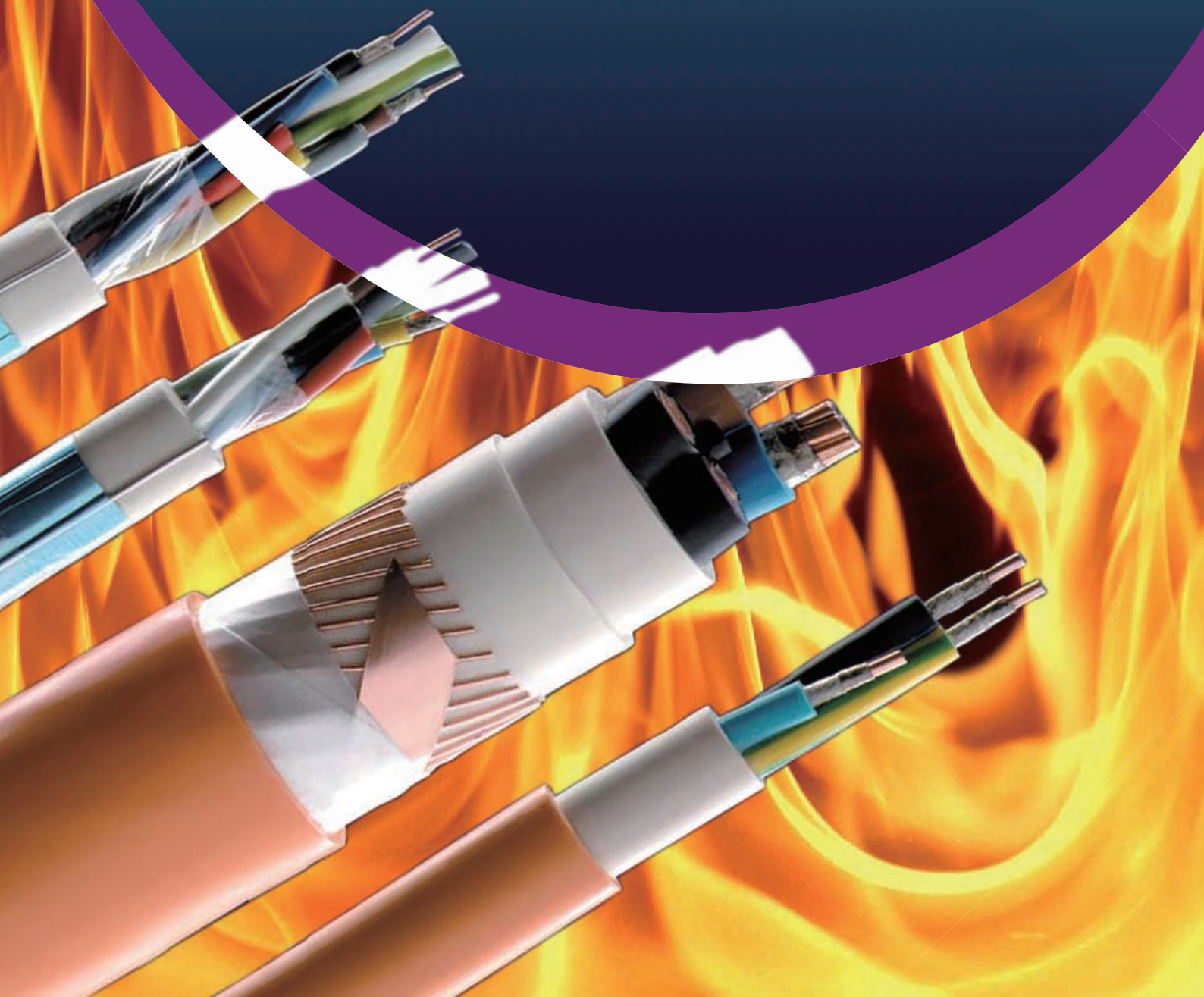
Caledonian

Fireflex
Fire Resistant Cable



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FIRE RESISTANT CABLES

In all fire disasters, fire smoke, heat and toxic fumes are the main obstacles to safe evacuation of a building or area. A major contribution towards overcoming these hazards is the use of fire resistant and non-halogenated cables.

Caledonian fire resistant cables, branded under Fireflex, provide the following features:

- Fire resistance
- Long-term circuit integrity in a fire
- Minimum smoke emission
- Flame retardance
- Reduced fire propagation
- Zero halogen

Fireflex cables are mainly used in the wiring of:

- Fire resistant safety circuits
- Public address and emergency voice communication systems in high-rise building
- Control and instrumentation services in industrial, commercial and residential complexes
- High-temperature installation conditions

CABLE CONSTRUCTION

Fireflex cables have been developed to maintain circuit integrity in a fire and to ensure maximum safe evacuation of personnel with no detrimental effects like toxic gases or smoke.

Fireflex cables are constructed in the following typical design:

- Solid/stranded annealed copper conductor
- Glass mica tape/silicone rubber as flame barrier
- XLPE/silicone rubber as insulation
- LSZH/flame retardant PVC as sheath

Fireflex cables are offered in either single core, multicore or multi-pair constructions. The insulation material can be elastomeric(EPR, SR), thermosetting (XLPE, LSZH) or thermoplastic (EVA, PVC) to meet different stringent environment requirement. The cables may be armoured or braided, with or without metallic screen, depending on different applications. Caledonian can provide PE, PU, PVC, SHF1, SHF2 or LSZH materials as outer sheath for different applications.

INTERNATIONAL STANDARD COMPLIANCE

The fire resistant cables manufactured by caledonian comply with either one or combination of the following standards.

What is Fire Resistance

In a fire, the electrical systems must be able to keep functioning for a suitable length of time. This is

particularly important for safety equipments used in emergency ventilation, emergency lighting, and alarm systems, together with the power supply to transport facilities and elevators.
Fire resistance means that the cable or the cable system where the cable is installed is capable to continue to operate even in case of fire for a specific period of time from 30 to 180 minutes.

Circuit integrity (Insulation integrity) refers to tests for the cables only. This is denoted by FE180 in some European countries such as Germany and Belgium. Functional integrity refers to tests on cables and systems (ladders, cable tray, clamps etc). It is denoted by E30, E60, E90 indicating the cable resistance for 30, 60 and 90 minutes according to a specific test and different installation systems.

The functional integrity and the circuit integrity are not related in any way as regards their content. The former is a system test and the circuit (insulation) integrity is an individual cable test. The integrated system test for functional integrity is regarded as a technical benchmark in the cable industry.

DESIGN STANDARD IN ACCORDANCE WITH DIFFERENT STANDARDS

BS 7629-1:2008 – Electric cables. Specification for 300/500V fire resistant screened cables having low emission of smoke and corrosive gases when affected by fire. Multicore and multipair cables.

This standard apply to cables with thermosetting insulation of rated voltage 300/500V which conform to the performance requirements for cables required to maintain limited circuit integrity under those fire conditions of BS 6387 specified as B, W and X. Those cables are intended for use in fire alarm and emergency lighting applications.

The cables are suitable for operation at a maximum sustained conductor temperature of 70°C although the insulation is suitable for operation at higher temperatures. Use at a temperature not exceeding 90°C is allowed for terminations within an enclosure providing the cable conductor temperature outside the enclosure does not exceed 70°C.

The standards apply to cables with a rated voltage of 300/500V, and
-two, three and four-core circular cables with uninsulated circuit protective conductor
-7,12 or 19 core with an uninsulated drain wire
-1,2,5,10,20 pairs having a collective metallic layer and drain wire.

They contain a metallic layer which provides electrostatic screening.

BS 7846:2009 – Electric cables. Thermosetting insulated, armoured, fire resistant cables of rated voltage 600/1000V, having low emission to smoke and corrosive gases when affected by fire.

Some circuits requiring an equivalent level of fire resistance need to be designed for larger cables than are found in BS 7629-1. Such circuits may be for the main emergency supply, fire fighting lifts, sprinkler system and water pumps, smoke extraction fans, fire shutters or smoke dampers. These larger cables are standardized in BS 7846 which covers the size range and LSZH performance under BS 6724. Through the use of mica tape to supplement the insulation, the cables can pass BS 6387 CWZ and additionally the ‘standard’ or ‘enhanced’ grade as specified in BS 5839-1.

The cables are intended for use in fixed installations in industrial areas, buildings and similar applications, where maintenance of power supply during a fire is essential and where the evolution of smoke and corrosive gases must be kept to a minimum.

The circuit integrity performance under fire conditions is assessed on the basis of various tests where resistance to fire, resistance to fire with water, and resistance to fire with mechanical shock are assessed separately or in combination. The cables are designated by the following categories:

Category F1- resistance to fire alone
Category F2- resistance to fire, resistance to fire with water, resistance to fire with mechanical shock, assessed separately.
Category F3- resistance to fire with mechanical shock and water assessed in combination.
The cables are wire armoured and
-two, three, four and five-core stranded copper conductor
-multicore auxiliary stranded copper conductor.

BS EN 60702 – Mineral insulated cables with a rated voltage not exceeding 750V.

BS EN 60702-1:2002 applies to mineral insulated general wiring cables with copper or copper alloy sheath and copper conductors and with rated voltage of 500V (light duty grade) and 750V(heavy duty grade). Provision is made for a corrosion resistant extruded outer covering over the copper sheath, when required. The standard sets out requirements for the optional outer covering, which includes requirements for halogen free covering and the thickness of the covering. The standard includes routine tests including a spark test on the outer covering. Sample tests includes such as flame retardance, emission of acidic and corrosive gases and smoke emission. Type tests such as fire resistance are included.

Mineral insulated cables are extremely resistant but rigid and a particular care has to be paid during installation to prevent moisture absorption by the mineral oxide.

500V grade cable includes the following conductor sizes:
- single and twin conductor cables up to 4mmsq csa
- three, four and seven conductor cables up to 2.5mmsq csa

750V grade cable provides for:
- single conductor cables up to 400mmsq csa
- two, three and four conductor cables up to 25mmsq csa
- seven conductor cables up to 4mmsq csa
- twelve conductor cables up to 2.5mmsq csa
- nineteen conductor cables up to 1.5mmsq csa

The fire related properties by the cable standards are summarised in the following table:

Cable Standard and type		Fire related properties	
BS 7629	Thermosetting insulated cables with limited circuit integrity when affected by fire	BS EN 50265-2-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 50268-2	Measurement of smoke density of electric cables burning under defined conditions.
		BS 6387 Cat B, W & X	Fire burning under defined conditions. Performance requirements for cables required to maintain integrity under fire conditions.
		BS EN 50267-2-1	Gases evolved during combustion of electric cables.
BS 7846	600/1000 V armoured electric cables having low emissions of smoke and corrosive gases when affected by fire	BS EN 50265-2-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 50266-2-4	Tests on electric cables under fire conditions - bunched cables.
		BS EN 50268-2	Measurement of smoke density of electric cables burning under defined conditions.
		BS EN 50267-2-1	Gases evolved during combustion of electric cables.
		BS 7846 Cat F1, F2 or F3	Performance requirements for cables required to maintain integrity under fire conditions.
BS EN 60702	Mineral insulated cables with a rated voltage not exceeding 750V	BS EN 50265-2-1	Tests on electric cables under fire conditions - single core cable.
		BS EN 50268-2 (for zero-halogen coverings)	Measurement of smoke density of electric cables burning under defined conditions.
		BS EN 50267-2-1(for zero-halogen coverings)	Gases evolved during combustion of electric cables.
		BS 6387 Cat C, W &Z	Performance requirements for cables required to maintain integrity under fire conditions.


CODE OF PRACTICE IN ACCORDANCE WITH DIFFERENT STANDARDS

BS 5839-1:2002+A2:2008 (Fire detection and fire alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance).

This standard provides recommendations for the planning, design, installation, commissioning and maintenance of fire detection and fire alarm systems in and around building, other than dwellings. It recommends the use of fire resisting cables for mains power supply circuit and all critical signal path in such systems. It does not recommend whether or not a fire alarm system should be installed in any given premises. Cables are described in clause 26. This standard introduces two different levels of resistance of cables during a fire(standard and enhanced grade).

BS 5839-6:2004 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings.

This code of practice covers every type of fire detection ‘system’, from a simple self-contained battery smoke alarm right through to major hard wired 24V systems.

BS 5839-6 also covers almost every conceivable type of premises, including:
Bungalows
Multi-storey houses
Individual flats
Individual maisonettes
Mobile homes
Individual sheltered accommodation
Houses in multiple occupation (HMOs)
NHS housing in the community

BS 5839-6 is primarily concerned with saving lives and reducing injuries. BS 5839-6 grades fire detection systems from Grade F up to Grade A. Generally speaking, the greater the fire risk and the more demanding the application, the more comprehensive the system needs to be.

BS 5839-8:2008 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.

Many people believe they can simply use their PA system to provide a voice message in the event of an emergency like a fire. Unfortunately PA systems, whilst very good for providing music and messages, are not guaranteed to work when there is an emergency. This is where the British Standard BS 5839 - 8:1998 on Voice Alarm comes into use, as it clearly defines the requirements of

a true VA system. A true VA system is a highly secure public address system which has the following features;

-All internal and external circuits are monitored for faults
-A minimum battery back up of 24 hours standby and 30 minutes alarm.
-A monitored secure link to a fire alarm panel
-A number of pre-recorded emergency messages
-Incorporates an emergency 'firemans' microphone

BS 5839-9:2011 - Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of emergency voice communication systems.

An emergency voice communication systems(EVCS) is a fixed, secure, bi-directional, full duplex voice communication system to assist fire fighters in an emergency in high rise buildings or large sites where radio communication may not work, and covers the operation of both fire telephones and disabled refuge systems. Where both systems are fitted to a building, Bs5839-9 specifies these should be a single system.

BS 5266-1:2005 - Emergency lighting. Code of practice for the emergency lighting of premises.

The purpose of emergency lighting, anti-panic lighting and standby lighting is to ensure that the main fire exit routes from a building or open and high risk areas are sufficiently lit in the case of a mains failure, in order to allow persons to safely evacuate the areas or premises. Manual fire alarm points, first aid points, fire fighting and safety equipment should also be clearly lit, so that it can be clearly identified.

Cables installed for these systems have to withstand to fire for at least 60 minutes according to BS EN 50200.

BS 8519:2010- Selection and installation of fire resistant power and control cable systems for life safety and fire fighting applications. Code of practice.

BS 8519 was introduced specifically to apply only to large and complex buildings and has been widely welcomed within the industry. The new standard offers guidance for the selection of fire resistant power and control cables in life safety and firefighting systems such as smoke barriers, sprinkler systems, fire fighting and evacuation lift supplies. Consequently, BS 8519 should increase the protection of emergency and fire personnel, as well as evacuees who may be inside a large or complex building when fire breaks out.

CIRCUIT (INSULATION) INTEGRITY IN ACCORDANCE WITH DIFFERENT STANDARDS

Circuit (insulation) Integrity in accordance with IEC 60331

IEC 60331 specifies tests for electric cable for circuit integrity under fire conditions. It is divided in following parts that describe the test modes, the conditions, and the equipment to use. The test was originally carried out only in fire alone for a period of 180 minutes at a temperature of 750°C.

To better simulate the real fire conditions, with mechanical stresses due to the fall of materials and with the presence of water, the testing conditions have been modified by changing the duration, increasing the temperature of the flame and by adding mechanical stresses and water spray.

IEC 60331-1 ed 1.0 (2009-05)- Part 1: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV and with an overall diameter exceeding 20mm.

IEC 60331-2 ed 1.0 (2009-05)- Part 2: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV and with an overall diameter not exceeding 20mm.

IEC 60331-3 ed 1.0 (2009-05)- Part 3: Test method for fire with shock at a temperature of at least 830°C for cables of rated voltage up to and including 0.6/1KV tested in a metal enclosure.

IEC 60331-11 ed1.01 Consol. with am1 (2009-07) – Part 11: Apparatus – Fire alone at a flame temperature of at least 750°C.

IEC 60331-12 ed1.01 Consol. with am1 (2009-07) – Part 12: Apparatus – Fire with shock at a flame temperature of at least 830°C.

IEC 60331-21 ed1.0 (1999-04) – Part 21: Procedures and requirements – Cables of rated voltage up to and including 0.6/1KV.

IEC 60331-23 ed1.0 (1999-04) – Part 23: Procedures and requirements – Electric Data Cables.

IEC 60331-25 ed1.0 (1999-04) – Part 25: Procedures and requirements – Optic Fiber Cables.

IEC 60331-31 ed1.0 (1999-04) – Part 31: Tests for electric cables for fire conditions and shock-Circuit integrity. Procedures and requirements for fire with shock – Cables of rated voltage up to and including 0.6/1KV.

IEC 60331-21/60331-23 A sample of the cable length of 1200mm sustained by two metal rings is mounted horizontally in a special ventilated cabin. During the test, to the wire cores of cable a voltage of the nominal value is applied (for telecommunication cables equal to 110 V), thereby creating a closed electric circuit. The sample is subjected to an action of linear gas burner with a length of 500mm and the flame temperature equal to 750°C till 800°C. The time of the fire is 180 minutes. Result of the test is considered positive if at that time will not be considered a short circuit in the circuit being researched.

IEC 60331-25 details a method to assess the circuit integrity of optical fiber cables. The standard specifies a ribbon burner and the recommended flame temperature is 750°C. The optical power meter is zeroed and the changes in attenuation during the 180 minutes burner application period are monitored. The maximum change in attenuation (a change from zero) is recorded during the burner application period. In the 15 minutes period after the flame application, a maximum attenuation is also recorded. Result of the test is considered positive if at that time will not be considered a short

circuit in the circuit being tested.

IEC 60331-31 applies to the cables with a diameter greater than 20mm, and introduces the standards and procedures for testing of cables exposed to fire and mechanical shock (equipment according to 60331-12). The test sample provides cable fragment length at least 1500mm. Bent wire on the U-shaped with a radius equal to the smallest permissible by the manufacturer, is mounted on a metal assay ladder. During the study, through all the cable wires is passed current with rated voltage and these cables are subjected to fire during 120min, where fire source is a gas burner set in conformity with standards, as well the mechanical shock of the 5 minutes interval. Result of the test is considered positive if at that time will not be considered a short circuit in the circuit being tested.

Circuit (insulation) Integrity in accordance with BS 6387:1994

BS 6387:1994 specifies the requrements for cables required to maintain circuit integrity under fire conditions. This is the first standard to include also mechanical stress and water stress in the fire resistance test of electric cables. BS 6387 standard is still used in many countries. Being different from EN 50200, Its limits is to require three different tests on three different cable samples.

