.5	0.26	1.4	10.5	12.2	381	1.24	1.21	310	0.60
25	6.4	1.8	0.26	1.4	12.3	14.4	539	0.795	0.780	300	0.60
35	7.7	1.8	0.31	1.4	13.6	15.9	682	0.565	0.554	250	0.50
50	9.2	1.8	0.31	1.4	15.0	17.5	882	0.393	0.386	220	0.40
70	11.0	1.8	0.31	1.5	16.8	19.7	1174	0.277	0.272	200	0.40
95	12.5	2.2	0.31	1.5	19.0	22.2	1483	0.210	0.206	190	0.40
120	14.2	2.2	0.31	1.6	20.8	24.3	1819	0.164	0.161	180	0.30
150	15.8	2.2	0.31	1.6	22.3	26.1	2188	0.132	0.129	160	0.30
185	17.5	2.4	0.31	1.7	24.5	28.6	2606	0.108	0.106	160	0.30
240	20.1	2.4	0.31	1.8	27.1	31.7	3318	0.0817	0.0801	140	0.20
300	22.5	2.4	0.31	1.9	29.5	34.6	4015	0.0654	0.0641	120	0.20
400	25.8	2.6	0.31	2.0	33.2	38.9	5170	0.0495	0.0486	120	0.20

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

FRL-HT-6S-OS 3.6/6 kV

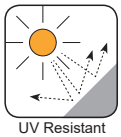
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Min. Screen Wire Diameter	Min. Average Sheath Thickness	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
								Tinned Conductor	Plain Conductor		
					Min.	Max.		20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
2.5	1.95	2.6	0.16	1.4	9.9	11.6	209	8.21	7.98	870	1.70
4	2.5	2.6	0.16	1.4	10.4	12.2	240	5.09	4.95	750	1.50
6	3.0	2.6	0.21	1.4	10.9	12.8	291	3.39	3.30	670	1.30
10	3.9	2.6	0.21	1.4	11.8	13.8	363	1.95	1.91	570	1.10
16	5.0	2.6	0.21	1.4	12.8	15.0	453	1.24	1.21	480	0.90
25	6.4	2.9	0.26	1.4	14.7	17.2	640	0.795	0.780	430	0.80
35	7.7	2.9	0.26	1.4	15.9	18.6	770	0.565	0.554	380	0.70
50	9.2	2.9	0.31	1.5	17.5	20.5	1012	0.393	0.386	330	0.60
70	11.0	2.9	0.31	1.5	19.2	22.4	1307	0.277	0.272	280	0.50
95	12.5	2.9	0.31	1.6	20.8	24.3	1586	0.210	0.206	250	0.50
120	14.2	2.9	0.31	1.6	22.4	26.2	1916	0.164	0.161	230	0.40
150	15.8	2.9	0.31	1.7	24.1	28.2	2309	0.132	0.129	210	0.40
185	17.5	3.2	0.31	1.8	26.4	30.9	2750	0.108	0.106	210	0.40
240	20.1	3.4	0.31	1.9	29.4	34.4	3420	0.0817	0.0801	190	0.30
300	22.5	3.4	0.31	1.9	31.7	37.1	4150	0.0654	0.0641	170	0.30
400	25.8	3.4	0.31	2.0	35.0	40.9	5200	0.0495	0.0486	150	0.30

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Impact Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant

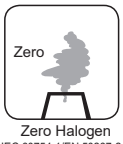

Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853

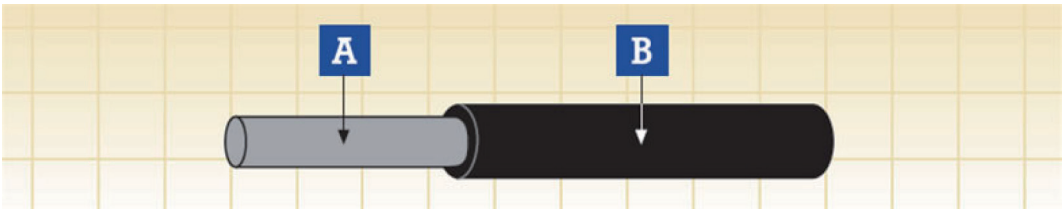

Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902



Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL High Temperature Single Core Cables with Reinforced Insulation 3.6/6 kV EN 50382-2 (FRL-HT-6SURI)



A. Conductor B. Insulation

Construction

Conductor

Extra flexible tinned annealed copper wires(red copper only for 150 °C core temperature)class 6 according to HD 383

Insulation

Silicon rubber according to EN 50382-1 (EI 112)

Electrical & Mechanical Properties

Nominal Voltage	3.6/6 kV
Max. Conductor Temperature	120 °C /150 °C (fixed installation)
Min. Permissible Ambient Temperature	-25 °C /-40 °C (fixed installation)
Bending Radius	3 x Overall Diameter (D<12mm); 4 x Overall Diameter (D>12mm)

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

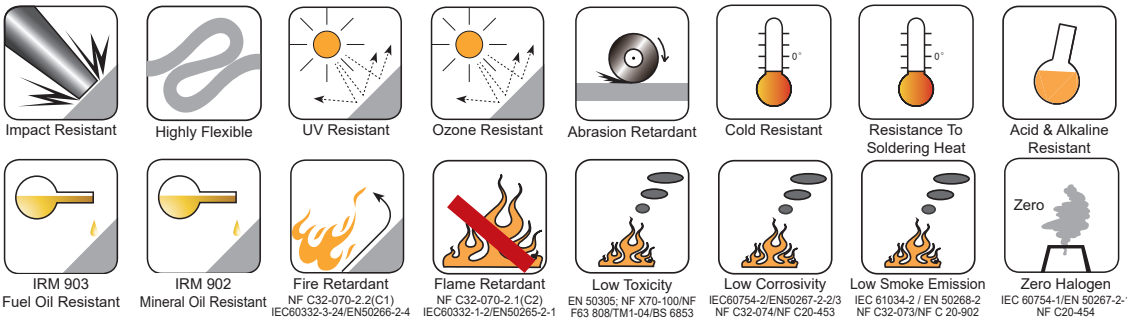
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-HT-6SURI 3.6/6 kV

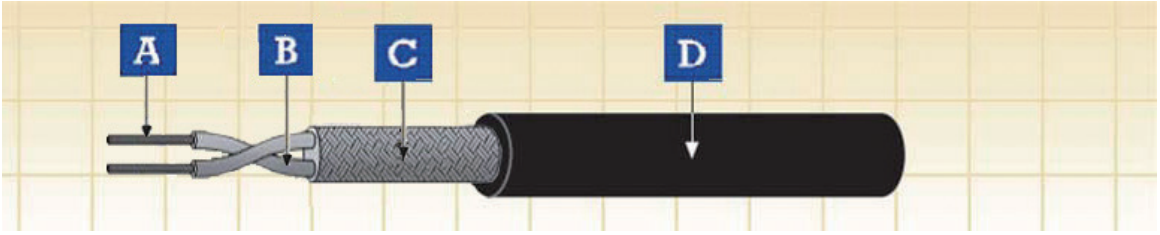
Nominal Cross-Sectional Area	Conductor Diameter (a)	Min. Mean Thickness of Insulation	Overall Diameter		Weight	Max.Conductor Resistance		Min. Insulation Resistance	
			Min.	Max.		Tinned Conductor	Plain Conductor		
						20 °C	20 °C	20 °C	150 °C
mm^2	mm	mm	mm	mm	kg/km	Ω/km	Ω/km	MΩ x km	MΩ x km
50	9.2	3.0	15.2	17.8	560	0.393	0.386	340	0.70
70	11.0	3.0	16.9	19.8	770	0.277	0.272	300	0.60
95	12.5	3.0	18.3	21.4	970	0.210	0.206	270	0.55
120	14.2	3.1	20.1	23.5	1200	0.164	0.161	250	0.50
150	15.8	3.1	21.6	25.3	1480	0.132	0.129	220	0.45
185	17.5	3.2	23.4	27.4	1800	0.108	0.106	210	0.40

(a)= For information, indicative only

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



WTB (Wired Train Bus) Cables
FRL-WTB-02YCH-2G0.75/FRL-WTB-02YCH-1P0.75S/FRL-WTB-02YCH-2P0.75S



A. Conductor B. Insulation C. Screen D. Sheath

Application

The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction

Conductors
Stranded tinned copper conductor according to IEC 60228 class 5

Insulation
Foam PE or foam skin PE

Core Wrapping
Plastic tape(s)

EMC Screen
Tinned copper braid

Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	12 x Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ;	Low Smoke Emission

NF C 20-902; NF F 16 101; VDE 0472 Teil 816	
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-WTB-02YCH-2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	8.3	97	26.7	120+/-12	30	10	13	14	18

FRL-WTB-02YCH-1P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	9.0	110	26.7	120+/-12	30	10	13	14	18

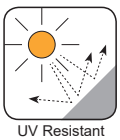
FRL-WTB-02YCH-2P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	11.4	150	26.7	120+/-12	30	10	13	14	18

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903 Fuel Oil Resistant


IRM 902 Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

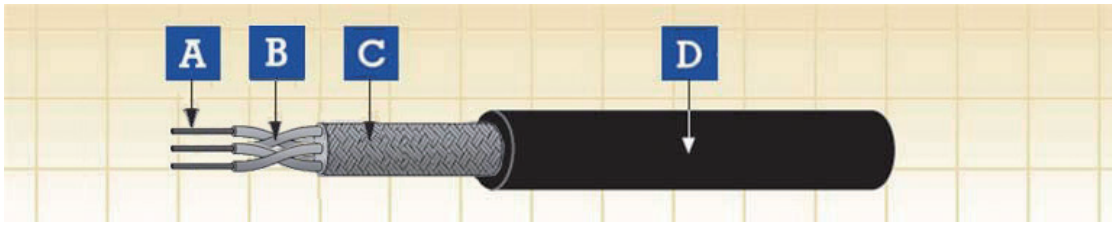

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853

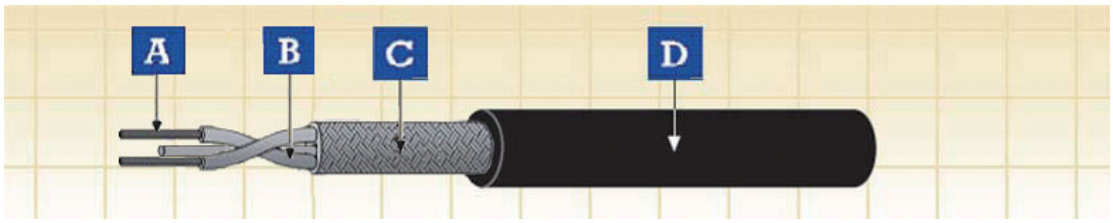

Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

MVB (Multifunction Vehicle Bus) Cables
FRL-MVB-02YCH-1P0.5S+1G0.5/FRL-MVB-02YCH-2P0.5S





A. Conductor B. Insulation C. Screen D. Sheath

Application

The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction

Conductor
Stranded tinned copper conductor according to IEC 60228 class 5

Insulation
Foam PE or foam skin PE

Core Wrapping
Plastic tape(s)

EMC Screen
Tinned copper braid

Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	10 × Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

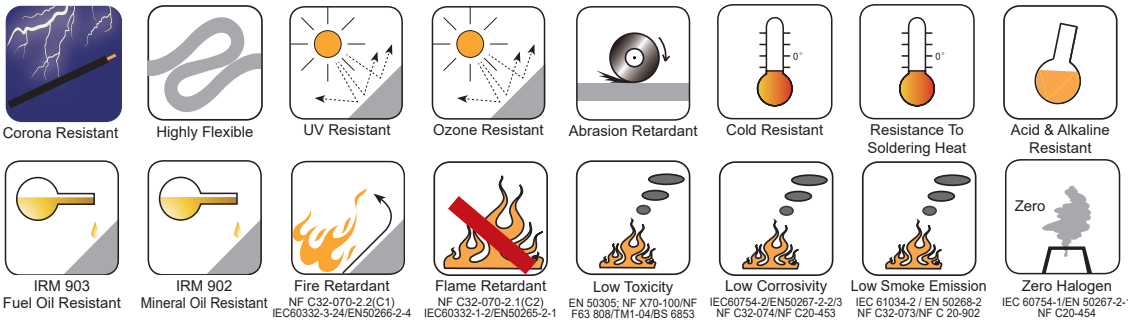
FRL-MVB-02YCH-1P0.5S+1G0.5

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@0.5-2MHz	f<=20MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.5	19/0.18	1.2	6.8	62	41	120+/-12	20	12.5	15	18	21

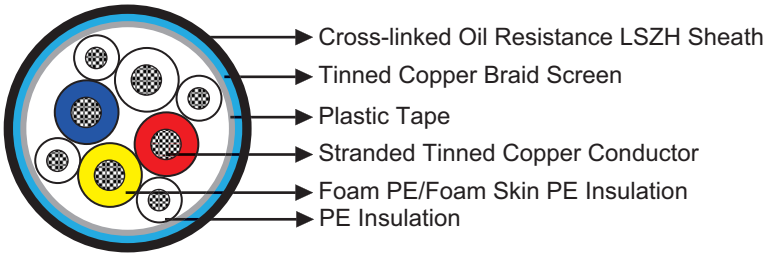
FRL-MVB-02YCH-2P0.5S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=20MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.5	19/0.18	1.2	8.3	100	41	120+/-12	20	12.5	15	18	21

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



MVB (Multifunction Vehicle Bus) Cables (Redundant Version)
FRL-MVB-02YCH-1Q0.5S+4G0.25



Application

The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction

Conductor
Stranded tinned copper conductor according to IEC 60228 class 5

Insulation
0.6mm foam PE/foam skin PE (for 0. 5mmsq conductor), 0.2mm PE (for 0.25mmsq conductor)

Core Wrapping
Plastic tape(s)

EMC Screen
Tinned copper braid

Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	10 × Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

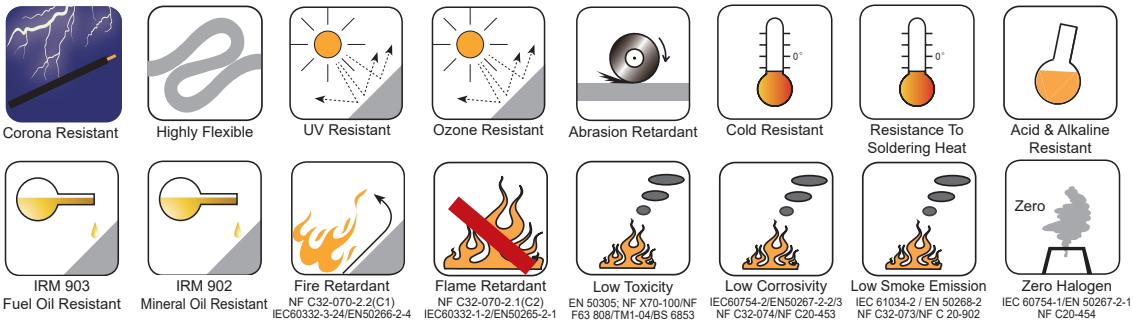
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission

EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

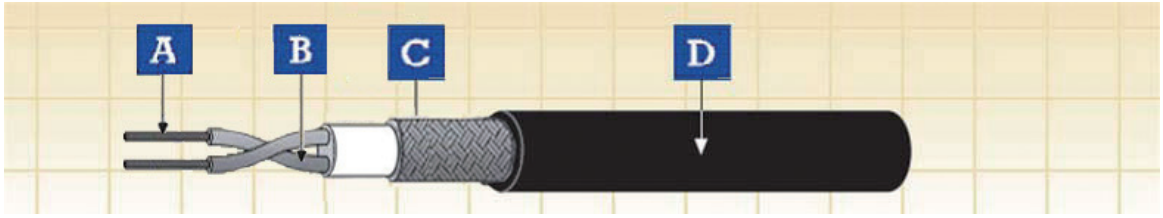
FRL-MVB-02YCH-1Q0.5S+4G0.25

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Transfer Impedance	Max.Attenuation	
					20 °C	@0.75-3MHz	f<=20MHz	@1.5MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km
0.5	19/0.18	1.2	7.9	95	41	120+/-12	20	17	25