The fire resistant cables are categorized by a letter symbol (e.g. A) or series of symbols (e.g. CWZ) according to the requirements for fire resistance characteristics which they meet, the test temperature selected and the duration of the test for resistance to fire alone in according to BS 6387 as below:

The test provides the basis for the following categories:

Test	Category
(1) Resistance to fire alone 650°C for 3 hours 750°C for 3 hours 950°C for 3 hours 950°C for 20 minutes (short duration)	 A B C S
(2) Resistance to fire with water Exposed to fire @ 650°C for 15 mins then exposed to fire @ 650°C with water for another 15 mins.	W
(3) Resistance to fire with mechanical shock Exposed to fire @ 650°C for 15 mins then exposed to fire @ 650°C with mechanical shock for 15 mins. Exposed to fire @ 750°C for 15 mins then exposed to fire @ 750°C with mechanical shock for 15 mins. Exposed to fire @ 950°C for 15 mins then exposed to fire @ 950°C with mechanical shock for 15 mins	 X Y Z

The most common test comprises the three categories C, W and Z.
–Category C is a fire resistance test in which the cable is exposed to a fire at a temperature of 950°C with a duration of 3 hours. under realistic conditions.
– Category W is a fire and water resistance test in which the cable is exposed to a fire at a temperature of 650°C and then for another 15 minutes to fire with water that is poured over the area around the cable. This simulates effect of water from a sprinkler that is activated during the fire.
-Category Z is a fire and mechanical stroke test in which the cable is installed in a defined manner on a vertical wall with three cable clips and subject to heat from a gas burner; mechanical shock is simulated by striking the cable with a hammer. The cable is exposed to a fire at a temperature of 950°C and then for another 15 minutes to fire with mechanical shock at a frequency of 2 strikes per minute.

During testing in all three categories, the cable is connected to a 400V three-phase power supply protected with a 3 A fuse on each phase. The test is regarded as successful if none of the fuses blow during the test period.

Circuit (insulation) Integrity in accordance with EN 50200:2006

EN 50200:2006 defines method of test for resistance to fire of unprotected small cables (up to 20mm) for use in emergency circuits.
In the adapted chamber is mounted a cable sample with a length of 1200mm, to which wire cores during the test a nominal value voltage is applied, creating thereby a closed circuit. During the test the cable is subjected to actions of the fire at conventional temperature 842°C and mechanical stroke for a specified period of time. The measured time of proper functioning of the cable corresponds to the so-called cable fire resistance class PH, which is also mentioned in the standard PN-B-02851-1 - Fire resistance tests of elements of buildings (Test method for thin wires with an outside diameter not greater than 20mm).

The test duration is expressed in minutes and is recorded in the following classification:

Test	Cattegory
Flame exposure for 15 minutes	PH 15
Flame exposure for 30 minutes	PH 30
Flame exposure for 60 minutes	PH 60
Flame exposure for 90 minutes	PH 90
Flame exposure for 120 minutes	PH 120

EN 50200 annex E also foresees the water stress (fire, mechanical shock & water spray), as previously provided by BS 8434-1 standard. EN 50200 is similar to IEC 60331-2. Being different from BS 6387, EN 50200 test the same samples simultaneously stressed by the flame action, by the mechanical shock and by water spray.

Circuit (insulation) Integrity in accordance with EN 50362:2003

EN 50362:2003 / BS EN 50362:2003 / DIN EN 50362:2003 / CEI EN 50362:2003 (CEI 20-36/5-0) defines method of test for resistance to fire of larger unprotected power and control cables for use in emergency circuits. This standard provides the same tests foreseen by IEC 60331-31 standards. (Flame Temperature of 830°C).

Circuit (insulation) Integrity in accordance with BS 5839-1:2002

The new edition of BS 5839-1:2002 (Fire detection and fire alarm systems for buildings. Code of practice for system design, installation, commissioning and maintenance) describes two level of fire performance for fire rated cabling for fire alarm system: Standard Grade and Enhanced Grade. In order to confirm the compliance of the cable to both categories, BS 5839-1 refers to EN 50200 and BS 8434-2003 Part 1 & 2. (Method of tests for the assessmeent of fire integrity of electricity cables). These tests are carried out to verify the circuit integrity of small cables exposed to flame, mechanical shock and water in accordance with the new fire alarm code of practice.

Standard Grade clause 26.2d
Maintenance of circuit integrity:
BS 8434-1:2003 at 830°C for 30 minutes,
15 minutes with fire and mechanical shock plus
15 minutes with fire, mechanical shock and water.
BS EN 50200 PH30
30 minutes at 830°C with fire and mechanical shock

Enhanced Standard Grade clause 26.2e
Maintenance of circuit integrity:
BS 8434-2:2003 at 930°C for 120 minutes,
60 minutes with fire and mechanical shock plus
60 minutes with fire, mechanical shock and water.
BS EN 50200 PH120 (improved)
120 minutes at 830°C with fire and mechanical shock

Circuit (insulation) Integrity in accordance with BS 8434-1:2003 & BS 8434-2:2003 + A2:2009

BS 8434- Methods of test for assessment of the fire integrity of electric cables Part1: Test for unprotected small cables for use in emergency circuits - BS EN 50200 with the addition of water spray. Part 2: Test for unprotected small cables for use in emergency circuits- BS EN 50200 with a 930°C flame and with water spray.

BS 8434-1:2003 defines test which is equivalent to BS EN 50200 with a 830°C flame and water spray. The cable is stressed by the flame at 830°C with mechanical shocks for 15 minutes and further 15 minutes with the addition of water spray. BS 8434-2:2003 defines test which is equivalent to BS EN 50200 with a 930°C flame and water spray. The cable is stressed by the flame at 930°C with mechanical shocks for 60 minutes and further 60 minutes with the addition of water spray. The tests for BS 8434-2 have not been covered in the BS EN 50200 standard yet and are still in force.

Circuit (insulation) Integrity in accordance with BS 8491:2008

BS8491:2008 Method for assessment of fire integrity of large diameter power cables for use as components for smoke and heat control systems and certain other active fire safety systems. This standard is related to cables included in BS 7346-6 and certain other active fire safety systems. It is applicable to cables of rated voltage not exceeding 600/1000V and overall diameter greater than 20mm. The test method in BS 8491-2008 includes subjecting the cable under test to radiation via direct impingement corresponding to a constant temperature attack of 842°C, to direct mechanical impacts corresponding to a force of approximately 10N and to direct application of a water jet simulating a water fire fighting jet. The test method given in this standard includes three different test durations to allow testing of cables intended for different applications.

Circuit (insulation) Integrity in accordance with DIN VDE 0472-814

DIN VDE 0472-814:1991 - Testing of cables. wires and flexible cords; continuance of insulation effect under fire conditions.

A test fire is applied horizontally from a distance of 60cm to a single suspended cable during a specified time. The test is passed when there was continuous circuit integrity and no extremely increased attenuation values during and after the test respectively. For instance FE 90 cables can endure at least 90 minutes, „FE“ stands for flame exposure. The fire test with circuit integrity shows how many minutes a mechanically unstressed connection at a flame exposure of minimum 750°C keeps minimum insulation efficiency (circuit integrity) in a dry environment.
Similar standard is IEC 60331 (FE) and BS 6387 Cat C. This is a fire test for insulation integrity without any mechanical and water stress.

Circuit (insulation) Integrity in accordance with NBN C 30-004 (cat. F3)

NB N C 32 004 – Fire Resistance of electric cables. Classification and test method.
The cable is stressed by the flame at 900°C with mechanical shocks every 30 seconds for a duration of 3 hours. The cable is deemed to pass the test if the current leakage does not exceed 1 amp per conductor. The test must be passed by 4 successive samples.

Circuit (insulation) Integrity in accordance with SS229-1

SS229-1 Fire resistant cables - Performance requirements for cables required to maintain circuit integrity under fire conditions.

Circuit (insulation) Integrity in accordance with CEI 20-36/2-1

CEI 20-36/2-1 Tests for electric cables under fire conditions-Circuit integrity - Part 21: Procedures and requirements- Cables of rated voltage up to and including 0.6/1KV.
This is equivalent to IEC 60331-21.

Circuit (insulation) Integrity in accordance with CEI 20-36/4-0

CEI 20-36/4-0 Method of test for fire resistance of small cables unprotected for use in emergency circuits. This is equivalent to CEI EN 50200.

Circuit (insulation) Integrity in accordance with NF C32-070-2.3(CR1)

The cable is installed in a stainless steel conduit and heated to 920°C ± 20°C according to a specified time curve. A voltage of 500 V AC or 1,000 V AC respectively is applied to the cable. To simulate mechanical shock, a small hammer strikes the pipe at a frequency of 2 strikes / min.

SYSTEM CIRCUIT (FUNCTIONAL) INTEGRITY IN ACCORDANCE WITH DIFFERENT STANDARDS

System Circuit (functional) Integrity in accordance with DIN 4102-12

Maintaining the function of electrical cable during the fire, defined as the concept of cable system is characterized by the German DIN 4102, part 12. DIN 4101-12 is a testing for functional integrity of entire electrical cable systems together with fastener components and shall be considered as the most rigorous, but on the other hand, as most closely simulating the real fire conditions,

DIN 4102-12 defines the requirements and testing method for fire resistance of electric cable system required to maintain circuit integrity. The standard defines testing for the functionality of so-called cable set, which consists of a group set of power cables, telecommunications, data cables etc. to be fixed to the support structure consisting of channels, ladders, cable tray ,items to hang, handles, etc. Cables attached to this structure are powered by their work voltage. Functional integrity will be tested for short-circuit of insulation or discontinuity of any wire core.

DIN 4102-12 is a realistic fire-chamber testing with minimum dimensions 2 x 3 x 2.5 m. (width/length/height). A complete cable installation is tested under realistic conditions. The effects of thermal expansion and mechanical load during a fire are taken into account. The temperature must follow the standard fire curve (ETK): At E 90, the system is tested for 90 minutes, with a flame temperatures reaching up to 1000°C during the test. The cable is installed in a furnace and mounted with cable trays and cable clips with guides. A voltage of 400 V AC is applied to the cable (or 110 V AC for telecommunications cables)
There are three categories of function maintenance as follows:
E30 - cable system function maintenance in case of fire for 30 minutes
E60 - cable system function maintenance in case of fire for 60 minutes
E90 - cable system function maintenance in case of fire for 90 minutes
The numbers in each case designate the period of time for which the integrity of the power circuit must be maintained.

It is worth noting that duration of the cable operation under test is determined not only by design and selection of used cable materials, but also and often primarily, the construction and selection of supporting structure materials, which is subject to deformation in high temperatures, and these deformations in turn tighten the cables attached to the structure.

System Circuit (functional) Integrity in accordance with NBN 713 020

The test specifies fire performance of building materials and products. The cables are installed in 3 x 3 testing room They are installed on cable trays and undergo the flame action up to 1000°C. The cables are then classified according to the maximum time for resistance to fire (denoted by Rf1, Rf 1 1/2, Rf2 in which the number represents the time duration).

FLAME RETARDANCE IN ACCORDANCE WITH DIFFERENT STANDARDS

The following standards specify a method for flame propagation test for single core cables. The single cable sample undergoes the flame action of a bunsen burner. The test only lasts few minutes.

The IEC 60332-1 standards are taken over as EN standards and transferred to national standards Example: IEC 60332-1 becomes EN 60332-1 and introduced in Germany as DIN EN 60332-1.

Flame Retardance in accordance with EN 60332:2004

EN 60332:2004 Tests on electrical and optical cables under fire conditions. The standard applies to single insulated wires (cables) and requires a vertical flame test with a maximum flame climb of 450mm. The test lasts between 1 and 8 minutes, depending on the cable diameter.

EN 60332-1-1:2004 / BS EN 60332-1-1:2004 / IEC 60332-1-1:2004 / DIN EN 60332-1-1:2004 / VDE 0482-1-1:2005-06 Test on electrical and optical cables under fire conditions. Test for a vertical flame propagation fo a single insulated wire or cables.

EN 60332-1-2:2004 / BS EN 60332-1-2:2004 / IEC 60332-1-2:2004 / DIN EN 60332-1-2:2004 / VDE 0482-1-2:2005-06 / CEI 60332-1-2(CEI 20-35/1-2) Tests on electrical and optical fiber cables under fire conditions. Test for a vertical flame propagation for a single insulated wire or cable – Procedure for 1kW premixed flame.

This standard specifies a method of test for resistance to vertical flame propagation for a single insulated wire or cable. Part 1-1 specifies the test apparatus and Part 1-2 specifies the test procedure.

The cable sample is deemed to pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50mm. In addition, a failure shall be recorded if burning extends downward to a point greater than 540mm from the lower edge of the top support.

EN 60332-1-2:2004 specifies the use of 1kW premix flame and is for general use, except that the procedure may not be suitable for the testing of small insulated conductors or cables of less than 0.5mm sq cross section because the conductor melts before the test is completed, or for the testing of small optic fiber cables because the fiber will be broken before the test is completed. In this case, the procedure given by EN 60332-2-1/2 is recommended.

EN 60332-2-1:2004 / BS EN 60332-2-1:2004 / IEC 60332-2-1:2004 / DIN EN 60332-2-1:2004 / VDE 0482-2-1:2005-06 Tests on electrical and optical cables under fire conditions. Test for a vertical flame propagation for a single small insulated wire or cable.

EN 60332-2-2:2004 / BS EN 60332-2-2:2004 / IEC60332-2-2:2004 / DIN EN 60332-2-2:2004 / VDE 0482-2-2:2005-06 / CEI 60332-2-2 (CEI 20-35/2-2) Test on electric and optical fiber cables under fire conditions. Tests for vertical flame propagation for a single small insulated wire or cable. Procedure for diffusion flame.
This test applies to small dimensions cables.

This standard specifies a method of test for resistance to vertical flame propagation for a single insulated wire or cable. Part 2-1 specifies the test apparatus and Part 2-2 specifies the test procedure.

Flame Retardance in accordance with NF C32-070-2.1(C2)

NF C32-070:2001 Insulated conductors and cables for installation - Classification tests on conductors and cables with regard to fire behavior.
NF C32-070 2.1 Procedure for 1 kW pre-mixed flame.

The NF F 32070 2.1 (Category C2) and IEC 60332-1-2 are very similar. The sole difference is the time during which the flame is applied.

Flame Retardance in accordance with EN 50265-1:1999 (replaced by EN 60332)

EN 50265-1:1999 / BS EN 50265-1:1999 / DIN EN 50265-1:1999 / VDE 0482-265-1:1999-04– Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Apparatus (Replaced by EN 60332-1-1:2004 and EN 60332-2-1:2004).

EN 50265-2-1:1999 / BS EN 50265-2-1:1999 / DIN EN 50265-2-1:1999 / VDE 0482-265-2-1:1999-04 – Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Part 2-1: Procedure 1kW pre-mixed flame (Replaced by EN 60332-1-2:2004).

EN 50265-2-2:1999 / BS EN 50265-2-2:1999 / DIN EN 50265-2-2:1999 / VDE 0482-265-2-2:1999-04 – Common test methods for cables under fire conditions. Test for resistance to a vertical flame propagation for a single insulated conductor or cable. Part 2-2: Procedure Diffusion flame (Replaced by EN 60332-2-2:2004).

Flame Retardance in accordance with BS 4066 Part 1 & 2 (replaced by EN 60332)

BS 4066-2:1980 (superseded) – Tests on electic cables under fire conditions. Method of test on a single vertical insulated wire or cable.

This standard is no longer in force and is replaced by BS EN 50265-2-1 which was also superseded by BS EN 60332-1:2009.

Flame Retardance in accordance with NBN C 30-004 (cat. F1)

NBN C 32-004 specifies a method of test for measuring the vertical flame propagation characteristics of a single wire or cable. The cable specimen is deemed to have passed the test and categorized as F1 if after burning has ceased, the charred or affected portion does not reach within 50mm of the lower edge of the top clamp which is equivalent to 425mm above the point of flame application.

Flame Retardance in accordance with IEEE 383

In the IEEE 383 test, cables are supported by a one foot wide vertical rack eight feet high. The cables are positioned in the centre six inches of the rack, spaced one-half diameter apart. The rack is centered in an eight foot enclosure. A ten inch ribbon burner ignites the cable with a 21 kW (70000 BTU). The burner is positioned 2 feet above the floor and 9 to 12 inches of cables are exposed to direct flames for 20 minutes. Cables on which flame extends above the top of the 8 foot rack fail the test.

REDUCED FIRE PROPAGATION IN ACCORDANCE WITH DIFFERENT STANDARDS

These standards specify a method for fire propagation test for vertically mounted bunched cables. These tests simulate the chimney effect in vertical installation of bunch of cables. A certain number of cable sections with a length of 3.5 m is fastened to a vertical ladder in an adapted chamber. The amount of combustible materials for cables and duration of flame application depends on the category the cable has to meet.

Resistance of the wires bundle arranged vertically to the spread of the flame should be such that after a certain time and stopping the source of ignition, flame is extinguished by itself and the length of charred fragments will not exceed 2.5 m in height measured above the lower edge of the burner.

Reduced Fire Propagation in accordance with IEC 60332-3

This test is the most common one to verify the behaviour of a cables for the fire propagation. The cables are installed on a bunch of vertical ladder inside a metal cabinet and undergo the action of a ribbon flame at 750°C.The standard is subdivided in several parts that differ one from the other for the quantity of cable to be installed, the installation mode and the flame application time.

EN 60332-3-10:2009 / BS EN 60332-3-10:2009 / IEC 60332-3-10 ed1.1 / DIN EN 60332-3-10:2009 / VDE 0482-332-3-10:2010-08 – Common test methods for cables under fire conditions. Tests on electric and optical fiber cables under fire conditions - Part 3-10: Test for vertical flame spread of vertically mounted bunched wires or cables.

EN 60332-3-21:2009 / BS EN 60332-3-21:2009 / IEC 60332-3-21 ed1.1 / DIN EN 60332-3-21 / VDE 0482-332-3-21:2010-08 / CEI EN 60332-3-21:2009 (CEI 20-22/3-1)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A . F/R
-Installation In one layer (front).
-Installation In two layers (front and rear)
-The quantity of the Installed cable is equal to 7 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-22:2009 / BS EN 60332-3-22:2009 / IEC 60332-3-22 ed1.1 / DIN EN 60332-3-22:2009 /VDE 0482-332-3-22:2010-08 / CEI EN 60332-3-22:2009 (CEI 20-22/3-2)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cable - Category A

-Installation In one layer (front).
-The quantity of the installed cable is equal to 7 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-23:2009 / BS EN 60332-3-23:2009 / IEC 60332-3-23 ed1.1 / DIN EN 60332-3-23:2009 / VDE 0482-332-3-23:2010-08 / CEI EN 60332-3-23:2009 (CEI 20-22/3-3)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-23: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category B

-Installation In one layer (front).
-The quantity of the installed cable is equal to 3.5 litres/m of combustible materials for cables
-The time of application of the flame is 40 minutes

EN 60332-3-24:2009 / BS EN 60332-3-24:2009 / IEC 60332-3-24 ed1.1 / DIN EN 60332-3-24:2009 / VDE 0482-332-3-24:2010-08 / CEI EN 60332-3-24:2009 (CEI 20-22/3-4) – Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category C

-Installation In one layer (front).
-The quantity of the installed cable is equal to 1.5 litres/m of combustible

materials for cables
-The time of application of the flame is 20 minutes

EN 60332-3-25:2009 / BS EN 60332-3-25:2009 / IEC 60332-3-25 ed1.1 / DIN EN 60332-3-25: 2009 / VDE 0482-332-3-25:2010-08 / CEI EN 60332-3-25:2009 (CEI 20-22/3-5)– Procedures. Tests on electric and optical fiber cables under fire conditions - Part 3-25: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category D
-Installation In one layer (front).
-The quantity of the installed cable is equal to 0.5 litres/m of combustible materials for cables
-The time of application of the flame is 20 minutes.

Summary of test condition:

IEC	60332-3-21	60332-3-22			60332-3-23		60332-3-24		60332-3-25	
BS EN 50266	50266-2-1	50266-2-2			50266-2-3		50266-2-4		50266-2-5	
CEI	20-22/3-1	20-22/3-2			20-22/3-3		20-22/3-4		20-22/3-5	
Category	AF/R	A			B		C		D	
Conductor cross-sections(mm^2)	＞35	＞35	≤35		＞35	≤35	＞35	≤35	＞35	≤35
NMV(litres per metre of cable)	7	7			3.5		1.5		0.5	
Minimum length of test pieces(m)	3.5	3.5			3.5		3.5		3.5	
Standard ladder (500 mm wide): • number of layers • maximum width of test sample	1front+1rear 300mm	≥1front 300mm	1front 300mm	- -	≥1front 300mm	1front 300mm	≥1front 300mm	1front 300mm	≥1front 300mm	
Wide ladder (800 mm wide): • number of layers • maximum width of test sample	- -	- -	- -	1front 600mm	- -		- -		- -	
Positioning of test pieces	Spaced 0.5×Diameter cable (Max.20mm)	Touching	Spaced 0.5×Diameter cable (Max.20mm)		Touching	Spaced 0.5×Diameter cable (Max.20mm)	Touching	Spaced 0.5×Diameter cable (Max.20mm)	Touching	
Number of burners	1	1	1	2	1		1		1	
Ladder mounting	Front and rear	Front, Wider ladder for larger cables			Front		Front		Front	
Flame application time(min)	40	40	40		40		40		40	
Test conditions	Wind speed: <8 m/s; Ternperature: 5°C - +40°C									
Extent of the charred portion	≤2.5m above the bottom edge of the burner, neither at the front nor at the rear of the ladder.									

Reduced fire propagation in accordance with NF C32-070-2.2(C1)

NF C32-070 :2001 Insulated conductors and cables for installation.
-Classification tests on conductors and cables with regard to fire behavior.

A 1600mm vertically installed bundled of cable is exposed to the effects of a radiating oven (approx 830°C) and forced ventilation. Pilot flames arranged above the oven burn off the emitted gases. The test duration is 30 minutes, with the ventilation stopped for every 10 minutes during the flame application period. The cable sample is classified under Category C1 according to NF F 32070-2.2 if the carbonised part of the cable sample does not extend more than 0.8m above the upper base of the oven.

Depending on the damaged length, they can be further classified into 4 classes A, B, C and D according to NF F 16-101 as follows:

Category	Test Result
A	No damaged length from top of the oven in upper position.
B	Damaged length from top of oven in upper position not extending more than 50mm.
C	Damaged length from top of oven in upper position not extending more than 300mm
D	Damaged length from top of oven in upper position not extending above the top of the chimney

Reduced Fire Propagation in accordance to EN 50266-1, EN 50266-2-2, EN 50266-2-3, EN 50266-2-4.

EN 50266-1:2001 / BS EN 50266-1:2001 / DIN EN 50266-1:2001 / VDE 0482-266-1:2001-09– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 1: Apparatus (Replaced by EN 60332-3-10:2009)

EN 50266-2-1:2001 / BS EN 50266-2-1:2001 / DIN EN 50266-2-1:2001 / VDE 0482-266-2-1:2001-09 / CEI EN 50266-2-1– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-1 : Procedures. Category A F/R (Replaced by EN 60332-3-21:2009)

EN 50266-2-2:2001 / BS EN 50266-2-2:2001 / DIN EN 50266-2-2:2001 / VDE 0482-266-2-2:2001-09 / CEI EN 50266-2-2– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-2: Procedures. Category A (Replaced by EN 60332-3-22:2009)

EN 50266-2-3:2001 / BS EN 50266-2-3:2001 / DIN EN 50266-2-3:2001 / VDE 0482-266-2-3:2001-09 / CEI EN 50266-2-1– Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-3: Procedures. Category B (Replaced by EN 60332-3-23:2009)

EN 50266-2-4:2001 / BS EN 50266-2-4:2001 / DIN EN 50266-2-4:2001 / VDE 0482-266-2-4:2001-09 / CEI EN 50266-2-4:2001 – Common test methods for cables under fire conditions. Test for vertical flame spread of vertically mounted bunched wires or cables - Part 2-4: Procedures. Category C (Replaced by EN 60332-3-24:2009).

Reduced Fire Propagation in accordance with BS 4066-3

BS 4066-3:1994 (superseded) – Tests on electic cables under fire conditions. Tests on bunched wires or cables.
This standard is no longer in force and is replaced by the BS EN 50266-1:2001

Reduced Fire Propagation in accordance with NBN C 32-004 (F2)

NBN C 32-004 specifies a method of test for measuring the vertical flame propagation characteristics of a bunch of cables. The cable specimen is deemed to have passed the test and categorized as F2 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.

HALOGEN CONTENT TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

In the event of a fire, many fumes are produced. This test is concerned with the possibilities of corrosive acid gases being released from halogen containing cables and the damage such cables can cause (to equipments). These standards specify a method for determination of the amount of halogen acid gas, evolved during combustion of compound.

Halogen Content Test in accordance with EN 50267-2-1

EN 50267-2-1:1998 / BS EN 50267-2-1:1999 / DIN EN 50267-2-1:1999 / VDE 0482-267-2-1:1999-04 / CEI EN 50267-2-1:1999 (CEI 20-37/2-1) Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-1: Procedures. Determination of the amount of halogen acid gas.

This part of the standard defines the method to measure the amount of halogen acid evolved and which should be expressed in hydrochloric acid. The amount of halogen acid contained in the test solution is determined by a titration method.

If the cables are described as zero halogen or halogen free, it is recommended that the hydrochoric acid yield should be less than 0.5%.

Halogen Content Test in accordance with IEC 60754-1

IEC 60754-1 ed 2.0 Common test methods for cables under fire conditions. Test on gases evolved during combustion of materials from cables. Part 1: Procedures. Determination of the amount of halogen acid gas.
Basically, this is same as EN 50267-2-1.

Halogen Content Test in accordance with BS 6425-1

BS 6425-1:1990(superseded): Test on gases evolved during the combustion of materials from cables. Method for determination of amount of halogen acid gas evolved during combustion of polmeric materials taken from cables.
This standard is no longer in force and is replaced by the EN 50267-2-1.

ACID GAS EMISSION TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The following standards specify a method for determination of acidity of gas evolved during

combustion of cables by measuring PH and conductivity. This test allows to determine the corrosivity of the acid gases generally halogens, that develop during the electric cable combustion.

Acid Gas Emission Test in accordance with EN 50267-2-2

EN 50267-2-2:1999 / BS EN 50267-2-2:1999 / DIN EN 50267-2-2:1999 / VDE 0482-267-2-2:1999-04 / CEI EN 50267-2-2:1999 (CEI 20-37/2-2). Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-2: Procedures. Determination of degree of acidity of gases for materials by measuring PH and conductivity.
The standard states that the pH and the conductivity of a test solution should be measured, using calibrated PH and conductivity meters.

If the cables are described as zero halogen or halogen free, it is recommended that at least both of the following requirements should be met for each of the individual materials of a cable:

-The PH value should not be less than 4.3 when related to 1 litre of water

-The conductivity should not be less than 10us/mm when related to 1 litre of water

EN 50267-2-3:1999 / BS EN 50267-2-3:1999 / DIN EN 50267-2-3:1999 / VDE 0482-267-2-3:1999-04 / CEI EN 50267-2-3:1999 (CEI 20-37/2-3). Common test methods for cables under fire conditions- Test on gases evolved during combustion of materials from cables- Part 2-3:Procedures. Determination of degree of acidity of gases for cables by determination of the weighted average of pH and conductivity.

The standard states that the pH and the conductivity of a test solution should be measured, using calibrated pH and conductivity meters. The results from the different components of the cable are then weighted.

Acid Gas Emission Test in accordance with IEC 60754-2

IEC 60754-2 ed1.0 Test on gases evolved during combustion of electric cables - Part 2 : Determination of degree of acidity of gases evolved during combustion of materials taken from electric cables by measuring pH and conductivity.

Acid Gas Emission Test in accordance with NF C32-074

NF C32-074 Common test methods for cables under fire conditions - Test on gases evolved during combustion of materials from cables. This standard is equivalent to IEC 60754-2

Acid Gas Emission Test in accordance with BS 6425-2

BS 6425-2:1993 (superseded) Test on gases evolved during the combusion of materials from cables. Determination of degree of acidity (corrosivity) of gases by measuring pH and conductivity.

This standard is no longer in force and is replaced by the EN 50267-2-2:1999.

Acid Gas Emission Test in accordance with DIN VDE 0472-813 / VDE 0472-813:1994

DIN VDE 0472-813 / VDE 0472-813:1994 Corrosivity of combustion gases.

The standards are no longer in force and are replaced by the EN 50267-2-2 & VDE 0482-267-2-2.

SMOKE DENSITY TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The smoke density measurement taken from a material under fire conditions gives an indication of the visibility through the smoke. This is important as reduced visibility in a real fire situation makes it more difficult to escape from the fire thus increasing the threat to human life from the toxic gas, fumes and heat.
The following standards specify the method for measuring the generation of smoke from cables during fire.

Smoke Density Test in accordance with IEC 61034-1 & IEC 61034-2

IEC 61034-1:2005 / EN 61034-1:2005 / BS EN 61034-1:2005 / DIN EN 61034-1:2006 / VDE 0482-1034-1:2006 Measurement of smoke density of cables burning under defined conditions. Part 1: Test apparatus

IEC 61034-2:2005 / EN 61034-2:2005 / BS EN 61034-2:2005 / DIN EN 61034-2:2006 / VDE 0482-1034-2:2006 / CEI EN 61034-2:2006 (CEI 20-37/3-1) Measurement of smoke density of cables burning under defined conditions.
Part 2: Test procedure and requirements.

The standard specifies a method of measurement of smoke density of cables. Part 1 specifies the test apparatus and Part 2 specifies the test procedure.

The test is usually performed inside a chamber of 3m x3m x3m and the test is sometimes described as 3 metre cube test. The test is performed by monitoring the tranmittance reduction of a white light beam, running from one side of the chamber to the other, at a set height, thus monitoring the build up of smoke inside the chamber. The minimum percentage of light transmittance is often used to determine if the cable has passed or failed the test , often a minimum light transmittance of 60% is applied in order to classify a cable as low smoke.

Smoke Density Test in accordance with NF C32- 073

NF C32 073 Common test methods for cables under fire conditions.
- Measurement of smoke density of cables burning under defined conditions.
This standard is equivalent to IEC 61034-2

Smoke Density Test in accordance with BS 7622-1 & BS 7622-2

BS 7622-1:1993 (superseded) – Measurement of smoke density of electric cables burning under defined condiitions. Test apparatus.
BS 7622-2:1993 (superseded) – Measurement of smoke density of electric cables burning under defined condiitions. Test procedure and requirements.

The standards are no longer in force and were replaced by the EN 50268-1:2000 and EN 50268-2:2000 even though they too were superseded by EN 61034-1:2005 and EN 61034-2:2005.

Smoke Density Test in accordance with EN 50268-1 & EN 50268-2

EN 50268-1:2000 / BS EN 50268-1:2000 / DIN EN 50268-1:2000 / VDE 0482-268-1:2000 (superseded) – Common test methods for cables under fire conditions. Measurement of smoke density of cable burning under defined conditions. Part 1: Apparatus
EN 50268-2:2000 / BS EN 50268-2:2000 / DIN EN 50268-2:2000 / VDE 0482-268-2:2000 (superseded) – Common test methods for cables under fire conditions. Measurement of smoke density of cable burning under defined conditions. Part 2: Procedure.
The standards are no longer in force and are replaced by the EN 61034-1:2005 and EN 61034-2:2005. Although these standards have been withdrawn, they are still called upon in some specification documents such as in the London Underground specification 1-085.

Smoke Density Test In Accordance with DIN VDE 0472-816 / VDE 0472-816:1994

DIN VDE 0472-816/VDE 0472-816:1994 Testing of cables, wires and flexible cords. Smoke Density.

The standards are no longer in force and are replaced by the EN 50268-1, VDE 0482-268-1, EN 50268-2 & VDE 0482-268-2 which are also replaced by the EN 61034-1:2005 and EN 61034-2:2005.

OXYGEN INDEX TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

The oxygen index is defined as the minimum concentration of oxygen, expressed as volume percentage, in a mixture of oxygen and nitrogen that will just support combustion of a material initially at room temperature under specified test conditions.

Oxygen Index Test in accordance with ASTM D 2863

ASTM D 2863-10 Measuring the minimum oxygen concentration to support candle-like combustion of plastics (Oxygen Index).

The test is performed in accordance with the procedure specified in ASTM 2863-95 using test piece cut from the outer sheath of the cable. The apparatus holds a small specimen which is clamped vertically in a tube in an atmosphere where the relative concentration of oxygen and nitrogen can be changed. The aim is to test the flammability of the sample with a small pilot flame to find the minimum oxygen concentration required to just sustain combustion of the sample.

Oxygen Index Test in accordance with ISO 4589-2

ISO4589-2:1996 Determination of burning behaviour by oxygen index Part 2: Ambient temperature test.
Specimens measuring 100mm long by 6mm wide are used for testing. The test is performed in accordance with the procedure specified in the standard.

TEMPERATURE INDEX TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

This is a test for assessing the performance of a material when it is tested in accordance with BS2782: Part 1: Method 143a and 143b. The oxygen index of a material will drop when the temperature rises. When the temperature rises and the oxygen index drops to 21%, the material will burn

automatically. This temperature is defined as temperature index. For example, the oxygen index of the coal at room temperature is 50% and when the temperature climbs to 150°C, it's oxygen index drops to 21°C and the coal will burn by itself automatically. The temperature index of the coal is defined as 150°C. In general, the temperature index of fire retardant cable exceeds 250°C.

Temperature Index Test in accordance with BS 2782

BS 2782: Part 1:1989 Method 143a and 143b Temperature of materials. Determination of flammability.
Specimens measuring nominally 100mm long by 6.5mm wide by 3mm thick are used for testing. The specimens are then tested in accordance with the test procedure specified in the standard.

Temperature Index Test in accordance with ISO 4589-3

ISO4589-3:1996 Determination of burning behaviour by oxygen index Part 3: Elevated temperature test.
Specimens measuring 100mm long by 6mm wide are used for testing. The test is performed in accordance with the procedure specified in the standard.

TOXICITY TEST IN ACCORDANCE WITH DIFFERENT STANDARDS

Toxicity test in accordance with NES 02-713

Measuring a fume from a material exposed to a controlled fire conditions gives an indication of the fumes which may be produced in a real fire situation. A standard method of test for determining the toxicity of materials under fire condition is Defense Standard NES 02-713- Toxicity. This method gives the level of toxicity of the fumes produced from the material under test. During the test, the test specimen is heated via direct flame application at 1150°C.

The flame is applied via a bunsen burner with a flame height of between 100m and 125mm formed with a methane gas and an external supply of compressed air. The specimen toxicity is determined from accurate pre-analysis weight (4pp) colorimetric tubes and ion chromatography.

The test may determine the following species: Hydrogen Bromide, Hydrochloric Acid, Hydrogen Fluoride, Formaldehyde, Nitrous gases, Carbon Monoxide, Carbon Dioxide, Acrylonitrile, Phenol,
Hydrogen Sulphide, Sulphur Dioxide, Hydrocyanic Acid, Ammonia. The concentration in ppm for each gas detected are provided. The toxicity index of the speciments summates the toxic gases, taking into account of their level of danger to humans. The smaller the toxicity index, the better the product. A limit of 5 is often applicable.

Toxicity test in accordance with NF C 20-454

NF C 20-454 base environmental testing procedures. Fire behaviour. Analysis and titration of gases evolved during pyrolysis or combustion of materials used in electrotechnics. Exposure to abnormal heat or fire. Tube furnace method.

The test defined by this standard serves to define the conventional toxicity index (cti) of the gases emitted by the insulating or sleeving materials during combustion at 800°C.

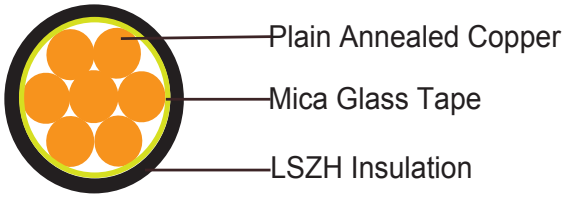
Toxicity test in accordance with NF X 70-100

NF X 70-100 Fire Tests; Analysis of gaseous effluents.

The test is conducted within a tube furnace where the temperature is set at either 400°C, 600°C, 800°C (commonly 600°C is used for most of the materials or 800°C for some electrical products) for 40 minutes throughout the test by analysis of the toxicity index of the gases including CO, CO_2, HCL, HBr, HCN, HF and SO_2.

450/750V & 600/1000V Mica+LSZH Insulated Power Cables (Single Core)

FFX100 07mZ1-R (CU/MGT+LSZH 450/750V Class 2)
FFX100 1mZ1-R (CU/MGT+LSZH 600/1000V Class 2)



APPLICATION

This cable is used in fire extinguishing systems, sprinklers, control panels, and exit lights in high-rise buildings, hotels, hospitals, sub-ways, and public facilities.