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



WTB (Wired Train Bus) / MVB (Multifunction Vehicle Bus) Cables
FRL-WTB/MVB-02Y(ST+C)H-1P20A



A. Conductor B. Insulation C. EMC Screen 1 & 2 D. Sheath

Application

The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction

Conductor
Stranded tinned copper conductor according to IEC 60228 class 5

Insulation
Foam PE or foam skin PE

Cable Element
Twisted pair

Core Wrapping
Plastic tape(s)

EMC Screen 1
Aluminium clad polyester foil

EMC Screen 2
Tinned copper braid

Core Wrapping
Plastic tape(s)

Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	12 × Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

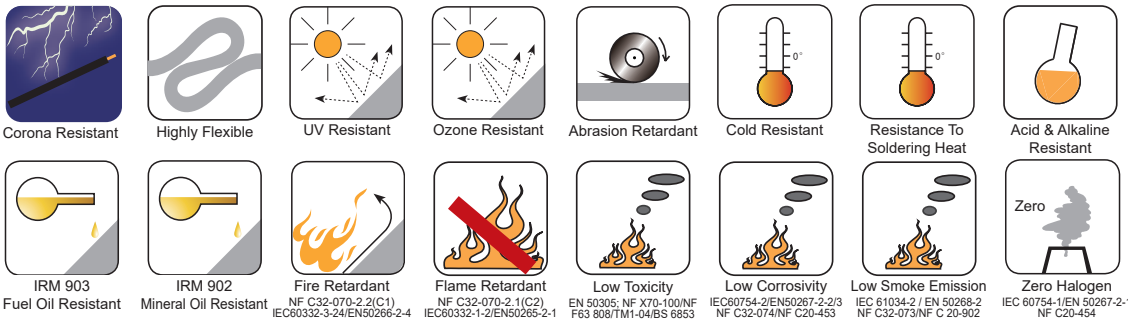
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-WTB/MVB-02Y(ST+C)H-1P20A

Nominal Cross-Sectional Area		Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation	
						20 °C	@0.75-3MHz	@1MHz	@2MHz
mm^2	AWG	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km
0.62	20	19/0.2	1.2	8.3	80	33.1	120+/-12	10	15

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

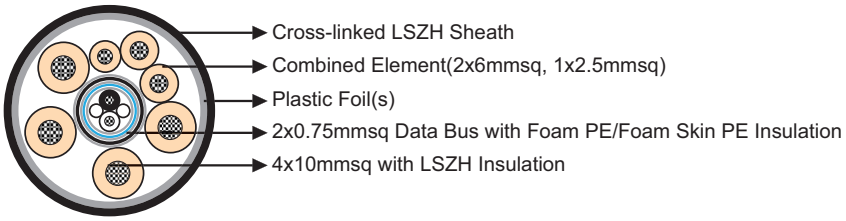


Integrated 9/11/18/20 Cores 0.75mmsq UIC Databus Cables
FRL-UIC-4G10+2G6+1G2.5+2G0.75
FRL-UIC-4G10+2G6+1G2.5+2G1+2G0.75
FRL-UIC-4Q1S+2G0.75/FRL-UIC-4Q1S+2P0.75S

Application

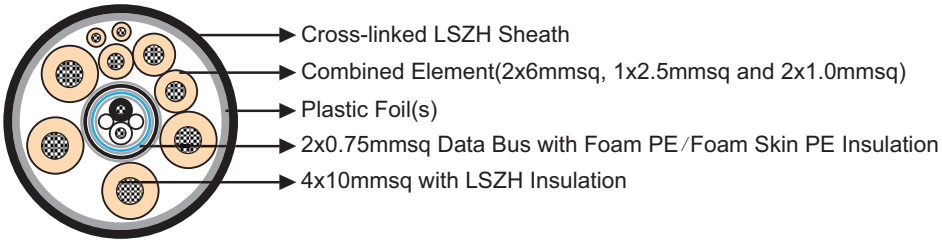
The cables are used as connecting cables to transmit digital signals inside railway rolling stocks.

Construction



For 9 cores UIC databus cables

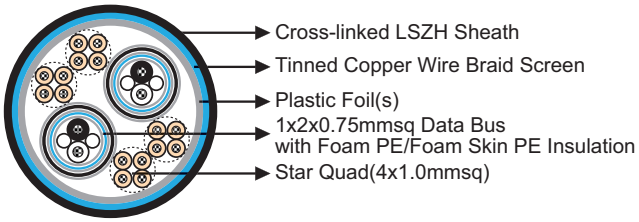
4 cores: 10 mm^2 stranded tinned copper conductor with LSZH insulation
Combined Element: 3 cores (with Cu-strand 2 x 6mm^2, 1 x 2.5mm^2) are twisted with a filling element to form a combined element
Core Wrapping: Overlapped plastic-foil(s)
Elements Sheaths: TPE
UIC Data Bus 0.75mm^2: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Elements Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Stranding: 4 strands are twisted to a core together with 3 cored element, the UIC data bus and two fillers
Core Wrapping: Overlapped plastic-foil(s)
Outer Sheath: Cross-linked oil resistant LSZH compound

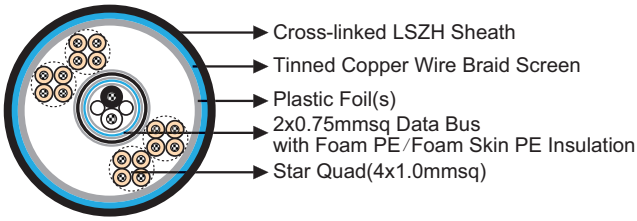


For 11 cores UIC databus cables

4 cores: 10 mm^2 stranded tinned copper conductor with LSZH insulation
Combined Element: 5 cores (with Cu-strand 2 x 6mm^2, 1 x 2.5mm^2 and 2 x 1.0 mm^2) are twisted with a filling element to form a combined element
Core Wrapping: Overlapped plastic-foil(s)
Element sheaths: TPE
UIC Data Bus 0.75mm^2: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Element Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Stranding: 4 strands are twisted to a core together with 5 cored element, the UIC data bus and two fillers

Core Wrapping: Overlapped plastic-foil(s)
Outer Sheath: Cross-linked oil resistant LSZH compound





For 18/20 cores UIC databus cables

Star Quad: Four LSZH insulated 1mm^2 stranded tinned copper conductors are twisted to form a star quad.
UIC Data Bus 0.75mm^2: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Element Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Stranding: 4 star quads are stranded together with 2 or 4 UIC data bus cable and several fillers
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid.
Outer Sheath: Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	12 × Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-UIC-4G10+2G6+1G2.5+2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	25	917	26.7	120+/-12	10	13	14	18
10	80/0.4				1.95	-	-	-	-	-
6	84/0.3				3.39	-	-	-	-	-
2.5	37/0.29				8.21	-	-	-	-	-

FRL-UIC-4G10+2G6+1G2.5+2G1+2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	25	969	26.7	120+/-12	10	13	14	18
10	80/0.4				1.95	-	-	-	-	-
6	84/0.3				3.39	-	-	-	-	-
2.5	37/0.29				8.21	-	-	-	-	-

FRL-UIC-4Q1S+2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	18.5	498	26.7	120+/-12	10	13	14	18
1	19/0.25				20	-	-	-	-	-

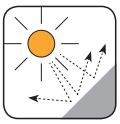
FRL-UIC-4Q1S+2P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.5	23	530	26.7	120+/-12	10	13	14	18
1	19/0.25				20	-	-	-	-	-

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Corona Resistant

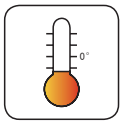

Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant

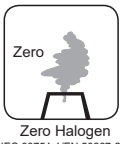

Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853

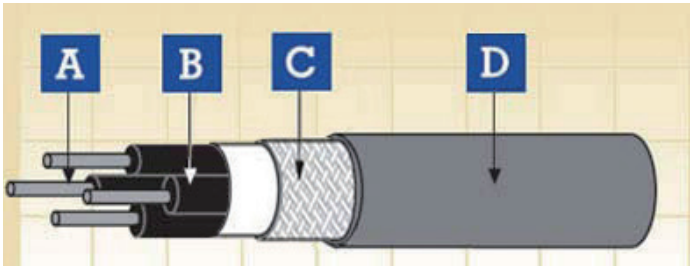

Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902



Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

Category 5E Data Cables
FRL-Cat5E-4C0.5S/FRL-Cat5E-4C22A/FRL-Cat5E-4P22A



A. Conductor B. Insulation C. EMC Screen 1 & 2 D. Sheath

Application

The cables are designed for permanently protected installation, inside and outside railway rolling stock, buses and other vehicles to connect fixed parts. Ethernet based networks as: infotainment, multimedia, passenger information system etc.