STANDARDS

Basic design to BS 7211

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

450/750V & 600/1000V

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2
Fire Barrier: Mica glass tape
Insulation: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour as per BS7671

	With Earth Conductor	Without Earth Conductor
2Cores	-	Brown, Blue
3Cores	Yellow/Green, Brown, Blue	Brown, Gray, Black
4Cores	Yellow/Green, Brown, Gray, Black	Brown, Gray, Black, Blue
5Cores	Yellow/Green, Brown, Gray, Black, Blue	Brown, Gray, Black, Blue, Black
above 5 Cores	Yellow/Green, Black Numbered	Black Numbered

Sheath Colour: Black (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	600/1000V: 3500 V r.m.s. x 5' (core/core); 450/750V: 2500 V r.m.s. x 5' (core/core)
Insulation resistance	20 MΩ x km (at 20°C)
Short circuit temperature	250°C

CONSTRUCTION PARAMETERS

Conductor		FFX100 07mZ1-R			FFX100 1mZ1-R		
Nominal Cross Section Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight
mm^2	No./mm	mm	mm	kg/km	mm	mm	kg/km

1.5	7/0.53	0.7	3.5	25	0.8	3.8	30
2.5	7/0.67	0.8	4.1	35	0.8	4.2	40
4	7/0.85	0.8	4.6	52	1	5.3	70
6	7/1.04	0.8	5.2	72	1	6	96
10	7/1.35	1	6.5	120	1	6.6	130
16	7/1.70	1	7.6	180	1	7.7	200
25	7/2.14	1.2	9	275	1.2	9.1	290
35	7/2.52	1.2	10.2	370	1.2	10.3	390
Conductor		FFX100 07mZ1-R			FFX100 1mZ1-R		
Nominal Cross Section Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight
mm^2	No./mm	mm	mm	kg/km	mm	mm	kg/km
50	19/2.52	1.4	11.8	500	1.4	11.9	520
70	19/2.14	1.4	13.4	700	1.4	13.5	730
95	19.2.52	1.6	15.8	980	1.6	15.9	990
150	37/2.52	1.8	18.8	1500	1.8	18.9	1520
185	37/2.52	2	21	1900	2	21.2	1900
240	37/2.52	2.2	25.7	2500	2.2	25.8	2550
300	37/2.52	2.4	28.6	3140	2.4	28.8	3150
400	61/2.85	2.6	32	4000	2.6	32.2	4000
500	61/3.20	2.8	35.5	5000	2.8	35.7	5000
630	127/2.52	2.8	39.5	6300	2.8	39.7	6360

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

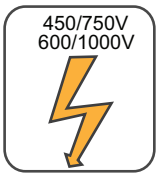
Conductor cross-section area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray, horizontal or vertical)		Reference Method 12 (free air)		
									Horizontal flat spaced	Vertical flat spaced	Trefoil
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c. flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single -phase a.c. or d.c. or flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three phase	2 cables, single-phase a.c. or d.c. or 3 cables three phase	3 cables, trefoil 3-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	A	A	A	A	A	A	A	A	A	A
1.5	18	17	22	19	25	23	-	-	-	-	-
2.5	24	23	30	26	34	31	-	-	-	-	-
4	33	30	40	35	46	41	-	-	-	-	-
6	43	39	51	45	59	54	-	-	-	-	-
10	58	53	71	63	81	74	-	-	-	-	-
16	76	70	95	85	109	99	-	-	-	-	-
25	100	91	126	111	143	130	158	140	183	163	138
35	125	111	156	138	176	161	195	176	226	203	171
50	149	135	189	168	228	209	293	215	274	246	209
70	189	170	240	214	293	268	308	279	351	318	270
95	228	205	290	259	355	326	375	341	426	389	330
120	263	235	336	299	413	379	436	398	495	453	385
150	300	270	375	328	476	436	505	461	570	524	445
185	341	306	426	370	545	500	579	530	651	600	511
240	400	358	500	433	644	590	686	630	769	711	606
300	459	410	573	493	743	681	794	730	886	824	701
400	-	-	684	584	868	793	915	849	1065	994	820
500	-	-	783	666	990	904	1044	973	1228	1150	936
630	-	-	900	764	1130	1033	1191	1115	1423	1338	1069

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2 cables d.c.	2 cables, single-phase a.c.		3 or 4 cables, 3-phase a.c.		
		Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)	Ref. Methods 1 and 11 (clipped direct or on trays touching)	Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)	Ref. Methods 1, 11 and 12 (in trefoil)	Ref. Methods 1 and 11 (Flat and touching)

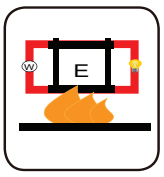
1	2	3			4			5			6			7		
mm^2	mV/A/m	mV/A/m			mV/A/m			mV/A/m			mV/A/m			mV/A/m		
1.5	31		31			27			27			27			27	
2.5	19		19			16			16			16			16	
4	33		12			10			10			10			10	
6	7.8		7.9			6.8			6.8			6.8			6.8	
10	4.7		4.7			4.7			4			4			4	
16	2.9		2.9			2.9			2.5			2.5			2.5	
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
25	1.85	1.6	0.31	1.9	1.85	0.19	1.85	1.6	0.27	1.65	1.6	0.165	1.6	1.6	0.19	1.6
35	1.35	1.35	0.29	1.35	1.35	0.18	1.35	1.15	0.25	1.15	1.15	0.155	1.5	1.15	0.18	1.15
50	0.99	1	0.29	1.05	0.99	0.18	1	0.87	0.25	0.9	0.86	0.155	0.87	0.86	0.18	0.87
70	0.68	0.7	0.28	0.75	0.68	0.175	0.71	0.6	0.24	0.65	0.59	0.15	0.61	0.59	0.175	0.62
95	0.49	0.51	0.27	0.58	0.49	0.17	0.52	0.44	0.23	0.5	0.43	0.145	0.45	0.43	0.17	0.46
120	0.39	0.41	0.26	0.48	0.39	0.165	0.43	0.35	0.23	0.42	0.34	0.14	0.37	0.34	0.165	0.38
150	0.32	0.33	0.26	0.43	0.32	0.165	0.36	0.29	0.23	0.37	0.28	0.14	0.31	0.28	0.165	0.32
185	0.25	0.27	0.26	0.37	0.26	0.165	0.3	0.23	0.23	0.32	0.22	0.14	0.26	0.22	0.165	0.28
240	0.19	0.21	0.26	0.33	0.2	0.16	0.25	0.185	0.22	0.29	0.17	0.14	0.22	0.17	0.165	0.24
300	0.155	0.175	0.25	0.31	0.16	0.16	0.22	0.15	0.22	0.27	0.14	0.14	0.195	0.135	0.16	0.21
400	0.12	0.14	0.25	0.29	0.13	0.155	0.2	0.125	0.22	0.25	0.11	0.135	0.175	0.11	0.16	0.195
500	0.093	0.12	0.25	0.28	0.105	0.155	0.185	0.1	0.22	0.24	0.09	0.135	0.16	0.088	0.16	0.18
630	0.072	0.1	0.25	0.27	0.086	0.155	0.175	0.088	0.21	0.23	0.074	0.135	0.15	0.071	0.16	0.17

Note : r = conductor resistance at operating temperature
x = reactance
z = impedance



Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24
EN50266-2-4

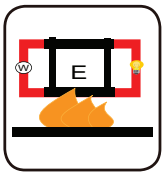

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

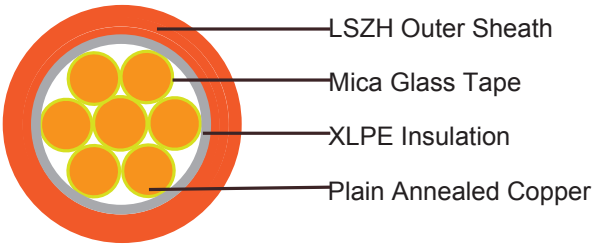
Halogen Free
IEC60754-1/
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V Mica+XLPE Insulated, LSZH Sheathed Power Cables (Single Core)

FFX300 05mRZ1-R (CU/MGT+XLPE/LSZH 300/500V Class 2)



APPLICATION

The cables are designed for areas where the integrity of the electrical circuit is critical in maintaining power supply. Applications can be found in emergency lightings, control and power circuits, power stations, fire alarm systems, underground tunnels, lifts, escalators, and high-rise buildings.

STANDARDS

Basic design to IEC 60502-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

300/500 V

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound
Earth Conductor(optional): Uninsulated solid or stranded tinned copper conductor.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour as per BS7671

	With Earth Conductor	Without Earth Conductor
2Cores	-	Brown, Blue
3Cores	Yellow/Green, Brown, Blue	Brown, Gray, Black
4Cores	Yellow/Green, Brown, Gray, Black	Brown, Gray, Black, Blue
5Cores	Yellow/Green, Brown, Gray, Black, Blue	Brown, Gray, Black, Blue, Black
above 5 Cores	Yellow/Green, Black Numbered	Black Numbered

Sheath Colour: Black (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation resistance	1000 MΩ x km (at 20°C)
Short circuit temperature	250°C

CONSTRUCTION PARAMETERS

Conductor		FFX300 05mRZ1-R			
Nominal Cross Section Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Without Earth Conductor	
				Nominal Overall Diameter	Approx. Weight
mm^2	No./mm	mm	mm	mm	kg/km
1.5	7/0.53	0.5	0.5	4.4	29
2.5	7/0.67	0.5	0.5	4.9	40
4	7/0.85	0.5	0.5	5.5	55

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C
Current-Carrying Capacities (Amp)

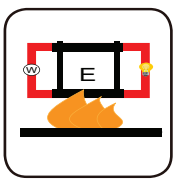
Conductor cross-section area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray, horizontal or vertical)		Reference Method 12 (free air)		
									Horizontal flat spaced	Vertical flat spaced	Trefoil
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c. flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three phase	2 cables, single-phase a.c. or d.c. or 3 cables three phase	3 cables, trefoil 3-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	A	A	A	A	A	A	A	A	A	A
1.5	18	17	22	19	25	23	-	-	-	-	-
2.5	24	23	30	26	34	31	-	-	-	-	-
4	33	30	40	35	46	41	-	-	-	-	-

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2 cables d.c.	2 cables, single-phase a.c.		3 or 4 cables, 3-phase a.c.		
		Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)	Ref. Methods 1 and 11 (clipped direct or on trays touching)	Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)	Ref. Methods 1, 11 and 12 (in trefoil)	Ref. Methods 1 and 11 (Flat and touching)
1	2	3	4	5	6	7
mm^2	mV/A/m	mV/A/m	mV/A/m	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27	27	27	27
2.5	19	19	16	16	16	16
4	33	12	10	10	10	10

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

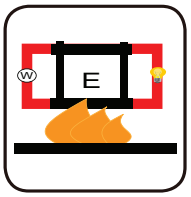

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

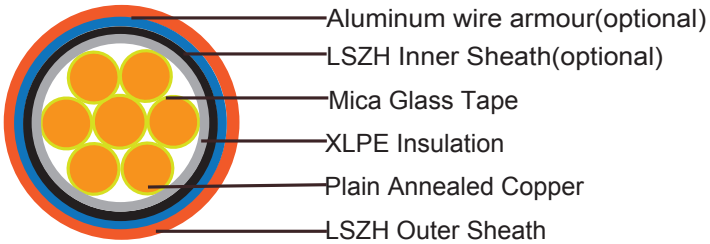
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

600/1000V Mica+XLPE Insulated, LSZH Sheathed Power Cables (Single-Core)

FFX300 1mRZ1-R (CU/MGT+XLPE/LSZH 600/1000V Class 2)
FFX300 1mRMZ1-R (CU/MGT+XLPE/LSZH/AWA/LSZH 600/1000V Class 2)



APPLICATION

This cable is designed for areas where the integrity of the electrical circuit is critical in maintaining power supply. Applications can be found in emergency lightings, control and power circuits, power stations, fire alarm systems, underground tunnels, communications systems, sewage treatment plants, lifts, escalators, and high-rise buildings.

STANDARDS

Basic design to IEC 60502-1 / BS 6724

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

600/1000 V

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound
Inner Sheath (optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Armouring (optional): Aluminum wire armour
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour as per BS7671

	With Earth Conductor	Without Earth Conductor
2Cores	-	Brown, Blue
3Cores	Yellow/Green, Brown, Blue	Brown, Gray, Black
4Cores	Yellow/Green, Brown, Gray, Black	Brown, Gray, Black, Blue
5Cores	Yellow/Green, Brown, Gray, Black, Blue	Brown, Gray, Black, Blue, Black
above 5 Cores	Yellow/Green, Black Numbered	Black Numbered

Sheath Colour: Black (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter (unarmoured cable)
10 x Overall Diameter (armoured cable)

ELECTRICAL PROPERTIES

Dielectric test:	3500 V r.m.s. x 5' (core/core)
Insulation resistance	1000 MΩ x km (at 20°C)
Short circuit temperature	250°C

CONSTRUCTION PARAMETERS

Conductor				FFX300 1mRZ1-R		FFX300 1mRMZ1-R	
Nominal Cross Section Area	No./ Nominal Diameter of Strands	Dia. of Conductor	Nominal Insulation Thickness	Unarmoured Cable		Armoured Cable	
				Approx. Overall Diameter	Approx. Weigh	Approx. Overall Diameter	Approx. Weight
mm^2	No./mm	mm	mm	mm	kg/km	mm	kg/km

1.5	7/0.53	1.59	0.7	6.5	54	-	-
2.5	7/0.67	2.01	0.7	6.8	67	-	-
4	7/0.85	2.55	0.7	7.5	86	-	-
6	7/1.04	3.12	0.7	8.1	110	-	-
10	7/1.35	4.05	0.7	9.2	155	-	-
16	7/1.70	5.1	0.7	10.2	220	-	-
25	7/2.14	6.42	0.9	11.9	325	-	-
35	19/1.53	7.65	0.9	13.2	425	-	-
50	19/1.78	8.9	1	14.6	600	18.5	780
70	19/2.14	10.7	1.1	16.6	820	20.5	1010
95	19/2.52	12.6	1.1	18.7	1100	23	1320
120	37/2.03	14.21	1.2	20.5	1350	24.5	1610
150	37/2.25	15.75	1.4	22.7	1640	27	2010
185	37.2.52	17.64	1.6	25.5	2040	29.5	2440
240	61/2.25	20.25	1.7	28.5	2650	34.5	3060
300	61/2.52	22.68	1.8	31.5	3260	36.9	3690
400	65/2.85	25.65	2	35.4	4130	41.5	4780
500	61/3.20	28.8	2.2	39	5200	45.5	5970
630	127/2.52	32.76	2.4	43.5	6600	50.5	7530
800	127/2.85	37.05	2.6	48.5	8300	56.8	9680
1000	127/3.20	41.6	2.8	53.5	10000	61.5	11980

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C
FFX300 1mRZ1-R
Current-Carrying Capacities (Amp)

Conductor cross-section area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray, horizontal or vertical)		Reference Method 12 (free air)		
									Horizontal flat spaced	Vertical flat spaced	Trefoil
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c	3 or 4 cables, 3-phase a.c.	2 cables, single-phase a.c. or d.c. flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or flat and touching	3 or 4 cables, 3-phase a.c. flat and touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three phase	2 cables, single-phase a.c. or d.c. or 3 cables three phase	3 cables, trefoil 3-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
mm^2	A	A	A	A	A	A	A	A	A	A	A
1.5	18	17	22	19	25	23	-	-	-	-	-
2.5	24	23	30	26	34	31	-	-	-	-	-

4	33	30	40	35	46	41	-	-	-	-	-
6	43	39	51	45	59	54	-	-	-	-	-
10	58	53	71	63	81	74	-	-	-	-	-
16	76	70	95	85	109	99	-	-	-	-	-
25	100	91	126	111	143	130	158	140	183	163	138
35	125	111	156	138	176	161	195	176	226	203	171
50	149	135	189	168	228	209	293	215	274	246	209
70	189	170	240	214	293	268	308	279	351	318	270
95	228	205	290	259	355	326	375	341	426	389	330
120	263	235	336	299	413	379	436	398	495	453	385
150	300	270	375	328	476	436	505	461	570	524	445
185	341	306	426	370	545	500	579	530	651	600	511
240	400	358	500	433	644	590	686	630	769	711	606
300	459	410	573	493	743	681	794	730	886	824	701
400	-	-	684	584	868	793	915	849	1065	994	820
500	-	-	783	666	990	904	1044	973	1228	1150	936
630	-	-	900	764	1130	1033	1191	1115	1423	1338	1069
800	-	-	-	-	1288	1179	1358	1275	1580	1485	1214
1000	-	-	-	-	1443	1323	1520	1436	1775	1671	1349

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2 cables d.c.	2 cables, single-phase a.c.						3 or 4 cables, 3-phase a.c.								
		Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)			Ref. Methods 1 and 11 (clipped direct or on trays touching)			Ref. Methods 3 and 4 (enclosed in conduit etc, in or on a wall)			Ref. Methods 1, 11 and 12 (in trefoil)			Ref. Methods 1 and 11 (Flat and touching)		
1	2	3			4			5			6			7		
mm²	mV/A/m	mV/A/m			mV/A/m			mV/A/m			mV/A/m			mV/A/m		
1.5	31	31			27			27			27			27		
2.5	19	19			16			16			16			16		
4	33	12			10			10			10			10		
6	7.8	7.9			6.8			6.8			6.8			6.8		
10	4.7	4.7			4.7			4			4			4		
16	2.9	2.9			2.9			2.5			2.5			2.5		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
25	1.85	1.85	0.31	1.9	1.85	0.19	1.85	1.6	0.27	1.65	1.6	0.165	1.6	1.6	0.19	1.6
35	1.35	1.35	0.29	1.35	1.35	0.18	1.35	1.15	0.25	1.15	1.15	0.155	1.5	1.15	0.18	1.15
50	0.99	1	0.29	1.05	0.99	0.18	1	0.87	0.25	0.9	0.86	0.155	0.87	0.86	0.18	0.87

70	0.68	0.7	0.28	0.75	0.68	0.175	0.71	0.6	0.24	0.65	0.59	0.15	0.61	0.59	0.175	0.62
95	0.49	0.51	0.27	0.58	0.49	0.17	0.52	0.44	0.23	0.5	0.43	0.145	0.45	0.43	0.17	0.46
120	0.39	0.41	0.26	0.48	0.39	0.165	0.43	0.35	0.23	0.42	0.34	0.14	0.37	0.34	0.165	0.38
150	0.32	0.33	0.26	0.43	0.32	0.165	0.36	0.29	0.23	0.37	0.28	0.14	0.31	0.28	0.165	0.32
185	0.25	0.27	0.26	0.37	0.26	0.165	0.3	0.23	0.23	0.32	0.22	0.14	0.26	0.22	0.165	0.28
240	0.19	0.21	0.26	0.33	0.2	0.16	0.25	0.185	0.22	0.29	0.17	0.14	0.22	0.17	0.165	0.24
300	0.155	0.175	0.25	0.31	0.16	0.16	0.22	0.15	0.22	0.27	0.14	0.14	0.195	0.135	0.16	0.21
400	0.12	0.14	0.25	0.29	0.13	0.155	0.2	0.125	0.22	0.25	0.11	0.135	0.175	0.11	0.16	0.195
500	0.093	0.12	0.25	0.28	0.105	0.155	0.185	0.1	0.22	0.24	0.09	0.135	0.16	0.088	0.16	0.18
630	0.072	0.1	0.25	0.27	0.086	0.155	0.175	0.088	0.21	0.23	0.074	0.135	0.15	0.071	0.16	0.17
800	0.056	-	-	-	0.072	0.15	0.17	-	-	-	0.062	0.13	0.145	0.059	0.155	0.165
1000	0.045	-	-	-	0.063	0.15	0.165	-	-	-	0.055	0.13	0.14	0.05	0.155	0.165

FFX300 1mRMZ1-R
Current-Carrying Capacities (Amp)

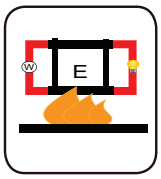
Nominal Cross Section Area	Reference Method 1 (clipped direct)		Reference Method 11 (on perforated cable tray)		Reference Method 12 (free air)	In single-way ducts		Laid direct in ground	
	2 cables singlephase a.c. or d.c. flat and touching	3 or 4 cables 3-phase a.c. flat and touching	2 cables singlephase a.c. or d.c. flat and touching	3 or 4 cables 3-phase a.c. flat and touching	3 cables 3-phase a.c. trefoil touching	2 cables singlephase a.c. or d.c. ducts touching	3 cables 3-phase a.c. trefoil touching	2 cables singlephase a.c. or d.c. touching	3 cables 3-phase a.c. trefoil touching
1	2	3	4	5	6	7	8	9	10
mm^2	A	A	A	A	A	A	A	A	A
50	237	220	253	232	222	255	235	275	235
70	303	277	322	293	285	310	280	340	290
95	367	333	389	352	346	365	330	405	345
120	425	383	449	405	402	410	370	460	389
150	488	437	516	462	463	445	405	510	435
185	557	496	587	524	529	485	440	580	490
240	656	579	689	612	625	550	500	670	560
300	755	662	792	700	720	610	550	750	630
400	853	717	899	767	815	640	580	830	700
500	962	791	1016	851	918	690	620	910	770
630	1082	861	1146	935	1027	750	670	1000	840
800	1170	904	1246	987	1119	828	735	1117	931
1000	1261	961	1345	1055	1214	919	811	1254	1038

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2 cables d.c.	2 cables single-phase a.c.			3 or 4 cables three-phase a.c.						2 cables singlephase a.c.		3 or 4 cables, 3-phase a.c. touching	
		Reference Method 1 & 11 (touching)			Reference Method 1, 11 & 12 (in trefoil touching)			Reference Method 1 & 11 (Flat touching)			In ducts	In ground	In ducts	In ground
1	2	3			4			5			6	7	8	9
mm^2	mV/A/m	mV/A/m			mV/A/m			mV/A/m			mV/A/m	mV/A/m	mV/A/m	mV/A/m
		r	x	z	r	x	z	r	x	z				
50	0.98	0.99	0.21	1	0.86	0.18	0.87	0.84	0.25	0.88	1.1	0.99	0.93	0.86
70	0.67	0.68	0.2	0.71	0.59	0.17	0.62	0.6	0.25	0.65	0.8	0.7	0.7	0.61
95	0.49	0.51	0.195	0.55	0.44	0.17	0.47	0.46	0.24	0.52	0.65	0.53	0.56	0.46
120	0.39	0.41	0.19	0.45	0.35	0.165	0.39	0.38	0.24	0.44	0.55	0.43	0.48	0.37
150	0.31	0.33	0.185	0.38	0.29	0.16	0.33	0.31	0.23	0.39	0.5	0.37	0.43	0.32
185	0.25	0.27	0.185	0.33	0.23	0.16	0.28	0.26	0.23	0.34	0.45	0.31	0.39	0.27
240	0.195	0.21	0.18	0.28	0.18	0.155	0.24	0.21	0.22	0.3	0.4	0.26	0.35	0.23
300	0.155	0.17	0.175	0.25	0.145	0.15	0.21	0.17	0.22	0.28	0.37	0.24	0.32	0.21
400	0.115	0.145	0.17	0.22	0.125	0.15	0.195	0.16	0.21	0.27	0.35	0.21	0.3	0.19
500	0.093	0.125	0.17	0.21	0.105	0.145	0.18	0.145	0.2	0.25	0.33	0.2	0.28	0.18
630	0.073	0.105	0.165	0.195	0.092	0.145	0.17	0.135	0.195	0.24	0.3	0.19	0.26	0.17
800	0.056	0.09	0.16	0.19	0.086	0.14	0.165	0.13	0.18	0.23	0.28	0.18	0.24	0.16
1000	0.045	0.092	0.155	0.18	0.08	0.135	0.155	0.125	0.17	0.21	0.26	0.17	0.22	0.15

Note: r = conductor resistance at operating temperature
x = reactance
z = impedance

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

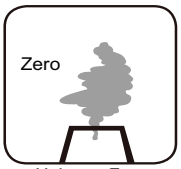

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

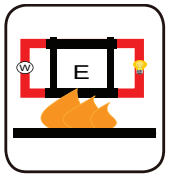

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



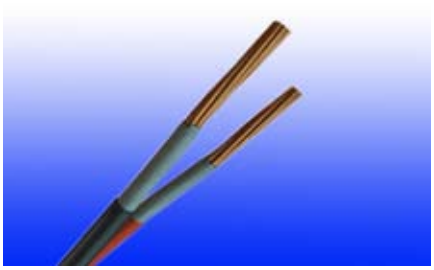
Halogen Free
IEC60754-1
EN50267-2-1

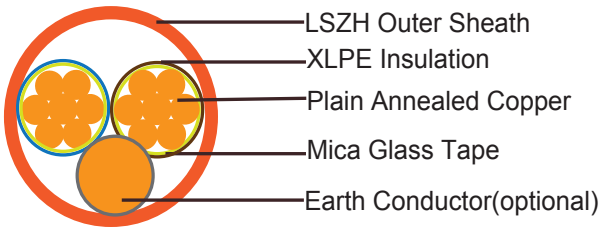


Functional Integrity
DIN 4102-12

300/500V Mica+XLPE Insulated, LSZH Sheathed Power Cables (2-4cores)

FFX200 05mRZ1-R (CU/MGT+XLPE/LSZH 300/500V Class 2)





APPLICATION

The cables are designed for areas where the integrity of the electrical circuit is critical in maintaining power supply. Applications can be found in emergency lightings, control and power circuits, power stations, fire alarm systems, underground tunnels, lifts, escalators, and high-rise buildings.

STANDARDS

Basic design to IEC 60502-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

300/500 V

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound
Earth Conductor(optional): Uninsulated solid or stranded tinned copper conductor.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour as per BS7671

	With Earth Conductor	Without Earth Conductor
2Cores	-	Brown, Blue
3Cores	Yellow/Green, Brown, Blue	Brown, Gray, Black
4Cores	Yellow/Green, Brown, Gray, Black	Brown, Gray, Black, Blue
5Cores	Yellow/Green, Brown, Gray, Black, Blue	Brown, Gray, Black, Blue, Black
above 5 Cores	Yellow/Green, Black Numbered	Black Numbered

Sheath Colour: Black (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation resistance	1000 MΩ x km (at 20°C)
Short circuit temperature	250°C

CONSTRUCTION PARAMETERS

Conductor				FFX200 05mRZ1-R			
				Without Earth Conductor		With Earth Conductor	
No. of Core X Cross Section	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight	Nominal Overall Diameter	Approx. Weight
No*mm^2	No./mm	mm	mm	mm	kg/km	mm	kg/km
2 Core							
2x1.5	7/0.53	0.5	0.5	7.7	70	8.2	80
2x2.5	7/0.67	0.5	0.5	8.8	100	9.6	120
2x4	7/0.85	0.5	0.5	9.8	140	10.5	170
3 Core							
3x1.5	7/0.53	0.5	0.5	8.7	90	10.5	100
3x2.5	7/0.67	0.5	0.5	9.5	125	10.7	150
3x4	7/0.85	0.5	0.5	11.5	180	12.5	220
4 Core							
4x1.5	7/0.53	0.5	0.5	10.3	105	12.2	120
4x2.5	7/0.67	0.5	0.5	11	155	13	190
4x4	7/0.85	0.5	0.5	12.5	255	13.5	270

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

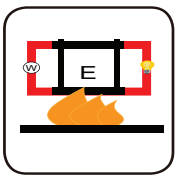
Nominal cross-section area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

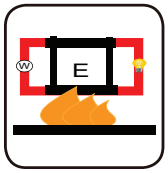

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

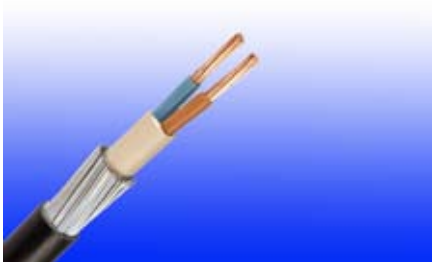
Halogen Free
IEC60754-1
EN50267-2-1

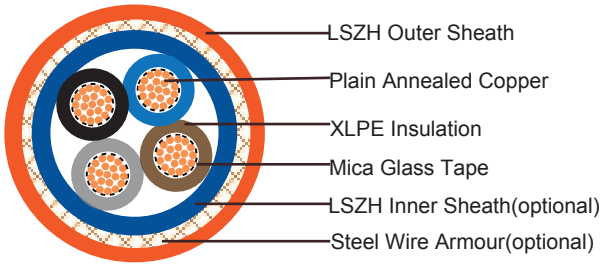


Functional Integrity
DIN 4102-12

600/1000V Mica+XLPE Insulated, LSZH Sheathed Power Cables (2-4 Cores & Multicore)

FFX400 1mRZ1-R (CU/MGT+XLPE/LSZH 600/1000V Class 2)
FFX400 1mRZ1MZ1-R (CU/MGT+XLPE/LSZH/SWA/LSZH 600/1000V Class 2)





APPLICATION

This cable is designed for areas where the integrity of the electrical properties circuit is critical in maintaining power supply. Applications can be found in emergency lightings, control and power circuits, power stations, fire alarm systems, underground tunnels, communications systems, sewage treatment plants, lifts, escalators, and high-rise buildings.

STANDARDS

Basic design to IEC 60502-1/BS 7846

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1); BS 7846-(F2)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

600/1000V

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Inner Sheath(optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Armouring(optional): Galvanized steel wire armour
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour as per BS7671

	With Earth Conductor	Without Earth Conductor
2Cores	-	Brown, Blue
3Cores	Yellow/Green, Brown, Blue	Brown, Gray, Black
4Cores	Yellow/Green, Brown, Gray, Black	Brown, Gray, Black, Blue
5Cores	Yellow/Green, Brown, Gray, Black, Blue	Brown, Gray, Black, Blue, Black
above 5 Cores	Yellow/Green, Black Numbered	Black Numbered

Sheath Colour: Black (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter (unarmoured cable)
10 x Overall Diameter (armoured cable)

ELECTRICAL PROPERTIES

Dielectric test:	3500 V r.m.s. x 5' (core/core)
Insulation resistance	1000 MΩ x km (at 20°C)
Short circuit temperature	250°C

CONSTRUCTION PARAMETERS

Conductor			FFX400 1mRZ1-R Unarmoured Cable		FFX400 1mRZ1MZ1-R Armoured Cable	
Cable Code	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight	Nominal Overall Diameter	Approx. Weight
	No./mm	mm	mm	kg/km	mm	kg/km
2Cores						
2G1.5	7/0.53	0.7	12.2	150	15.3	390
2G2.5	7/0.67	0.7	12.6	180	16.5	450
2G4	7/0.85	0.7	14.7	250	17.6	525
2G6	7/1.04	0.7	16.2	290	18.8	620

2G10	7/1.35	0.7	17.1	450	21	800
2G16	7/1.70	0.7	19.2	550	23	1100
2G25	7/2.14	0.9	20	680	27	1480
2G35	19/1.53	0.9	22	940	30	2000
2G50	19/1.78	1	24	1250	33	2450
2G70	19/2.14	1.1	27	1700	37	3200
2G95	19/2.52	1.1	31	2300	42	4350
2G120	37/2.03	1.2	36	3150	48	6500
3Cores						
3G1.5	7/0.53	0.7	12.3	170	16.5	420
3G2.5	7/0.67	0.7	13.8	200	17	500
3G4	7/0.85	0.7	15.2	300	18.5	600
3G6	7/1.04	0.7	16.8	380	19.8	785
3G10	7/1.35	0.7	18	550	22.6	1030
3G16	1/1.70	0.7	21	760	25	1370
3G25	7/2.14	0.9	22	960	29	1900
3G35	19/1.53	0.9	24	1300	32	2300
3G50	19/1.78	1	28	1700	35	2900
3G70	19/2.14	1.1	31	2400	40	4000
3G95	19/2.52	1.1	36	3250	45	5400
3G120	37/2.03	1.2	38	4000	49	6450
3G150	37/2.25	1.4	42	5000	55	8200
3G185	37/2.52	1.6	47	6100	60	9800
3G240	61/2.25	1.7	52	8000	68	12300
3G300	61/2.52	1.8	59	9850	74	14800
3G400	61/2.85	2	63	13000	83	17600
3Cores+1core Earth Conductor						
3G10+6	7/1.35	0.7	18.6	580	22.9	1100
3G16+10	7/1.70	0.7	19.7	810	25.7	1385
3G25+10	7/2.14	0.9	22	1090	27.3	1980
3G25+16	7/2.14	0.9	23	1150	29.8	2070
3G35+16	19/1.53	0.9	26	1420	30.5	2190
3G35+25	19/1.53	0.9	27	1490	32.8	2400
3G50+16	19/1.78	1	29	1800	36	3100
3G50+25	19/1.78	1	30	1890	36.6	3250
3G50+35	19/1.78	1	31	1920	37.3	3360
3G70+16	19/2.14	1.1	32	2200	38	3600
3G70+25	19/2.14	1.1	33	2400	41	3990
3G70+35	19/2.14	1.1	35	2900	42	4760
3G70+50	19/2.14	1.1	36	3300	44	5120
3G95+16	19/2.52	1.1	37	3560	45.8	5600
3G95+25	19/2.52	1.1	38	3700	46.7	6150
3G95+35	19/2.52	1.1	39	3910	47.2	6340
3G95+50	19/2.52	1.1	40	4200	47.8	6500
3G120+35	37/2.03	1.2	40	4250	49	6600

3G120+50	37/2.03	1.2	41	4300	50.5	6990
3G120+70	37/2.03	1.2	42	4400	51	7200
3G120+95	37/2.03	1.2	43	4600	52.3	7600
3G150+50	37/2.25	1.4	44	5700	57	9000
3G150+70	37/2.25	1.4	45	6700	59	10600
3G150+95	37/2.25	1.4	46	6800	60	10900
3G150+120	37/2.25	1.4	47	6900	61	11100
3G185+70	37/2.52	1.6	49	7980	63	11650
3G185+95	37/2.52	1.6	50	8050	64	12000
3G185+120	37/2.52	1.6	51	8200	65	12300
3G185+150	37/2.52	1.6	51	8400	67	12700
3G240+70	61/2.25	1.7	52	8800	70	12900
3G240+95	61/2.25	1.7	57	9000	71	13500
3G240+120	61/2.25	1.7	58	9500	73	14000
3G240+150	61/2.25	1.7	59	9700	74	14700
3G300+95	61/2.52	1.8	60	10300	75	15600
3G300+120	61/2.52	1.8	61	11050	76	15720
3G300+150	61/2.52	1.8	62	12000	77	16000
3G300+185	61/2.52	1.8	64	12800	79	17560
3G300+240	61/2.52	1.8	67	13800	86	18900
4Cores						
4G1.5	7/0.53	0.7	14.3	210	16	475
4G2.5	7/0.67	0.7	15.2	270	17.8	570
4G4	7/0.85	0.7	17.2	380	19.8	690
4G6	7/1.04	0.7	19	440	21	940
4G10	7/1.35	0.7	20.6	670	23.3	1200
4G16	1/1.70	0.7	23.6	820	26.5	1400
4G25	7/2.14	0.9	26	1320	30.5	2400
4G35	19/1.53	0.9	29	1730	34	2800
4G50	19/1.78	1	32	2300	38	3500
4G70	19/2.14	1.1	38	3180	44	5300
4G95	19/2.52	1.1	41.9	4370	48.5	6700
4G120	37/2.03	1.2	44	5400	54	8500
4G150	37/2.25	1.4	50.8	6500	59	10000
4G185	37/2.52	1.6	55	8200	64.5	12200
4G240	61/2.25	1.7	60.5	10600	74	15400
4G300	61/2.52	1.8	68.5	13200	82	19500
4G400	61/2.85	2	76	17000	92	25500
4Cores+1core Earth Conductor						
4G10+6	7/1.35	0.7	21	740	24	1300
4G16+10	7/1.70	0.7	22	900	26	1600
4G25+10	7/2.14	0.7	24	1200	29	2015
4G25+16	7/2.14	0.7	25	1450	32	2540
4G35+16	19/1.53	0.9	29.4	1800	35	3000
4G35+25	19/1.53	0.9	29.6	1890	35.6	3170

4G50+16	19/1.78	1	33	2400	40	3800
4G50+25	19/1.78	1	35.8	2560	41.4	4100
4G50+35	19/1.78	1	36.8	2730	42.9	4350
4G70+16	19/2.14	1.1	40	3350	45	6270
4G70+25	19/2.14	1.1	41	3500	47	6900
4G70+35	19/2.14	1.1	41.5	3800	48	7200
4G70+50	19/2.14	1.1	41.7	4600	50	7600
4G95+16	19/2.52	1.1	41.8	5300	51	8000
4G95+25	19/2.52	1.1	42.6	5700	52	8100
4G95+35	19/2.52	1.1	43.4	6390	53	8250
4G95+50	19/2.52	1.1	43.9	6600	54	8390
4G120+35	37/2.03	1.2	44	6400	54	8600
4G120+50	37/2.03	1.2	45	6500	55	8800
4G120+70	37/2.03	1.2	46	6600	56	9100
4G120+95	37/2.03	1.2	47	6700	57	9400
4G150+50	37/2.25	1.4	52	7600	61	10800
4G150+70	37/2.25	1.4	53	7800	62	11100
4G150+95	37/2.25	1.4	54	7900	64	11500
4G150+120	37/2.25	1.4	55	8100	65	11900
4G185+70	37/2.52	1.6	56	8400	66	12900
4G185+95	37/2.52	1.6	57	8800	68	13600
4G185+120	37/2.52	1.6	58	9200	70	14700
4G185+150	37/2.52	1.6	60	9700	73	15500
4G240+70	61/2.25	1.7	62	10800	76	16000
4G240+95	61/2.25	1.7	65	11400	77	16900
4G240+120	61/2.25	1.7	66	11900	78	17600
4G240+150	61/2.25	1.7	68	12400	79	18200
4G300+95	61/2.52	1.8	69	12800	81	19700
4G300+120	61/2.52	1.8	70	13400	82	20700
4G300+150	61/2.52	1.8	71	13900	83	21060
4G300+185	61/2.52	1.8	74	14800	85	22170
4G300+240	61/2.52	1.8	76	16200	87	24500
5Cores						
5G1.5	7/0.53	0.7	16.8	247	18.8	558
5G2.5	7/0.67	0.7	17.9	317	20.9	670
5G4	7/0.85	0.7	20.2	447	23.3	811
5G6	7/1.04	0.7	22.3	517	24.7	1105
5G10	7/1.35	0.7	24.2	787	27.4	1410
5G16	1/1.70	0.7	27.7	964	31.1	1645
5G25	7/2.14	0.9	30.6	1551	35.8	2820
5G35	19/1.53	0.9	34.1	2033	40.0	3290
5G50	19/1.78	1	37.6	2703	44.7	4113
5G70	19/2.14	1.1	44.7	3737	51.7	6228
5G95	19/2.52	1.1	49.2	5135	57.0	7873

5G120	37/2.03	1.2	51.7	6345	63.5	9988
5G150	37/2.25	1.4	59.7	7638	69.3	11750
5G185	37/2.52	1.6	64.6	9635	75.8	14335
5G240	61/2.25	1.7	71.1	12455	87.0	18095
5G300	61/2.52	1.8	80.5	15510	96.4	22913
5G400	61/2.85	2	89.3	19975	108.1	29963

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C
FFX400 1mRZ1-R
Current-Carrying Capacities (Amp)

Nominal Cross Section Area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase **a.c. or d.c.**	one 3-core cable or one **4-core cable 3-phase a.c.**
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42
6	38	51	44	58	52	63	54
10	51	69	60	80	71	86	75
16	68	91	80	107	96	115	100
25	89	119	105	138	119	149	127
35	109	146	128	171	147	185	158
50	130	175	154	209	179	225	192
70	164	221	194	269	229	289	246
95	197	265	233	328	278	352	298
120	227	305	268	382	322	410	346
150	259	334	300	441	371	473	399
185	295	384	340	506	424	542	456
240	346	459	398	599	500	641	538
300	396	532	455	693	576	741	621
400	-	625	536	803	667	865	741

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27

2.5	19	19			16		
4	12	12			10		
6	7.9	7.9			6.8		
10	4.7	4.7			4		
16	2.9	2.9			2.5		
		r	x	z	r	x	z
25	1.85	1.85	0.16	1.9	1.6	0.14	1.65
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15
50	0.98	0.99	0.155	1	0.86	0.135	0.87
70	0.67	0.67	0.15	0.69	0.59	0.13	0.6
95	0.49	0.5	0.15	0.52	0.43	0.13	0.45
120	0.39	0.4	0.145	0.42	0.34	0.13	0.37
150	0.31	0.32	0.145	0.35	0.28	0.125	0.3
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26
240	0.195	0.2	0.14	0.24	0.175	0.125	0.21
300	0.155	0.16	0.14	0.21	0.14	0.12	0.185
400	0.12	0.13	0.14	0.19	0.115	0.12	0.165