Construction

For 4 x 0.5mm^2, 4 x 22 AWG cables

Conductor: Stranded tin plated copper conductor (for 0.5mm^2 cables) or stranded silver plated copper conductor (for 22AWG cables) according to IEC 60228 class 5
Insulation: PE
Cable Element: Individual conductor stranded together
EMC Screen 1: Plastic laminated aluminium tape
EMC Screen 2: Tin plated copper braid
Core Wrapping: Plastic tape(s)
Outer Sheath: Electron beam crosslinkable compound

For 4 x 2 x 22 AWG cables

Center: PE filler.
Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5
Insulation: PE
EMC Screen 1: Plastic laminated aluminium tape
EMC Screen 2: Tin plated copper braid
Core Wrapping: Plastic tape(s)
Outer Sheath: Electron beam crosslinkable compound

Electrical & Mechanical Properties

Nominal Voltage	300 V
Max.Temperature	90 °C
Min. Temperature	-40 °C
Bending Radius	6 × Overall Diameter

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkalil
EN 50305	Resistance to ozone
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II

NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRL-Cat5E-4C0.5S

Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
mm^2	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
0.5	1.2	8.3	102	40.1	1.1	100+/-5	200	65	100

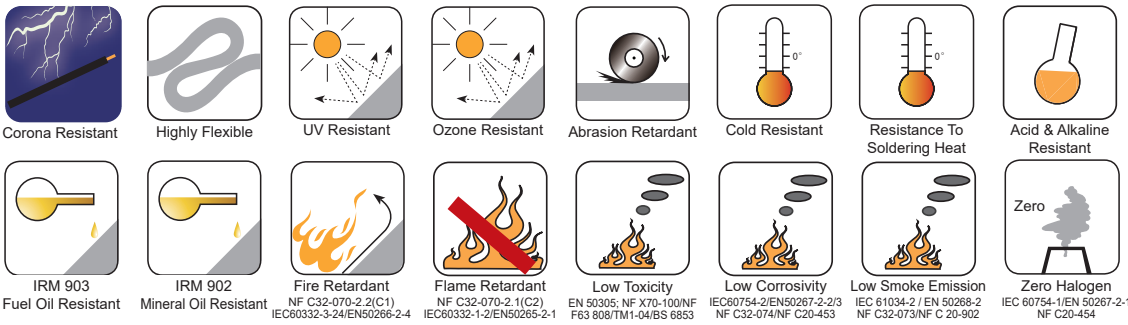
FRL-Cat5E-4C22A

Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
AWG	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
22	1.2	7.25	81	54.4	1.1	100+/-5	200	65	100

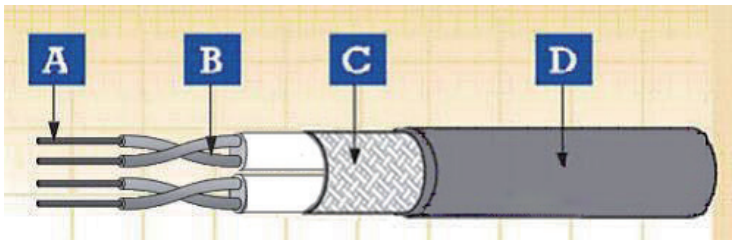
FRL-Cat5E-4P22A

Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
AWG	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
22	1.2	12.6	174	54.4	1.1	100+/-5	200	65	100

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



RS 485 Databus Cables
300/500 V
FRL-MVB-02Y(ST)CH-IOS-xPyS/FRL-MVB-02YCH-OS-xPyS



A. Conductor B. Insulation+Pair Screen C. Overall Screen D. Sheath

Application

120 Ohm data transmission cables

Construction

Multipair Databus RS 485 Double Screened Cable

Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5(0.22mm^2-1mm^2).
Insulation: Cross linked foam PE or foam skin PE
Cable Element: Twisted pair
Pair Screen:Individual Aluminium tape
Overall Screen: Copper wire braid
Outer Sheath: Cross linked EVA rubber type EM 104 or equivalent, in accordance with EN 50264-1

Multipair Databus RS 485 Single Screened Cable

Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5(0.22mm^2-1mm^2)
Insulation: Cross linked foam PE or foam skin PE
Cable Element: Twisted pair
Overall Screen: Copper wire braid
Outer Sheath: Cross linked EVA rubber type EM 104 or equivalent, in accordance with EN 50264-1

Electrical & Mechanical Properties

Nominal Voltage	300/500 V
Impedance	120 Ω+/-15 %
Capacitance@1KHz	41 nF/km
Min. Insulation Resistance	5000 MΩ

Chemical & Environmental Properties

EN 60684-2	No fluorine
EN 50305; EN 60811-2-1	Resistance to mineral oil & fuel oil, acid & alkali
EN 50305	Resistance to ozone

Fire Performance for Rolling Stock Application

EN 50306-2	Hazard levels HL1, HL2, HL3
DIN 5510-2	Protection level 1/2/3/4
BS 6853	Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101	F0
EN45545-2	R15 Interior/ R16 Exterior HL1, HL2, HL3

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ;	Low Smoke Emission

NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074; — Halogen Free
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; — Low Corrosivity (Acidity & Conductivity)
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853 — Low Toxicity
NF F 63 808; BS6853; NF F 16 101 — Smoke Index
EN45545-2 — Requirement for fire behavior of materials & components R15/R16

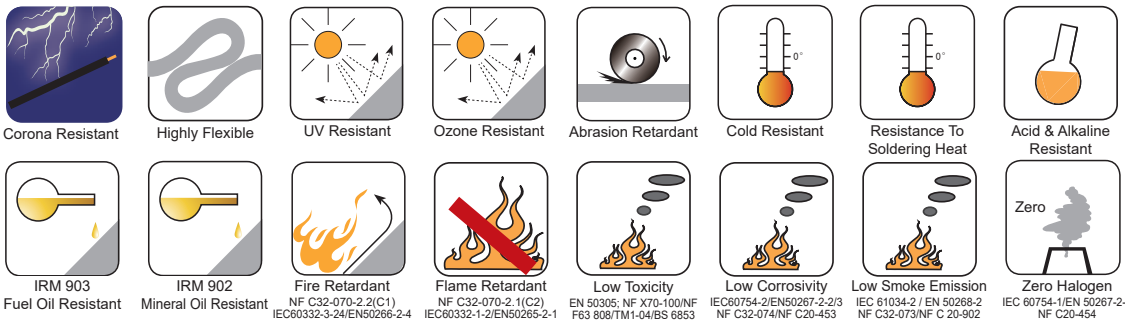
FRL-MVB-02Y(ST)CH-IOS-xPyS 300/500 V

No.of Pair x	Nominal Cross-Sectional Area y	Number & Nominal Diameter of Strands	Nominal Overall Diameter	Nominal Weight
	mm^2	No/mm	mm	kg/km
1	0.22	7/0.2	4.5	58
2	0.22	7/0.2	6.2	79
4	0.22	7/0.2	6.5	118
1	0.5	16/0.2	6.6	79
2	0.5	16/0.2	9.0	105
4	0.5	16/0.2	9.8	145
1	0.75	24/0.2	9.5	115
2	0.75	24/0.2	10.3	135
4	0.75	24/0.2	11.6	182
1	1	30/0.2	11.5	125
2	1	30/0.2	12.5	150
4	1	30/0.2	13.5	180