FFX400 1mRZ1MZ1-R
Current-Carrying Capacities (Amp)

Nominal Cross Section Area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated horizontal cable tray or Reference Method 13 [free air])		In single-way ducts		Laid direct in ground	
	one 2-core cable single phase a.c. or d.c.	one 3-core or 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core or 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core or 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core or 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8	9
mm^2	A	A	A	A	A	A	A	A
1.5	27	23	29	25	-	23	-	28
2.5	36	31	39	33	-	30	-	36
4	49	42	52	44	-	40	-	48
6	62	53	66	56	-	50	-	60
10	85	73	90	78	-	65	-	80
16	110	94	115	99	115	94	140	115
25	146	124	152	131	145	125	180	150
35	180	154	188	162	175	150	215	180
50	219	187	228	197	210	175	255	215
70	279	238	291	251	260	215	315	265
95	338	289	354	304	310	260	380	315
120	392	335	410	353	355	300	430	360
150	451	386	472	406	400	335	480	405
185	515	441	539	463	455	380	540	460
240	607	520	636	546	520	440	630	530

300	698	599	732	628	590	495	700	590
400	787	673	847	728	660	560	790	670

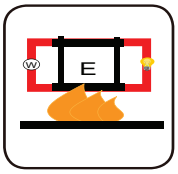
Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2 cables, single-phase a.c.			3 or 4 cables, 3-phase a.c.			2 cables, single-phase a.c. In ducts or in ground	3 or 4 cables, 3-phase a.c. In ducts or in ground
1	2	3			4			5	6
mm^2	mV/A/m	mV/A/m			mV/A/m			mV/A/m	mV/A/m
1.5	31	31			27			31	25
2.5	19	19			16			19	15
4	12	12			10			12	9.7
6	7.9	7.9			6.8			7.9	6.5
10	4.7	4.7			4			4.7	3.9
16	2.9	2.9			2.5			2.9	2.6
		r	x	z	r	x	z		
25	1.85	1.35	0.16	1.9	1.6	0.14	1.65	1.9	1.6
35	1.35	1.35	0.155	1.35	1.15	0.135	1.15	1.35	1.2
50	0.98	0.99	0.155	1	0.86	0.135	0.87	1	0.87
70	0.67	0.67	0.15	0.69	0.59	0.13	0.6	0.69	0.61
95	0.49	0.5	0.15	0.52	0.43	0.13	0.45	0.52	0.45
120	0.39	0.4	0.145	0.42	0.34	0.13	0.37	0.42	0.36
150	0.31	0.32	0.145	0.35	0.28	0.125	0.3	0.35	0.3
185	0.25	0.26	0.145	0.29	0.22	0.125	0.26	0.29	0.25
240	0.195	0.2	0.14	0.24	0.175	0.125	0.21	0.24	0.21
300	0.155	0.16	0.14	0.21	0.14	0.12	0.185	0.21	0.19
400	0.12	0.13	0.14	0.19	0.115	0.12	0.165	0.19	0.18

Note : r = conductor resistance at operating temperature
x = reactance
z = impedance

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

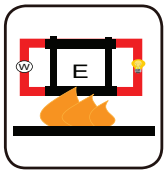

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

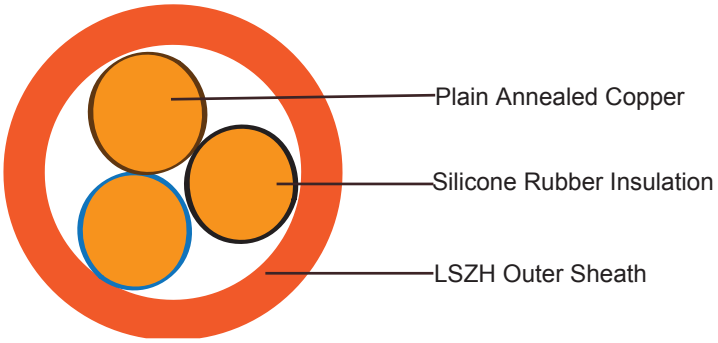
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V SR Insulated Control Cables (2-4 Cores)

FFX200 05SZ1-U (PH60) (CU/SR/LSZH 300/500V Class 1)



APPLICATION

The cables are designed, for use as control cable for emergency services and fire circuit control.

STANDARDS

Basic design adapted from BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH60); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

300/500 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, solid according to IEC(EN) 60228 class 1.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour
Without Earth Conductor
2 cores black - blue
3 cores black - blue - brown
4 cores black - blue - brown - black
With Earth Conductor
3 cores black - blue - yellow/green
4 cores black - blue - brown - yellow/green
Sheath Colour: Orange (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5’ (core/core)
Insulation resistance	≥300 MΩ x km (at 20°C)
Short circuit temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core					
FFX200 05SZ1-U (PH60)	2x1.5	0.7	0.9	7.4	70
FFX200 05SZ1-U (PH60)	2x2.5	0.8	1.0	8.8	105
3 core					
FFX200 05SZ1-U (PH60)	3x1.5	0.7	0.9	7.9	93
FFX200 05SZ1-U (PH60)	3x2.5	0.8	1.0	9.4	141
4 core					
FFX200 05SZ1-U (PH60)	4x1.5	0.7	1.0	8.8	122
FFX200 05SZ1-U (PH60)	4x2.5	0.8	1.1	10.4	183

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

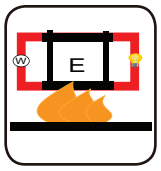
Conductor cross-sectional area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2 cables, single-phase a.c.	3 or 4 cables, 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

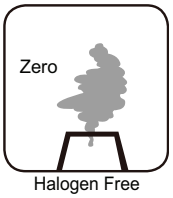

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

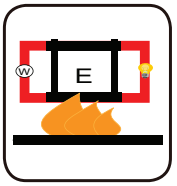

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



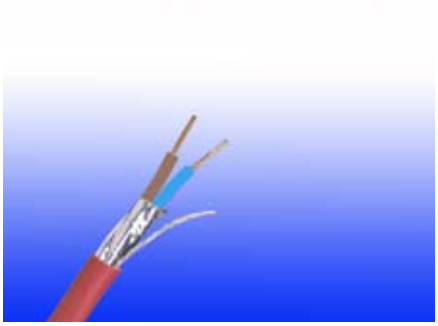
Halogen Free
IEC60754-1
EN50267-2-1

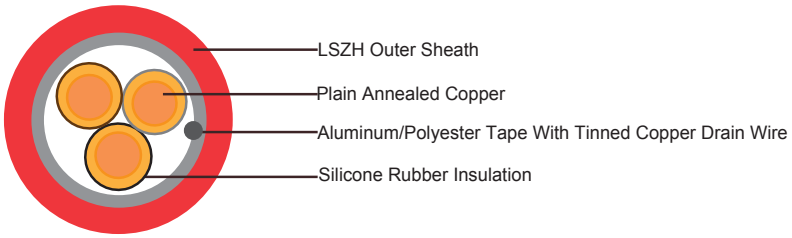


Functional Integrity
DIN 4102-12

300/500V SR Insulated & Overall Screened Control Cables (2-4 Cores & Multicore)

FFX200 05SOZ1-U (PH30/60) (CU/SR/OSCR/LSZH 300/500V Class 1)
FFX200 05SOZ1-R (PH30/60) (CU/SR/OSCR/LSZH 300/500V Class 2)





APPLICATION

The cables are primarily intended for use in the following applications:

BS 5266-1 for emergency lighting of premises
BS 5839-1 for fire detection and fire alarm systems in and around building
BS 5839-8 for voice alarm systems
BS 5839-9 for emergency voice communication systems.

STANDARDS

Basic design to BS7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30/60); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*

Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

300/500 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, solid according to IEC(EN) 60228 class 1, stranded according to IEC(EN) 60228 class 2.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Circuit Protective Conductor or Drain Wire: Uninsulated tinned copper conductor of the same section and class as the insulated conductors in the 2-, 3-and 4-core cables. Drain wire of 0.5mm^2 tinned copper conductor is provided in cables of more than 4 conductors.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:

2 cores	blue -brown
3 cores	brown -black -grey
4 cores	blue -brown -black -grey

(Colour Code Up To 4 Cores In Accordance To HD 308)

7 cores	centre: brown 1st layer: brown -black -4 cores white
12 cores	centre: brown -black -white 1st layer: brown -black -7 cores white
19 cores	centre: brown 1st layer: brown -black -4 cores white 2nd layer: brown -black -10 cores white

(on request the cores can be one colour only, identified by printed numbers)
Sheath Colour: Orange (other colors upon request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation resistance	≥300 MΩ x km (at 20°C)
Short circuit temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core					
FFX200 05SOZ1-U (PH30/60)	2x1.0	0.6	0.9	7.1	80
FFX200 05SOZ1-U (PH30/60)	2x1.5	0.7	0.9	8.0	95
FFX200 05SOZ1-U (PH30/60)	2x2.5	0.8	1.0	9.4	135
FFX200 05SOZ1-R (PH30/60)	2x1.5	0.7	0.9	8.4	106
FFX200 05SOZ1-R (PH30/60)	2x2.5	0.8	1.0	9.9	145
FFX200 05SOZ1-R (PH30/60)	2x4.0	0.8	1.1	11.5	210
3 core					
FFX200 05SOZ1-U (PH30/60)	3x1.0	0.6	0.9	8.0	95
FFX200 05SOZ1-U (PH30/60)	3x1.5	0.7	0.9	8.5	115
FFX200 05SOZ1-U (PH30/60)	3x2.5	0.8	1.0	10.0	170
FFX200 05SOZ1-R (PH30/60)	3x1.5	0.7	0.9	8.9	134
FFX200 05SOZ1-R (PH30/60)	3x2.5	0.8	1.0	10.3	180
FFX200 05SOZ1-R (PH30/60)	3x4.0	0.8	1.1	12.2	260
4 core					
FFX200 05SOZ1-U (PH30/60)	4x1.0	0.6	1.0	8.3	115
FFX200 05SOZ1-U (PH30/60)	4x1.5	0.7	1.0	9.4	150
FFX200 05SOZ1-U (PH30/60)	4x2.5	0.8	1.1	11.0	210
FFX200 05SOZ1-R (PH30/60)	4x1.5	0.7	1.0	9.8	166
FFX200 05SOZ1-R (PH30/60)	4x2.5	0.8	1.1	11.8	250
FFX200 05SOZ1-R (PH30/60)	4x4.0	0.8	1.2	13.5	330
7 Core					
FFX200 05SOZ1-U (PH30/60)	7x1.0	0.6	1.0	10.0	165
FFX200 05SOZ1-U (PH30/60)	7x1.5	0.7	1.1	11.3	225
12 core					
FFX200 05SOZ1-U (PH30/60)	12x1.0	0.6	1.1	12.5	255
FFX200 05SOZ1-U (PH30/60)	12x1.5	0.7	1.2	14.5	350
19 core					
FFX200 05SOZ1-U (PH30/60)	19x1.0	0.6	1.2	15.0	380
FFX200 05SOZ1-U (PH30/60)	19x1.5	0.7	1.3	17.0	520

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

Nominal Cross Section Area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable **3-phase a.c.**
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42

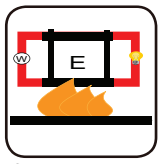


Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10

Rated Voltage

Standard

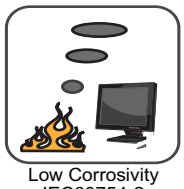


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

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

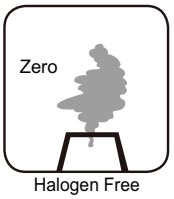
Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

Low Toxicity
NES 02-713/NF C 20-454

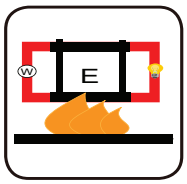


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074

Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



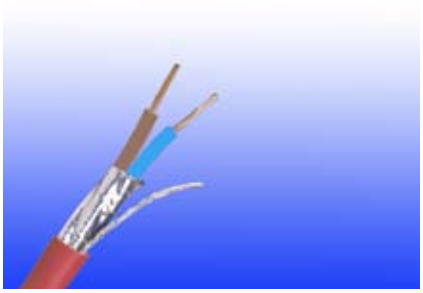
Halogen Free
IEC60754-1
EN50267-2-1

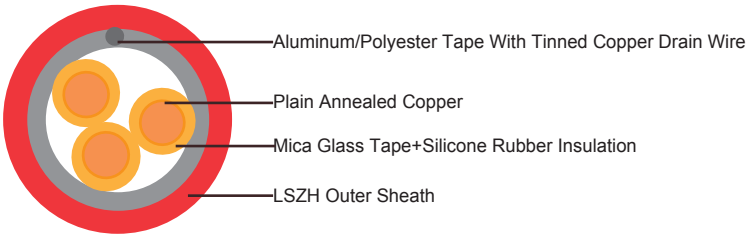


Functional Integrity
DIN 4102-12

300/500V Mica+SR Insulated & Overall Screened Control Cables (2-4 Cores & Multicore)

FFX200E 05mSOZ1-U (PH120) (CU/MGT+SR/OSCR/LSZH 300/500V Class 1)
FFX200E 05mSOZ1-R (PH120) (CU/MGT+SR/OSCR/LSZH 300/500V Class 2)





APPLICATION

The cables are primarily intended for use in the following applications:

BS 5266-1 for emergency lighting of premises
BS 5839-1 for fire detection and fire alarm systems in and around building
BS 5839-8 for voice alarm systems
BS 5839-9 for emergency voice communication systems.

STANDARDS

Basic design to BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-2 (120mins); BS 5839-1 Clause 26 2e; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH120); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*

Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

300/500 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, solid according to IEC(EN) 60228 class 1, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass fire resistant tape covered by fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Circuit Protective Conductor: Uninsulated tinned copper conductor of the same section and class as the insulated conductors in the 2-, 3- and 4-core cables. Drain wire of 0.5mm^2 tinned copper conductor is provided in cables of more than 4 conductors.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour

2 cores blue - brown
3 cores brown - black - grey
4 cores blue - brown - black - grey
(Colour Code Up To 4 Cores In Accordance to HD 308)
7 cores centre: brown 1st layer: brown - black - 4 cores white
12 cores centre: brown - black - white 1st layer: brown - black - 7 cores white
19 cores centre: brown 1st layer: brown - black - 4 cores white
2nd layer: brown - black - 10 cores white
(on request the cores can be one colour only, identified by printed numbers
Sheath Colour: Colour red or white (other colours on request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation resistance	≥300 MΩ x km (at 20°C)
Short circuit temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core,					
FFX200E 05mSOZ1-U(PH120)	2x1.0	0.6	0.9	7.9	85
FFX200E 05mSOZ1-U(PH120)	2x1.5	0.7	0.9	8.8	105
FFX200E 05mSOZ1-U(PH120)	2x2.5	0.8	1.0	10.2	150
FFX200E 05mSOZ1-R(PH120)	2x1.5	0.7	0.9	9.2	110
FFX200E 05mSOZ1-R(PH120)	2x2.5	0.8	1.0	10.3	155
FFX200E 05mSOZ1-R(PH120)	2x4.0	0.8	1.1	12.2	220
3 core					
FFX200E 05mSOZ1-U(PH120)	3x1.0	0.6	0.9	8.4	105
FFX200E 05mSOZ1-U(PH120)	3x1.5	0.7	0.9	9.3	130
FFX200E 05mSOZ1-U(PH120)	3x2.5	0.8	1.0	10.8	190
FFX200E 05mSOZ1-R(PH120)	3x1.5	0.7	0.9	9.4	135
FFX200E 05mSOZ1-R(PH120)	3x2.5	0.8	1.0	10.9	190
FFX200E 05mSOZ1-R(PH120)	3x4.0	0.8	1.1	13.0	280
4 core					
FFX200E 05mSOZ1-U(PH120)	4x1.0	0.6	1.0	9.3	125
FFX200E 05mSOZ1-U(PH120)	4x1.5	0.7	1.0	10.3	165
FFX200EE 05mSOZ1-U(PH120)	4x2.5	0.8	1.1	12.0	240
FFX200E 05mSOZ1-R(PH120)	4x1.5	0.7	1.0	10.5	170
FFX200E 05mSOZ1-R(PH120)	4x2.5	0.8	1.1	12.1	250
FFX200E 05mSOZ1-R(PH120)	4x4.0	0.8	1.2	14.4	350
7 core					
FFX200E 05mSOZ1-U(PH120)	7x1.0	0.6	1.0	10.5	175
FFX200E 05mSOZ1-U(PH120)	7x1.5	0.7	1.1	12.1	230
12 core					
FFX200E 05mSOZ1-U(PH120)	12x1.0	0.6	1.1	14.5	300
FFX200E 05mSOZ1-U(PH120)	12x1.5	0.7	1.2	16.0	380
19 core					
FFX200E 05mSOZ1-U(PH120)	19x1.0	0.6	1.2	17.5	470
FFX200E 05mSOZ1-U(PH120)	19x1.5	0.7	1.3	17.5	470

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

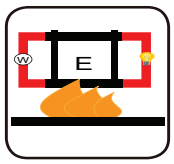
Conductor cross-sectional area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10

Rated Voltage

Standard

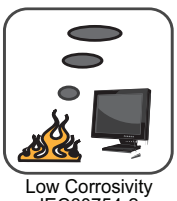


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)


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

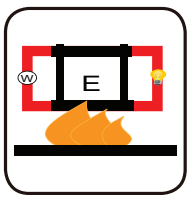

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

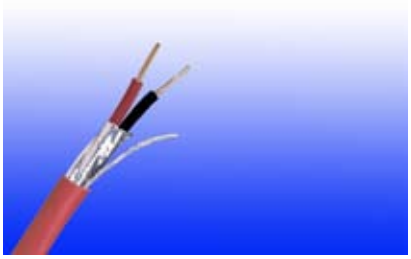
Halogen Free
IEC60754-1
EN50267-2-1

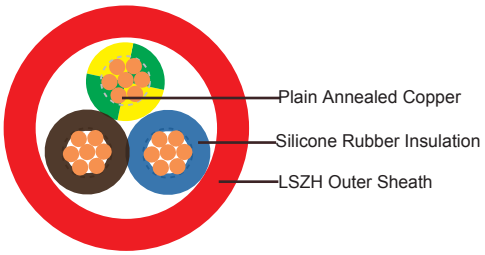


Functional Integrity
DIN 4102-12

450/750V SR Insulated Control Cables (2-5 Cores)

FFX200 07SZ1-R (PH60) (CU/SR/LSZH 450/750V Class 2)





APPLICATION

The cables are designed, manufactured and tested for general application in power supply and signal wiring, for emergency circuit and fire circuit control.

STANDARDS

Basic design adapted from BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH60); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

450/750 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:
Without Earth Conductor
2 cores blue - brown
3 cores brown - black - grey
4 cores blue - brown - black - grey
5 cores blue - brown - black - grey - black
With Earth Conductor
3 cores yellow/green - blue - brown
4 cores yellow/green - brown - black - grey
5 cores yellow/green - blue - brown - black - grey
Sheath Colour: Colour red (other colours on request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2500 V r.m.s. x 5' (core/core)
Insulation resistance	≥300 MΩ x km (at 20°C)
Short circuit temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core					
FFX200 07SZ1-R (PH60)	2x1.5	0.8	1.0	7,8	96

FFX200 07SZ1-R (PH60)	2x2.5	0.9	1.1	9,2	138
FFX200 07SZ1-R (PH60)	2x4.0	0.9	1.2	10,5	189
3 core					
FFX200 07SZ1-R (PH60)	3x1.5	0.8	1.0	8,3	116
FFX200 07SZ1-R (PH60)	3x2.5	0.9	1.1	9,8	169
FFX200 07SZ1-R (PH60)	3x4.0	0.9	1.2	11,6	246
4 core					
FFX200 07SZ1-R (PH60)	4x1.5	0.8	1.1	9,3	147
FFX200 07SZ1-R (PH60)	4x2.5	0.9	1.2	11,3	222
FFX200 07SZ1-R (PH60)	4x4.0	0.9	1.3	12,5	299
5 core					
FFX200 07SZ1-R (PH60)	5x1.5	0.8	1.1	10,5	180
FFX200 07SZ1-R (PH60)	5x2.5	0.9	1.2	12,3	259
FFX200 07SZ1-R (PH60)	5x4.0	0.9	1.3	14,0	359

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

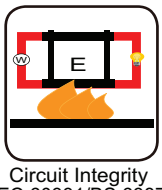
Conductor cross-sectional area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

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

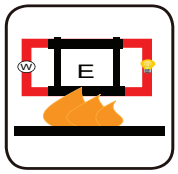
Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

Low Toxicity
NES 02-713/NF C 20-454

Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074

Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

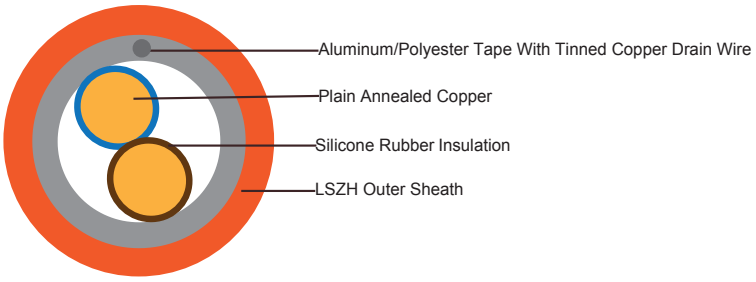
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

450/750V SR Insulated & Overall Screened Control Cables (1-4 Cores & Multicore)

FFX200 07SOZ1-F (PH30/60)(CU/SR/OSCR/LSZH 450/750V Class 5)



APPLICATION

The cables are designed, manufactured and tested for general application in power and signal wiring, for emergency circuit and fire circuit control where high rejection to electrostatic noise is needed.

STANDARDS

Basic design adapted from BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30/60); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

450/750 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, flexible according to IEC(EN) 60228 class 5.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:
Without Earth Conductor
2 cores blue - brown
3 cores brown - black - grey
4 cores blue - brown - black - grey
7 cores and above black numbered
With Earth Conductor
3 cores yellow/green - blue - brown
4 cores yellow/green - brown - black - grey
5 cores yellow/green - blue - brown - black - grey
7 cores and above yellow/green - black numbered
Sheath Colour: Colour red (other colours on request)

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	2500 V r.m.s. x 5’ (core/core)
Insulation Resistance	≥300 MΩ x km (at 20°C)
Short circuit Temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core					
FFX200 07SOZ1-F(PH30/60)	2x0.75	0.7	0.9	7,6	69
FFX200 07SOZ1-F(PH30/60)	2x1.0	0.7	1.0	8,0	78
FFX200 07SOZ1-F(PH30/60)	2x1.5	0.8	1.0	8,3	88
FFX200 07SOZ1-F(PH30/60)	2x2.5	0.9	1.1	9,8	123
3 core					
FFX200 07SOZ1-F(PH30/60)	3x0.75	0.7	0.9	8,0	84
FFX200 07SOZ1-F(PH30/60)	3x1.0	0.7	1.0	8,2	86
FFX200 07SOZ1-F(PH30/60)	3x1.5	0.8	1.0	8,8	112
FFX200 07SOZ1-F(PH30/60)	3x2.5	0.9	1.1	10,4	159
4 core					
FFX200 07SOZ1-F(PH30/60)	4x0.75	0.7	1.0	8,7	103
FFX200 07SOZ1-F(PH30/60)	4x1.0	0.7	1.1	8,9	110
FFX200 07SOZ1-F(PH30/60)	4x1.5	0.8	1.1	9,8	141
FFX200 07SOZ1-F(PH30/60)	4x2.5	0.9	1.2	11,4	196
7 core					
FFX200 07SOZ1-F(PH30/60)	7x1.0	0.7	1.1	10,8	176
FFX200 07SOZ1-F(PH30/60)	7x1.5	0.8	1.2	11,7	218
FFX200 07SOZ1-F(PH30/60)	7x2.5	0.9	1.3	13,4	305
12 core					
FFX200 07SOZ1-F(PH30/60)	12x1.0	0.7	1.2	13,9	275
FFX200 07SOZ1-F(PH30/60)	12x1.5	0.8	1.3	15,3	352
FFX200 07SOZ1-F(PH30/60)	12x2.5	0.9	1.5	17,9	505
19 core					
FFX200 07SOZ1-F(PH30/60)	19x1.0	0.7	1.4	16,4	408
FFX200 07SOZ1-F(PH30/60)	19x1.5	0.8	1.5	18,2	535
FFX200 07SOZ1-F(PH30/60)	19x2.5	0.9	1.6	21,1	760

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

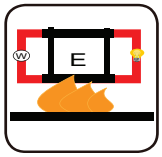
Conductor cross-sectional area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10

Rated Voltage

Standard

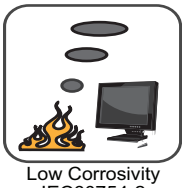


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

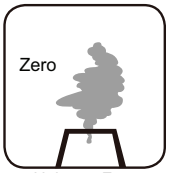

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

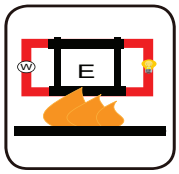

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



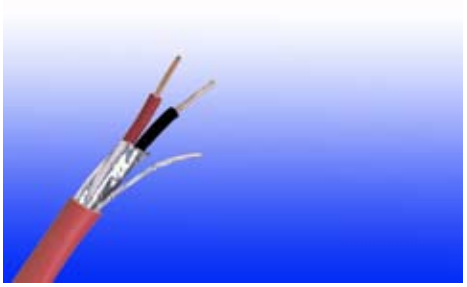
Halogen Free
IEC60754-1
EN50267-2-1

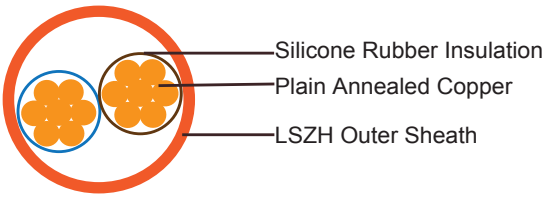


Functional Integrity
DIN 4102-12

600/1000V SR Insulated Flexibles Control Cables (2-4 Cores & Multicore)

FFX400 1SZ1-R(PH60)(CU/SR/LSZH 600/1000V Class 2)
FFX400 1SZ1-F(PH60)(CU/SR/LSZH 600/1000V Class 5)





APPLICATION

The cables are designed for power supply and signals trasmission, indoor or outdoor even wet environment. They are designed for fixed laying in free air, in pipe or conduit, on masonry and metal structures or suspended in places where in case of fire people are exposed to serious risks for emission of smoke, toxic and corrosive gases and where you want to avoid damage to facilities, equipment, goods. They are primarily intended for feeding of: emergency exits, alarm signals, warning of smoke or gas, escalators.

STANDARDS

Basic design adapted from BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH60); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*

No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

600/1000 V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, stranded for section up to 10mm^2 according to IEC(EN) 60228 class 2 or flexible for section above 10mm^2 according to IEC(EN) 60228 class 5.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:
Without Earth Conductor
2 cores blue - brown
3 cores brown - black - grey
4 cores blue - brown - black - grey
5 cores blue - brown - black - grey - black With Earth Conductor
3 cores yellow/green - blue - brown
4 cores yellow/green - brown - black - grey
5 cores yellow/green - blue - brown - black - grey
Sheath Colour: red (other colours on request).

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test:	3500 V r.m.s. x 5' (core/core)
Insulation Resistance	≥300 MΩ x km (at 20°C)
Short circuit Temperature	350°C

CONSTRUCTION PARAMETERS

Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 core					
FFX400 1SZ1-R(PH60)	2x1.5	1.0	1.2	9,2	124
FFX400 1SZ1-R(PH60)	2x2.5	1.1	1.3	10,0	155
FFX400 1SZ1-R(PH60)	2x4.0	1.1	1.4	11,2	207
FFX400 1SZ1-R(PH60)	2x6.0	1.1	1.5	13,1	298
FFX400 1SZ1-F(PH60)	2x10	1.1	1.6	15,9	441
FFX400 1SZ1-F(PH60)	2x16	1.1	1.7	17,4	602
3 core					
FFX400 1SZ1-F(PH60)	3x1.5	1.0	1.2	9,8	148
FFX400 1SZ1-F(PH60)	3x2.5	1.1	1.3	10,6	188
FFX400 1SZ1-F(PH60)	3x4.0	1.1	1.4	12,1	263
FFX400 1SZ1-F(PH60)	3x6.0	1.1	1.5	14,4	372
FFX400 1SZ1-F(PH60)	3x10	1.1	1.6	16,8	541
FFX400 1SZ1-F(PH60)	3x16	1.1	1.7	19,4	777
4 core					
FFX400 1SZ1-F(PH60)	4x1.5	1.0	1.3	10,6	176
FFX400 1SZ1-F(PH60)	4x2.5	1.1	1.4	11,5	228
FFX400 1SZ1-F(PH60)	4x4.0	1.1	1.5	13,6	332
FFX400 1SZ1-F(PH60)	4x6.0	1.1	1.6	11,5	214
FFX400 1SZ1-F(PH60)	4x10	1.1	1.7	18,5	680
FFX400 1SZ1-F(PH60)	4x16	1.1	1.8	21,2	973
5 core					
FFX400 1SZ1-F(PH60)	5x2.5	1.1	1.4	12,6	266
FFX400 1SZ1-F(PH60)	5x4.0	1.1	1.5	14,5	399
FFX400 1SZ1-F(PH60)	5x6.0	1.1	1.6	17,6	576
FFX400 1SZ1-F(PH60)	5x10	1.1	1.7	20,5	850
FFX400 1SZ1-F(PH60)	5x16	1.1	1.8	23,3	1202

ELECTRICAL PROPERTIES

Conductor Operating Temperature : 90°C
Ambient Temperature : 30°C

Current-Carrying Capacities (Amp)

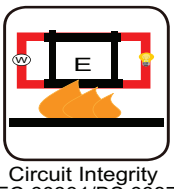
Nominal Cross Section Area	Reference Method 4 (enclosed in an conduit insulated wall etc)	Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable single phase a.c. or d.c.	one 3-core cable or one 4-core cable 3-phase a.c.	one 2-core cable singlephase **a.c. or d.c.**	one 3-core cable or one **4-core cable 3-phase a.c.**
1	2	3	4	5	6	7	8
mm^2	A	A	A	A	A	A	A
1.5	16.5	22	19.5	24	22	26	23
2.5	22	30	26	33	30	36	32
4	30	40	35	45	40	49	42
6	38	51	44	58	52	63	54
10	51	69	60	80	71	86	75
16	68	91	80	107	96	115	100

Voltage Drop (Per Amp Per Meter)

Nominal Cross Section Area	2-core cable d.c.	2-core cable single-phase a.c	3-core or 4-core cable 3-phase a.c.
1	2	3	4
mm^2	mV/A/m	mV/A/m	mV/A/m
1.5	31	31	27
2.5	19	19	16
4	12	12	10
6	7.9	7.9	6.8
10	4.7	4.7	4
16	2.9	2.9	2.5

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

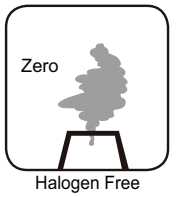

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

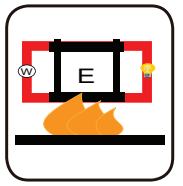

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



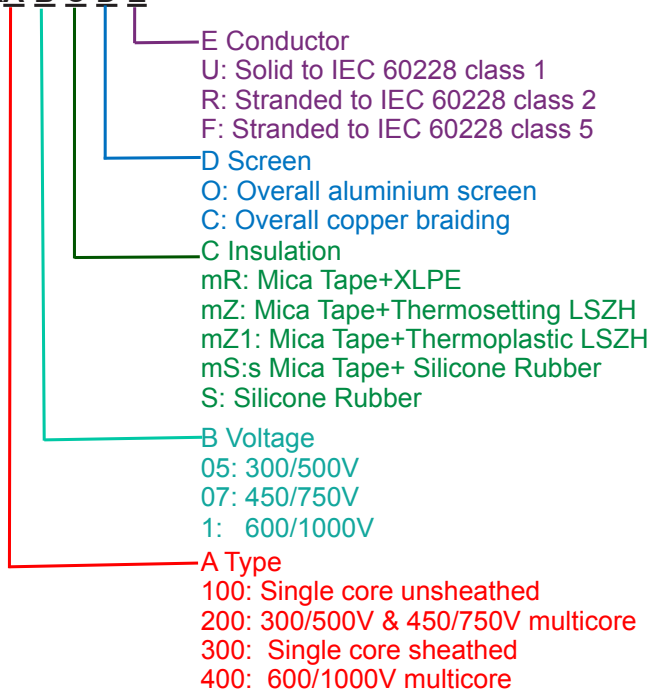
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

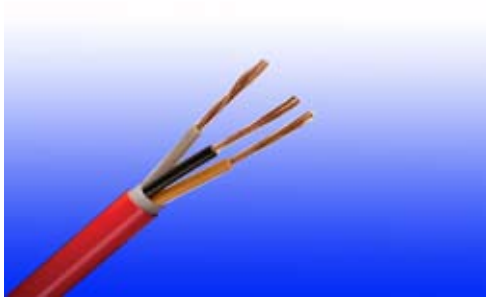
TYPE CODES FOR FIRE RESISTANT POWER & CONTROL CABLES

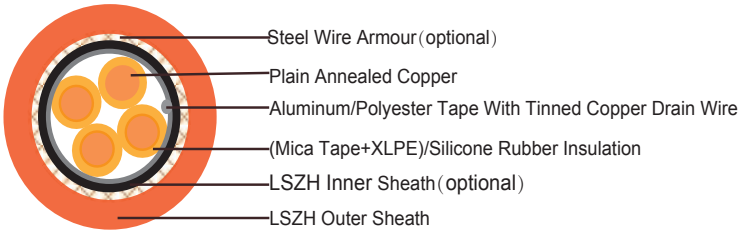
FFXA-B-C-D-E



300/500V Mica+XLPE or SR Insulated & Overall Screened Multicore Instrumentation Cables

RE-2X(St)H...CI. FE 180 PH30 (CU/MGT+XLPE/OSCR/LSZH 300/500V Class 2)
RE-2G(St)H...CI. FE 180 PH30 (CU/SR/OSCR/LSZH 300/500V Class 2)
RE-2X(St)HSWAH...CI. FE 180 PH30 (CU/MGT+XLPE/OSCR/LSZH/SWA/LSZH 300/500V Class 2)
RE-2G(St)HSWAH...CI. FE 180 PH30 (CU/SR/OSCR/LSZH/SWA/LSZH 300/500V Class 2)





APPLICATION

The cables are designed, manufactured and tested as data transmission cables for emergency services. These are used for data and voice transmission when high frequency signal has to be assured also in the event of a fire.

STANDARDS

Basic design to BS 5308/BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4

Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound or fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The cores are cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with 0.5mm^2 screen (7/0.3mm) with tinned copper drain wire.
Inner Sheath(optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Armouring(optional): Galvanized steel wire armour
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

VOLTAGE RATING

300/500 V

COLOUR CODE

Insulation Colour: White with black numberings.
Sheath Colour: Orange (other colours on request).

TYPE CODE

RE-	Instrumentation cable	H	Halogen free & zero halogen
2X	XLPE	2G	Silicon Rubber
(St)	Static shield of aluminium tape	SWA	Steel Wire Armoured
FE180	Insulation integrity (950°C 180 minutes)	CI	Circuit integrity
PH 90	Fire Test for 90 mins at 830°C		

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter (unarmoured cables with silicone rubber insulation)
8 x Overall Diameter (unarmoured cables with XLPE insulation)
10 x Overall Diameter (armoured cables)

ELECTRICAL PROPERTIES

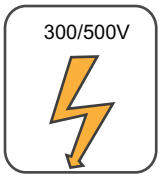
Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation Resistance	XLPE: ≥1000 MΩ x km (at 20°C) SR: ≥300 MΩ x km (at 20°C)
Short circuit Temperature	XLPE: 250°C SR: 350°C

CONSTRUCTION PARAMETERS

Conductor			RE-2X(St)H.CI. FE 180 PH30 RE-2G(St)H.CI. FE 180 PH30		RE-2X(St)HSWAH...CI. FE 180 PH30 RE-2G(St)HSWAH...CI. FE 180 PH30			
			Unarmoured		Armoured			
No. of Core X Cross Section	No./ Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight	Diameter Under Armour	Armour Wire Diameter	Nominal Overall Diameter	Approx. Weight
mm^2	no./mm	mm	mm	kg/km	mm	mm	mm	kg/km
2 Core								
2x1.0	7/0.43	0.6	8.0	82	8.0	0.90	12.4	288
2x1.5	7/0.53	0.7	8.5	101	8.5	0.90	13.1	342
2x2.5	7/0.67	0.8	10.5	137	10.5	0.90	15.1	419
2x4	7/0.85	0.8	12.5	180	12.5	0.90	17.1	484
3 Core								
3x1.0	7/0.43	0.6	8.0	100	8.0	0.90	12.4	324
3x1.5	7/0.53	0.7	9.5	127	9.5	0.90	14.1	383
3x2.5	7/0.67	0.8	12.0	176	12.0	0.90	16.6	466
3x4	7/0.85	0.8	13.5	236	13.5	0.90	18.1	560
4 Core								
4x1.0	7/0.43	0.6	9.0	127	9.0	0.90	13.6	383
4x1.5	7/0.53	0.7	10.5	161	10.5	0.90	15.1	445
4x2.5	7/0.67	0.8	13.0	224	13.0	0.90	17.6	548
4x4	7/0.85	0.8	15.0	302	15.0	1.25	20.5	772
7 Core								
7x1.0	7/0.43	0.6	11.0	187	11.0	0.9	15.6	485
7x1.5	7/0.53	0.7	12.5	250	12.5	0.90	17.3	597
7x2.5	7/0.67	0.8	15.0	354	15.0	1.25	20.5	862
12 Core								
12x1.5	7/0.53	0.7	16.0	402	16.0	1.25	21.7	997

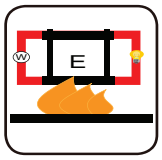
12x2.5	7/0.67	0.8	20.0	585	20.0	1.60	26.4	1421
19 Core								
19x1.5	7/0.53	0.7	19.0	597	19.0	1.60	25.6	1465
19x2.5	7/0.67	0.8	24.0	873	24.0	1.60	30.6	1837

Note : Other conductor sizes & core configurations are available upon request.