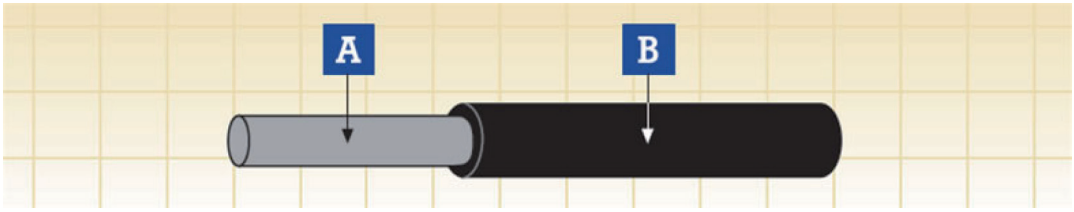
FRL-MVB-02YCH-OS-xPyS 300/500 V

No.of Pair x	Nominal Cross-Sectional Area y	Number & Nominal Diameter of Strands	Nominal Overall Diameter	Nominal Weight
	mm^2	No/mm	mm	kg/km
1	0.22	7/0.2	4.2	55
2	0.22	7/0.2	5.9	75
4	0.22	7/0.2	6.2	115
1	0.5	16/0.2	6.3	75
2	0.5	16/0.2	8.5	100
4	0.5	16/0.2	9.4	140
1	0.75	24/0.2	9.0	110
2	0.75	24/0.2	9.7	130
4	0.75	24/0.2	11.1	178
1	1	30/0.2	11.0	120
2	1	30/0.2	12.0	145
4	1	30/0.2	13.0	175

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Standard Wall Single Core Unsheathed Cables 500 V, 1000 V, 1500 V, 3000 V NF F 63-826 (FRF-SW-05SU/FRF-SW-1SU,FRF-SW-1.5SU/FRF-SW-3SU)



A. Conductor B. Insulation

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for use in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 5

Insulation

Special halogen free compound

Electrical & Mechanical Properties

Nominal Voltage	500 V, 1000 V, 1500 V, 3000 V
Max. Conductor Temperature	90 °C/105 °C
Temperature Range	-25 °C~90 °C
Bending Radius	4 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-826
NF F 16-101
BS 6853
EN45545-2

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRF-SW-05SU 500 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
1.0	32/0.20	1.3	3.8	4.5	26
1.5	30/0.25	1.3	4.1	4.8	33
2.5	50/0.25	1.3	4.5	5.2	43
4.0	56/0.30	1.3	5.0	5.8	59
6.0	84/0.30	1.4	5.7	6.5	82
10.0	80/0.40	1.5	6.9	8.1	135
16.0	126/0.40	1.5	8.2	9.2	210

FRF-SW-1SU 1000 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
1.5	30/0.25	1.5	4.4	5.2	42
2.5	50/0.25	1.5	4.8.	5.6	55
4.0	56/0.30	1.5	5.4	6.2	72
6.0	84/0.30	1.6	6.1	6.9	96
10.0	80/0.40	1.6	7.0	8.3	154
16.0	126/0.40	1.6	8.3	9.4	218
25.0	196/0.40	1.7	9.8	11.0	316
35.0	276/0.40	1.8	11.2	12.5	440
50.0	396/0.40	1.9	13.0	14.3	580
70.0	360/0.50	2.0	14.7	16.3	830
95.0	475/0.50	2.0	16.6	18.4	1040
120.0	608/0.50	2.1	18.6	20.5	1310

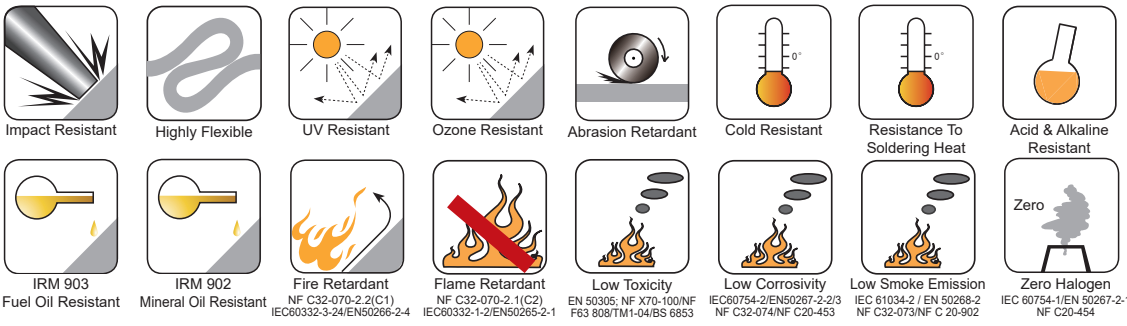
FRF-SW-1.5SU 1500 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
1.5	30/0.25	2.3	6.0	6.8	59
2.5	50/0.25	2.3	6.4	7.2	73
4.0	56/0.30	2.3	7.0	7.8	91
6.0	84/0.30	2.3	7.5	8.3	120
10.0	80/0.40	2.3	8.4	9.7	160
16.0	126/0.40	2.3	9.7	10.8	235
25.0	196/0.40	2.3	11.0	12.2	330
35.0	276/0.40	2.4	12.4	13.7	480
50.0	396/0.40	2.5	14.2	15.5	610
70.0	360/0.50	2.7	16.1	17.7	860
95.0	475/0.50	2.7	18.0	19.8	1070
120.0	608/0.50	2.8	20.0	21.9	1340
150.0	756/0.50	2.8	21.8	23.8	1620
185.0	925/0.50	2.9	23.7	25.9	1940
240.0	1221/0.50	3.1	26.6	29.1	2550
300.0	1525/0.50	3.45	29.4	31.9	2950

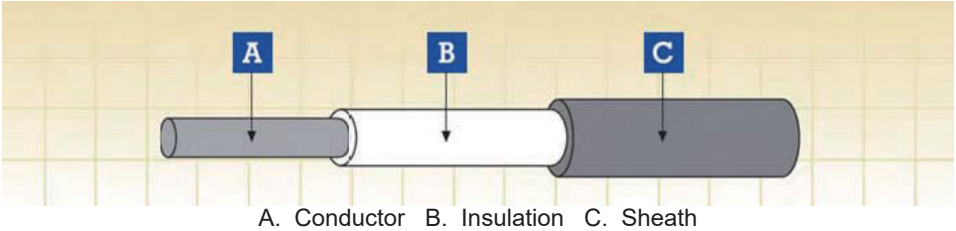
FRF-SW-3SU 3000 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
2.5	50/0.25	3.1	8.0	8.8	94
4.0	56/0.30	3.1	8.5	9.5	124
6.0	84/0.30	3.1	8.8	9.9	135
10.0	80/0.40	3.1	10.0	11.3	200
16.0	126/0.40	3.1	11.2	12.4	265
25.0	196/0.40	3.1	12.5	13.8	375
35.0	276/0.40	3.2	13.9	15.3	493
50.0	396/0.40	3.3	15.7	17.2	680
70.0	360/0.50	3.4	17.5	19.1	930
95.0	475/0.50	3.5	19.5	21.4	1066
120.0	608/0.50	3.6	21.6	23.5	1530
150.0	756/0.50	3.6	23.3	25.5	1740
185.0	925/0.50	3.7	25.2	27.6	2100
240.0	1221/0.50	3.9	28.1	31.7	2460
300.0	1525/0.50	4.45	31.4	35.0	3050

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Standard Wall Single Core Sheathed Cables 1500 V, 3000 V NF F 63-826 (FRF-SW-1.5S/FRF-SW-3S)



A. Conductor B. Insulation C. Sheath

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for use in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 5

Insulation

Halogen free compound

Sheath

Halogen free compound

Electrical & Mechanical Properties

Nominal Voltage	1500 V, 3000 V
Max. Conductor Temperature	90 °C/105 °C
Temperature Range	-25 °C~90 °C
Bending Radius	4 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-826
NF F 16-101
BS 6853
EN45545-2

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

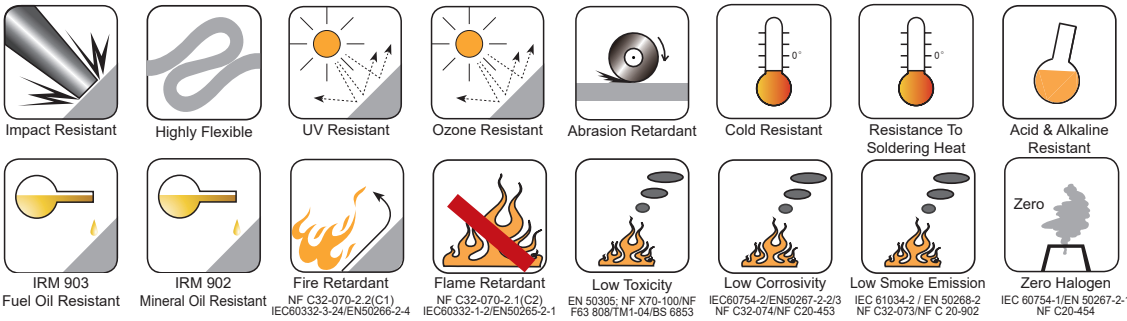
FRF-SW-1.5S 1500 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Overall Diameter		Weight
				Min.	Max.	
mm²	No/mm	mm	mm	mm	mm	kg/km
1.5	30/0.25	2.3	1.5	8.9	9.9	130
2.5	50/0.25	2.3	1.5	9.3	10.3	145
10.0	80/0.40	2.3	1.8	11.9	13.3	290
50.0	396/0.40	2.5	2.2	18.3	20.3	850
120.0	608/0.50	2.8	2.6	25.0	27.5	1770
150.0	756/0.50	2.8	2.6	26.7	29.3	2150
185.0	925/0.50	2.9	2.8	29.0	31.8	2530

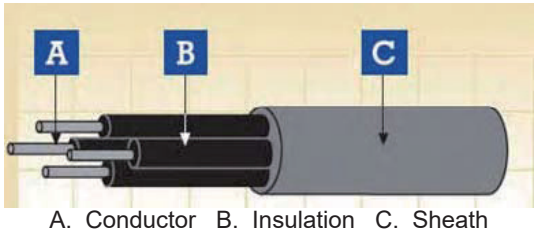
FRF-SW-3S 3000V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Overall Diameter		Weight
				Min.	Max.	
mm²	No/mm	mm	mm	mm	mm	kg/km
150.0	756/0.50	3.6	2.6	28.2	30.9	2270
185.0	925/0.50	3.7	2.8	30.5	33.4	2660

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Standard Wall Multicore Unscreened Cables 500 V NF F 63-826 (FRF-SW-05M)



A. Conductor B. Insulation C. Sheath

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for use in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 5

Insulation

Halogen free compound

Sheath

Halogen free compound

Electrical & Mechanical Properties

Nominal Voltage	500 V
Max. Conductor Temperature	90 °C/105 °C
Temperature Range	-25 °C~+90 °C
Bending Radius	4 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-826
NF F 16-101
BS 6853
EN45545-2

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

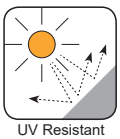
FRF-SW-05M 500 V

Number of Cores	Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Overall Diameter		Weight
				Min.	Max.	
-	mm²	No/mm	mm	mm	mm	kg/km
2	1.5	30/0.25	1.0	8.6	9.9	115
4	1.5	30/0.25	1.1	10.1	11.4	160
7	1.5	30/0.25	1.1	11.9	13.3	245
13	1.5	30/0.25	1.2	16.5	18.0	425
19	1.5	30/0.25	1.2	18.3	19.9	675
37	1.5	30/0.25	1.5	25.1	27.1	1170
2	2.5	50/0.25	1.1	10.0	11.3	185
4	2.5	50/0.25	1.2	11.7	13.1	275
13	2.5	50/0.25	1.4	19.5	21.1	750
19	2.5	50/0.25	1.4	21.6	23.4	980

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.


Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

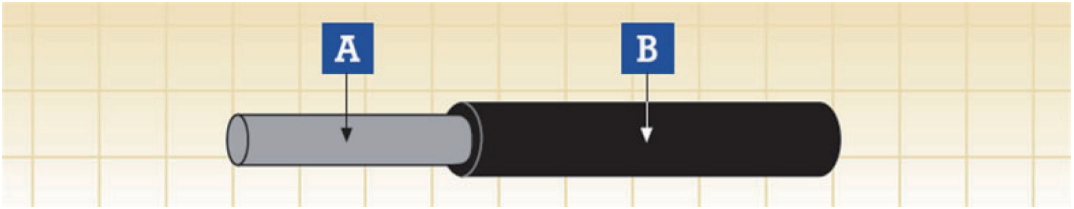

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL Extra-Flexible Standard Wall Single Core Unsheathed Cable 1500 V NF F 63-826 (FRF-SW-1.5SU-EF)



A. Conductor B. Insulation

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for use in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 6

Insulation

Special halogen free compound

Electrical & Mechanical Properties

Nominal Voltage	1500 V
Max. Conductor Temperature	90 °C/105 °C
Temperature Range	-25 °C~+90 °C
Bending Radius	3 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-826
NF F 16-101
BS 6853
EN45545-2

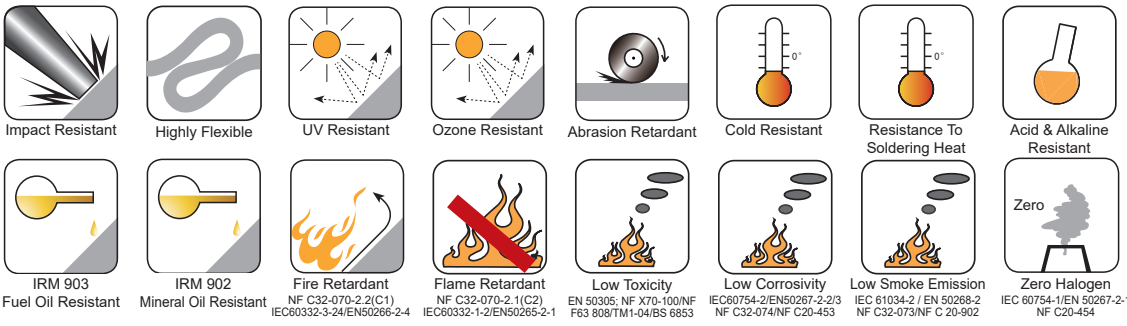
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

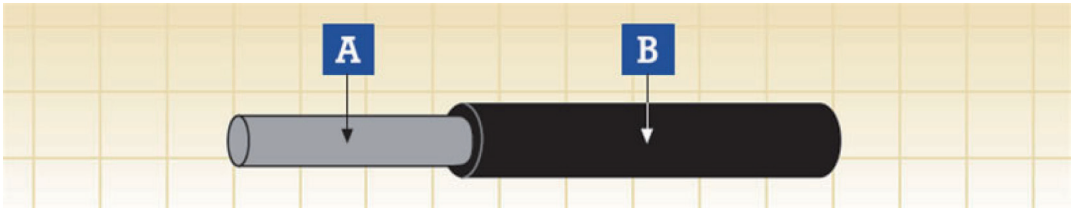
FRF-SW-1.5SU-EF 1500 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
10.0	320/0.20	2.3	8.4	9.5	187
16.0	512/0.20	2.3	9.7	10.8	266
25.0	800/0.20	2.3	11.0	12.2	354
35.0	1120/0.20	2.4	12.4	13.7	440
50.0	705/0.30	2.5	14.2	15.5	613
70.0	990/0.30	2.7	16.1	17.7	875
95.0	1340/0.30	2.7	18.0	19.8	1045
120.0	1690/0.30	2.8	20.0	21.9	1350
150.0	2123/0.30	2.8	21.8	23.8	1650
185.0	1470/0.40	2.9	23.7	25.9	2130

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Single Core Unsheathed Cables 250 V NF F 63-808 (FRF-TW-025SU)



A. Conductor B. Insulation

Application

These cables are used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor, suitable for use in cable harnesses, switchboards and control panels, driver desks etc

Construction

Conductor

Stranded tinned copper wires

Insulation

Radiation crosslinkable LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	250 V
Max. Conductor Temperature	105 °C/125 °C
Temperature Range	-40 °C~+105 °C
Bending Radius	5 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-808
NF F 16-101
BS 6853
DIN 5510
EN45545-2

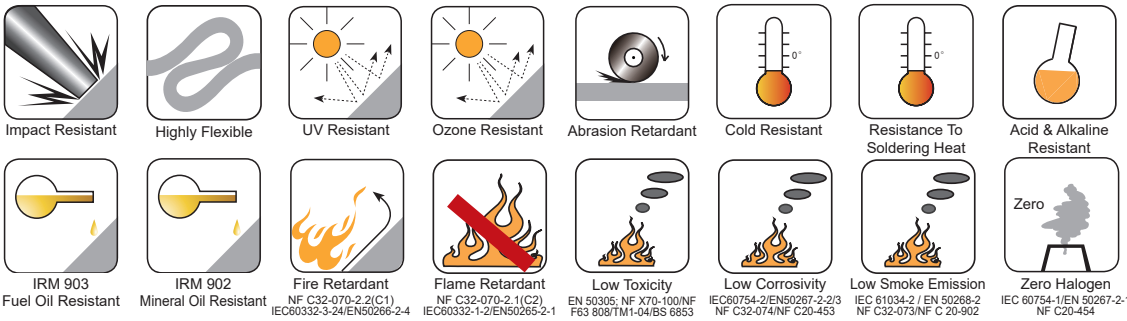
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

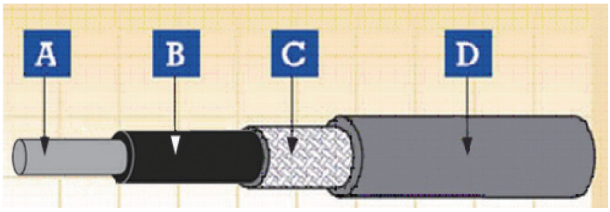
FRF-TW-025SU 250 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Overall Diameter		Weight
		Min.	Max.	
mm²	No/mm	mm	mm	kg/km
0.38	19/0.16	1.15	1.35	4.7
0.60	19/0.20	1.30	1.55	6.5
0.93	19/0.25	1.55	1.80	9.9
1.34	19/0.30	1.80	2.00	14.0
1.82	37/0.25	2.10	2.40	18.4
2.61	37/0.30	2.50	2.80	27.8
4.32	61/0.30	3.00	3.30	44.2

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Screened Single Core Cables With Standard Wall Sheath 250 V
NF F 63-808 (FRF-TW-025S-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

These cables are used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor, suitable for use in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires

Insulation

Radiation crosslinkable LSZH compound

Screen

Tinned copper braid

Sheath

Radiation crosslinkable LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	250 V
Max. Conductor Temperature	105 °C/125 °C
Temperature Range	-40 °C~+105 °C
Bending Radius	5 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-808
NF F 16-101
BS 6853
DIN 5510
EN45545-2

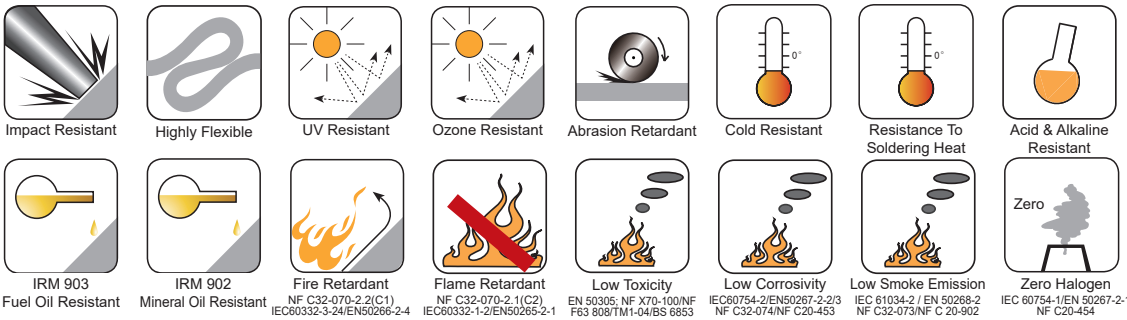
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

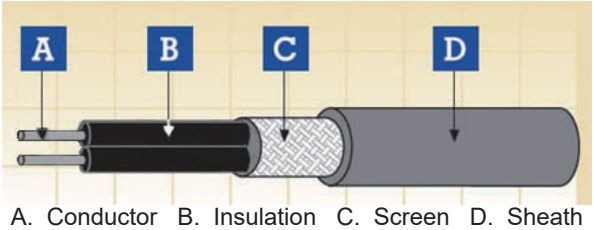
FRF-TW-025S-OS 250 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Overall Diameter		Weight
		Min.	Max.	
mm²	No/mm	mm	mm	kg/km
0.38	19/0.16	2.05	2.55	11.5
0.60	19/0.20	2.30	2.80	15.0
0.93	19/0.25	2.50	3.00	18.8
1.34	19/0.30	2.70	3.20	24.2
1.82	37/0.25	3.30	3.75	32.0
2.61	37/0.30	3.60	4.20	43.0
4.32	61/0.30	4.15	4.75	63.0

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Thin Wall Multicore Screened Cables With Standard Wall Sheath 250 V
NF F 63-808 (FRF-TW-025M-OS)



A. Conductor B. Insulation C. Screen D. Sheath

Application

These cables are used as signal and control cable for protected installations inside and outside of rail and transport vehicles, where space and weight are an important factor, suitable for use in cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor
Stranded tinned copper wires

Insulation
Radiation crosslinkable LSZH compound

Screen
Tinned copper braid

Sheath
Radiation crosslinkable LSZH compound

Electrical & Mechanical Properties

Nominal Voltage	250 V
Max. Conductor Temperature	105 °C/125 °C
Temperature Range	-40 °C~+105 °C
Bending Radius	5 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-808
NF F 16-101
BS 6853
DIN 5510
EN45545-2

Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

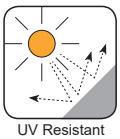
FRF-TW-025M-OS 250 V

Number of Cores	Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Overall Diameter		Weight
			Min.	Max.	
-	mm²	No/mm	mm	mm	kg/km
2	0.38	19/0.16	3.20	4.00	20.0
2	0.60	19/0.20	3.70	4.50	32.0
2	0.93	19/0.25	4.25	5.05	39.5
2	1.34	19/0.30	4.80	5.60	54.0
2	1.82	37/0.25	5.55	6.35	66.0
2	2.61	37/0.30	6.35	7.15	87.0
2	4.32	61/0.30	7.50	8.30	128.0
3	0.38	19/0.16	3.55	4.35	30.0
3	0.60	19/0.20	4.00	4.80	39.0
3	0.93	19/0.25	4.50	5.30	55.0
3	1.34	19/0.30	5.10	5.90	66.0
3	1.82	37/0.25	4.80	6.60	84.0
3	2.61	37/0.30	6.80	7.60	117.0
3	4.32	61/0.30	8.10	8.90	182.0
4	0.38	19/0.16	4.05	4.85	39.0
4	0.60	19/0.20	4.50	5.30	51.0
4	0.93	19/0.25	5.00	5.80	70.0
4	1.34	19/0.30	5.70	6.50	89.0
4	1.82	37/0.25	6.45	7.25	109.0
4	2.61	37/0.30	7.65	8.45	157.0
4	4.32	61/0.30	9.05	9.85	237.0

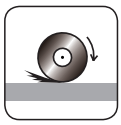
Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.

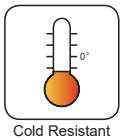

Corona Resistant


Highly Flexible


UV Resistant


Ozone Resistant


Abrasion Retardant


Cold Resistant


Resistance To Soldering Heat


Acid & Alkaline Resistant


IRM 903
Fuel Oil Resistant


IRM 902
Mineral Oil Resistant


Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

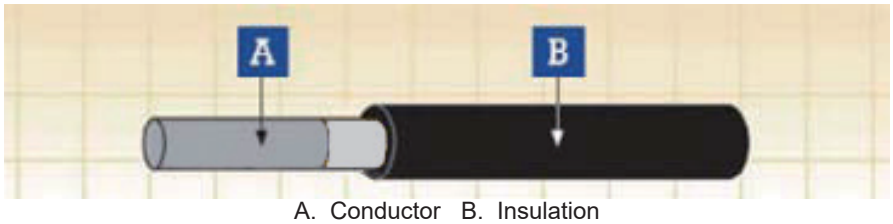

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

FIREROL High Temperature Single Core Unsheathed Cables 3000 V NF F 63-827 (FRF-HT-3SU)



A. Conductor B. Insulation

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for use in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 5

Separator

Polyester tape

Insulation

Halogen free silicone rubber

Electrical & Mechanical Properties

Nominal Voltage	3000 V
Max. Conductor Temperature	120 °C/140 °C
Temperature Range	-40 °C~+135 °C
Bending Radius	4 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-827
NF F 16-101
EN45545-2

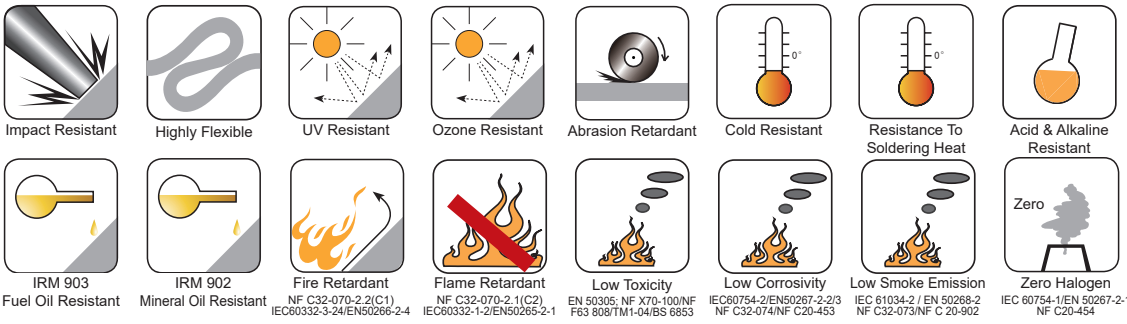
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

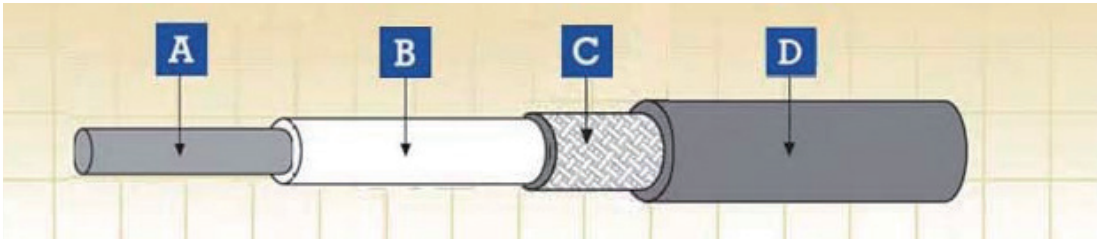
FRF-HT-3SU 3000 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
2.5	50/0.25	2.3	6.4	7.2	65
4.0	56/0.30	2.3	7.0	7.8	85
6.0	84/0.30	2.3	7.5	8.3	108
10.0	80/0.40	2.3	8.4	9.5	160
16.0	126/0.40	2.3	9.7	10.8	230
25.0	196/0.40	2.3	11.0	12.2	310
35.0	276/0.40	2.4	12.2	13.5	420
50.0	396/0.40	2.5	14.2	15.5	580
70.0	360/0.50	2.7	16.1	17.7	790
95.0	475/0.50	2.7	18.0	19.8	1030
120.0	608/0.50	2.8	20.0	21.9	1250
150.0	756/0.50	2.8	21.8	23.8	1560
185.0	925/0.50	2.9	23.7	25.9	1880
240.0	1221/0.50	3.1	26.6	29.1	2420

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



FIREROL Extra-Flexible High Temperature Single Core Screened & Sheathed Cables 3000 V
NF F 63-827 (FRF-HT-3S-EF)



A. Conductor B. Insulation C. Reinforcement D. Sheath

Application

These cables are used as power and control cable for protected installations inside and outside of rail and transport vehicles, where handling and installation cost are an important factor, suitable for used in control, auxiliary and main circuit wiring such as cable harnesses, switchboards and control panels, driver desks etc.

Construction

Conductor

Stranded tinned copper wires to IEC 60228 Class 6

Insulation

Halogen free silicone rubber

Reinforcement

Textile braid

Sheath

Halogen free silicone rubber

Electrical & Mechanical Properties

Nominal Voltage	3000 V
Max. Conductor Temperature	120 °C/140 °C
Temperature Range	-40 °C~135 °C
Bending Radius	3 × Overall Diameter

Fire Performance for Rolling Stock Application

NF F 63-827
NF F 16-101
EN45545-2

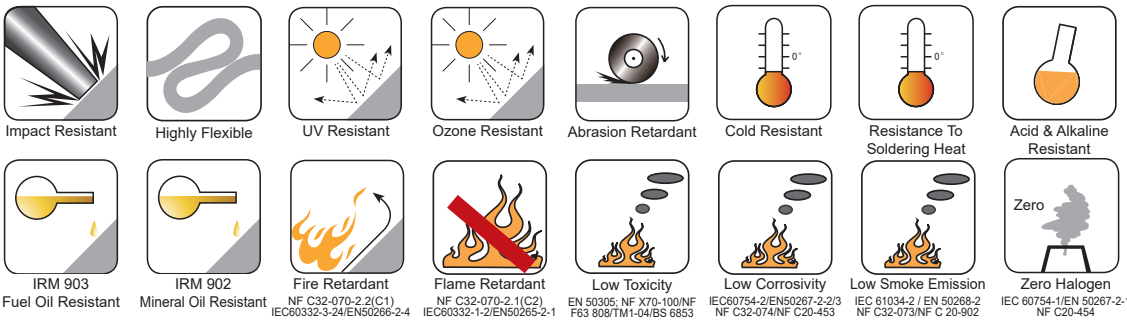
Fire Performance in General

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index
EN45545-2	Requirement for fire behavior of materials & components R15/R16

FRF-HT-3S-EF 3000 V

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Insulation Thickness	Overall Diameter		Weight
			Min.	Max.	
mm²	No/mm	mm	mm	mm	kg/km
25.0	800/0.20	2.8	12.0	13.2	390
35.0	1120/0.20	2.8	13.2	14.7	500
50.0	705/0.30	3.0	15.2	16.7	680
70.0	990/0.30	3.2	17.1	18.8	930
95.0	1340/0.30	3.2	19.0	21.0	1150
120.0	1690/0.30	3.3	21.0	23.1	1470
150.0	2123/0.30	3.3	22.8	25.0	1800
185.0	1470/0.40	3.4	24.7	27.1	2240
240.0	1905/0.40	3.6	27.6	31.2	2820

Note: The parameters listed above are nominal values as per cable standards. Actual values may vary due to material and manufacturing process variations. For precise specifications or customized requirements, please contact us for further information.



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