Rated Voltage

Standard

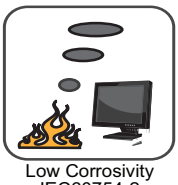


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

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

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

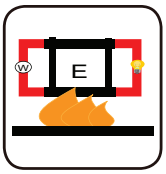
Low Toxicity
NES 02-713/NF C 20-454



Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074

Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

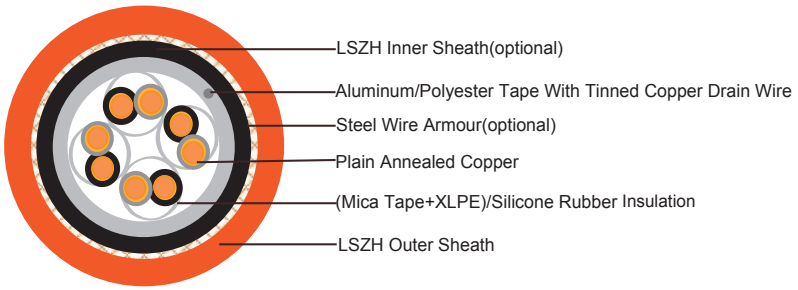
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V Mica+XLPE/SR Insulated & Overall Screened Multipair Instrumentation Cables

RE-2X(St)H...CI. FE 180 PH30 (CU/MGT+XLPE/OSCR/LSZH 300/500V Class 2)
RE-2G(St)H...CI. FE 180 PH30 (CU/SR/OSCR/LSZH 300/500V Class 2)
RE-2X(St)HSWAH...CI. FE 180 PH30 (CU/MGT+XLPE/OSCR/LSZH/SWA/LSZH 300/500V Class 2)
RE-2G(St)HSWAH...CI. FE 180 PH30 (CU/SR/OSCR/LSZH/SWA/LSZH 300/500V Class 2)



APPLICATION

The cables are designed, manufactured and tested as data transmission cables for emergency services. These are used for data and voice transmission when high frequency signal has to be assured also in the event of a fire.

STANDARDS

Basic design to BS 5308/BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*

No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound or fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together.In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, the bunches are then cabled together.
Overall Screen: Aluminum/polyester tape with 0.5mm^2 screen (7/0.3mm) tinned copper drain wire.
Inner Sheath(optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Armouring(optional): Galvanized steel wire armour
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

VOLTAGE RATING

300/500 V

COLOUR CODE

Insulation Colour: White with black numberings.
Sheath Colour: Orange (other colours on request).

TYPE CODE

RE-	Instrumentation cable	H	Halogen free & zero halogen
2X	XLPE	2G	Silicon Rubber
(St)	Static shield of aluminium tape	SWA	Steel Wire Armoured
FE180	Insulation integrity (950°C 180 minutes)	CI	Circuit integrity
PH 90	Fire Test for 90 mins at 830°C		

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +70°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter (unarmoured cables with silicone rubber insulation)
8 x Overall Diameter (unarmoured cables with XLPE insulation)
10 x Overall Diameter (armoured cables)

ELECTRICAL PROPERTIES

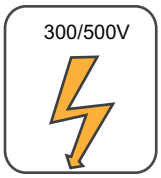
Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation Resistance	XLPE: ≥1000 MΩ x km (at 20°C); SR: ≥300 MΩ x km (at 20°C)
Short circuit Temperature	XLPE: 250°C SR: 350°C

CONSTRUCTION PARAMETERS

Conductor			RE-2X(St)H...CI. FE 180 PH30 RE-2G(St)H...CI. FE 180 PH30		RE-2X(St)HSWAH...CI. FE 180 PH30 RE-2G(St)HSWAH...CI. FE 180 PH30			
			Unarmoured		Armoured			
No. of Pairs X Cross Section	No./ Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight	Diameter Under Armour	Armour Wire Diameter	Nominal Overall Diameter	Approx. Weight
mm^2	no./mm	mm	mm	kg/km	mm	mm	mm	kg/km
1 Pairs								
1X2x1.0	7/0.43	0.6	8.0	76	8.0	0.90	12.4	281
1X2x1.5	7/0.53	0.7	8.5	94	8.5	0.90	13.1	332
1X2x2.5	7/0.67	0.8	10.5	130	10.5	0.90	15.1	401
2 Pairs								
2X2x1.0	7/0.43	0.6	12.4	120	12.4	0.90	17.4	370
2X2x1.5	7/0.53	0.7	14.0	160	14.0	0.90	18.4	450
2X2x2.5	7/0.67	0.8	16.0	230	16.0	0.90	20.5	550
5 Pairs								
5X2x1.0	7/0.43	0.6	16.5	276	16.5	1.25	22	854
5X2x1.5	7/0.53	0.7	20.5	368	20.5	1.25	26.2	1023
5X2x2.5	7/0.67	0.8	23.0	518	23.0	1.25	28.9	1276
10 Pairs								
10X2x1.0	7/0.43	0.6	20.5	501	20.5	1.25	26.4	1271
10X2x1.5	7/0.53	0.7	26.0	673	26.0	1.60	32.8	1742
10X2x2.5	7/0.67	0.8	29.5	971	29.5	1.60	36.5	2205
20 Pairs								

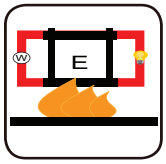
20X2x1.0	7/0.43	0.6	26.5	917	26.5	1.60	33.3	2197
20X2x1.5	7/0.53	0.7	34.0	1258	34.0	1.60	41.2	2705
20X2x2.5	7/0.67	0.8	38.5	1830	38.5	2.00	46.7	3836

Note : Other conductor sizes & pair configurations are available upon request.



Rated Voltage

Standard

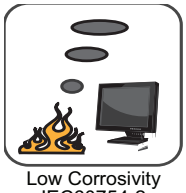


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

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

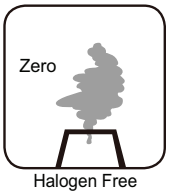
Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

Low Toxicity
NES 02-713/NF C 20-454

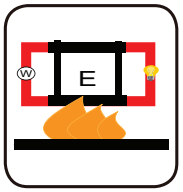


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074

Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



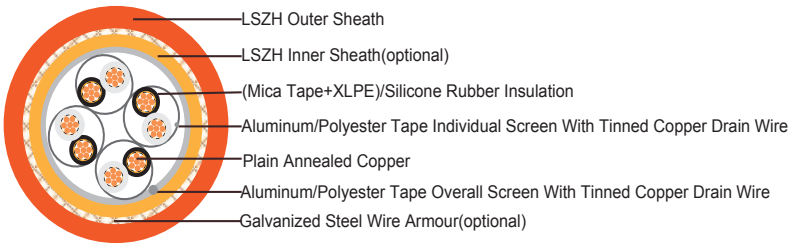
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V Mica+XLPE Insulated Individual And Overall Screened Instrumentation Cables

RE-2X(St)H PiMF...CI. FE 180 PH30 (CU/MGT+XLPE/PSCR/OSCR/LSZH 300/500V Class 2)
RE-2G(St)H PiMF...CI. FE 180 PH 30 (CU/SR/PSCR/OSCR/LSZH 300/500V Class 2)
RE-2X(St)HSWAH PiMF..CI. FE 180 PH 30 (CU/MGT+XLPE/PSCR/OSCR/LSZH/SWA/LSZH 300/500V Class 2)
RE-2G(St)HSWAH PiMF...CI. FE 180 PH 30 (CU/SR/PSCR/OSCR/LSZH/SWA/LSZH 300/500V Class 2)



APPLICATION

The cables are designed, manufactured and tested as data transmission cables for emergency services. These are used for data and voice transmission when high frequency signal has to be assured also in the event of a fire.

STANDARDS

Basic design to BS 5308/BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*

Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound or fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together.In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, the bunches are then cabled together.
Individual Screen: Aluminum/polyester tape with 0.5mm^2 screen (7/0.3mm) tinned copper drain wire.
Overall Screen: Aluminum/polyester tape with 0.5mm^2 screen (7/0.3mm) tinned copper drain wire.
Inner Sheath(optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Armouring(optional): Galvanized steel wire armour
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

VOLTAGE RATING

300/500 V

COLOUR CODE

Insulation Colour: White with black numberings.
Sheath Colour: Orange (other colours on request).

TYPE CODE

RE-	Instrumentation cable	H	Halogen free & zero halogen
2X	XLPE	2G	Silicon Rubber
(St)	Static shield of aluminium tape	SWA	Steel Wire Armoured
FE180	Insulation integrity (950°C 180 minutes)	CI	Circuit integrity
PH 90	Fire Test for 90 mins at 830°C		

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +70°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 6 x Overall Diameter (unarmoured cables with silicone rubber insulation)
8 x Overall Diameter (unarmoured cables with XLPE insulation)
10 x Overall Diameter (armoured cables)

ELECTRICAL PROPERTIES

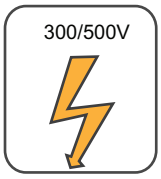
Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation Resistance	≥1000 MΩ x km (at 20°C);
Short circuit Temperature	XLPE: 250°C SR: 350°C

CONSTRUCTION PARAMETERS

Conductor			RE-2X(St)H PiMF...CI. FE 180 PH30 RE-2G(St)H PiMF...CI. FE 180 PH30		RE-2X(St)HSWAH PiMF..CI. FE 180 PH30 RE-2G(St)HSWAH PiMF..CI. FE 180 PH30			
No. of Pairs X Cross Section	No./ Nominal Diameter of Strands	Nominal Insulation Thickness	Unarmoured		Armoured			
			Nominal Overall Diameter	Approx. Weight	Diameter Under Armour	Armour Wire Diameter	Nominal Overall Diameter	Approx. Weight
mm^2	no./mm	mm	mm	kg/km	mm	mm	mm	kg/km
2 Pairs								
2X2x1.0	7/0.43	0.6	15.2	166	15.2	0.90	20.0	555
2X2x1.5	7/0.53	0.7	17.0	205	17.0	1.25	22.7	769
2X2x2.5	7/0.67	0.8	19.2	350	19.2	1.25	24.9	938
5 Pairs								
5X2x1.0	7/0.43	0.6	17.5	335	17.5	1.25	23.2	1000
5X2x1.5	7/0.53	0.7	21.5	433	21.5	1.60	28.1	1352
5X2x2.5	7/0.67	0.8	24.0	592	24.0	1.60	30.8	1665
10 Pairs								
10X2x1.0	7/0.43	0.6	22.5	626	22.5	1.60	29.3	1800
10X2x1.5	7/0.53	0.7	28.0	811	28.0	1.60	35.0	2165
10X2x2.5	7/0.67	0.8	31.5	1132	31.5	2.00	39.5	3007
20 Pairs								
20X2x1.0	7/0.43	0.6	30.5	1143	30.5	2.00	38.5	3019
20X2x1.5	7/0.53	0.7	38.0	1509	38.0	2.00	46.2	3684

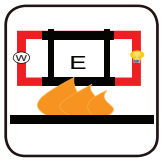
20X2x2.5	7/0.67	0.8	42.5	2112	42.5	2.50	51.9	5107

Note : Other conductor sizes & pair confi gurations are available upon request.



Rated Voltage

Standard

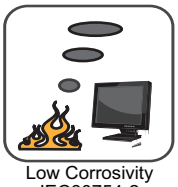


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

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

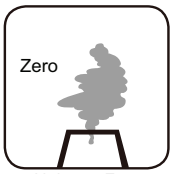
Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

Low Toxicity
NES 02-713/NF C 20-454

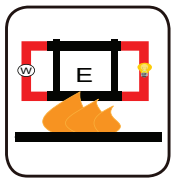


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074

Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



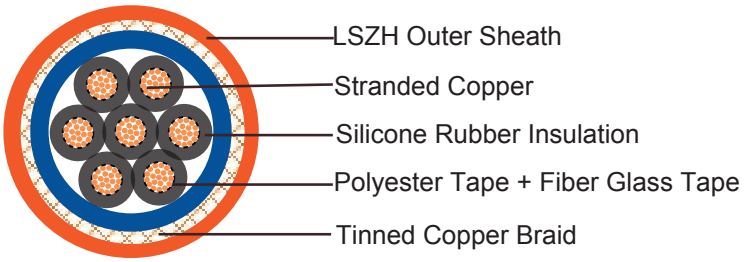
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V Braid-Screened Flexible Equipment Cables (Multipair)

LI-05SOZ1 FE180 (PH30) (CU/SR/OSCR/LSZH 300/500V Class 5)



APPLICATION

The cables are designed for indoor instrumentation and control cabling, electrically noisy environments and fire alarm systems in office buildings.

STANDARDS

Basic design to VDE 0812/EN 50290-2-27

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductor: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling: The insulated cores are cabled in concentric layers with suitable non-hygroscopic fillers.
Fire Barrier: Polyester tape + fiber glass tape
Overall screen: Aluminum/polyester tape with tinned copper braid (min. 85% Coverage)
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

VOLTAGE RATING

300/500 V

COLOUR CODE

Insulation Colour: Per VDE 0812
Sheath Colour: Orange (other colours on request)

TYPE CODE

LI	Equipment cable with fine stranded conductor
H	Halogen free ceramic polymer compound
C	Copper Wire Braid
FE180	Insulation integrity (950°C 180 minutes)
PH 90	Fire Test for 90 mins at 830°C

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

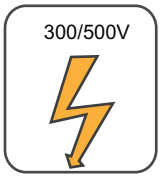
ELECTRICAL PROPERTIES

Dielectric test:	2000 V r.m.s. x 5' (core/core)
Insulation Resistance	≥300 MΩ x km (at 20°C);
Short circuit Temperature	350°C

CONSTRUCTION PARAMETERS

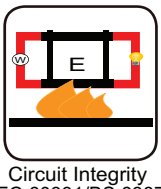
Cable Code	No. of Core X Cross Section	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	mm	mm	mm	kg/km
2 cores					
LI-HCH FE180 (PH30)	2x0.75	0.6	0.8	6.3	55

LI-HCH FE180 (PH30)	2x1.0	0.6	0.9	6.9	62
LI-HCH FE180 (PH30)	2x1.5	0.7	0.9	7.3	79
3 cores					
LI-HCH FE180 (PH30)	3x0.75	0.6	0.8	6.6	67
LI-HCH FE180 (PH30)	3x1.0	0.6	0.9	7.2	77
LI-HCH FE180 (PH30)	3x1.5	0.7	0.9	7.6	101
4 cores					
LI-HCH FE180 (PH30)	4x0.75	0.6	0.9	7.2	85
LI-HCH FE180 (PH30)	4x1.0	0.6	1.0	7.7	98
LI-HCH FE180 (PH30)	4x1.5	0.7	1.0	8.2	112
5 cores					
LI-HCH FE180 (PH30)	5x0.75	0.6	0.9	7.9	105
LI-HCH FE180 (PH30)	5x1.0	0.6	1.0	7.9	117
LI-HCH FE180 (PH30)	5x1.5	0.7	1.0	9.0	127
6 cores					
LI-HCH FE180 (PH30)	6x0.75	0.6	0.9	8.6	121
LI-HCH FE180 (PH30)	6x1.0	0.6	1.0	9.1	138
LI-HCH FE180 (PH30)	6x1.5	0.7	1.0	10.0	161
7 cores					
LI-HCH FE180 (PH30)	7x0.75	0.6	0.9	8.6	131
LI-HCH FE180 (PH30)	7x1.0	0.6	1.0	9.1	152
LI-HCH FE180 (PH30)	7x1.5	0.7	1.1	10.0	193



Rated Voltage

Standard

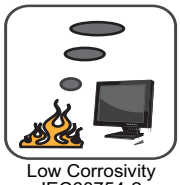


Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)

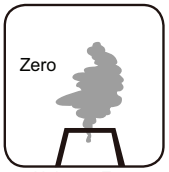

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

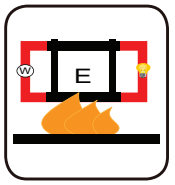

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



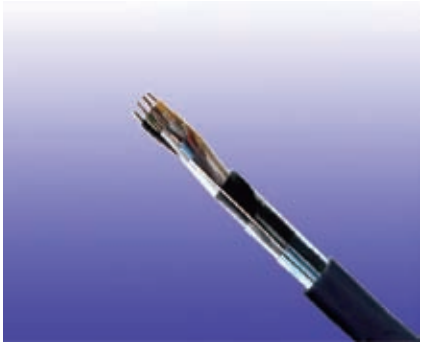
Halogen Free
IEC60754-1
EN50267-2-1

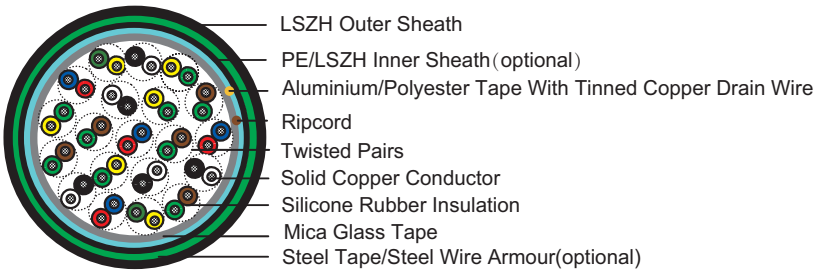


Functional Integrity
DIN 4102-12

225V SR Insulated & LSZH Sheathed Fire Alarm Cables

JE-H(St)H…Bd FE180 E30 (CU/SR/OSCR/LSZH 225V Class 1)
JE-H(St)HSWAH…Bd FE180 E30 (CU/SR/OSCR/LSZH/SWA/LSZH 225V Class 1)





APPLICATION

The cables are used for the internal wiring of building when the circuit integrity during fire is paramount. The cables are intended for use in fire fighting plants with special ceramized silicone insulation, with and without aluminum foil and LSZH outer sheath. The fire alarm cables with 30 to 90 minutes circuit integrity should be used for control voltages and data transfer in alarm and fire alarm systems, where a system circuit integrity E30/E60/E90 depending on lay system in accordance with DIN 4102-12 is required. The circuit integrity is guaranteed with a test voltage of 110V.

STANDARDS

Basic design to VDE 0815

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*

No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Solid annealed bare or tinned copper sized 0.6/0.8/0.9mm as per class 1 of VDE 0295/ IEC 60228.
Insulation: Silicone Rubber compound as per DIN VDE 0266.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together.In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, and the bunches are then cabled together.
Cable Core Assembly: The twisted pairs are stranded to the core in layers.
Core Wrapping: One or more non hygroscopic polyester tapes are helically or longitudinally laid with an overlap prior to sheathing.
Screen: A laminated Aluminum/Polyester tape is placed in contact with solid copper 0.6mm or 0.8mm drain wire.
Inner Sheath(optional): PE or thermoplastic LSZH compound type.
Armour (optional): Either corrugated steel tape armour or galvanized steel wire is applied over an inner polyethylene sheath. For steel tape armour, the 0.15mm thick steel tape is coated with a copolymer and applied with an overlap. For steel wire armour, single layer of galvanized steel wire armour is applied.
Ripcord: Nylon ripcord may be placed parallel to the cores to facilitate sheath removal.
Drain Wire: A solid tinned earth/continuity wire shall be laid longitudinally for screened cables.
Outer Sheath: Thermoplastic LSZH compound HM2 as per DIN VDE 0207-24. UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Quad colour in each bundle:
Pair 1: Blue-Red Pair 2: Green-Yellow Pair 3: Green-Brown Pair 4: White-Black
The individual bundles are identified by a numbered helix.

TYPE CODE

JE-	Fire alarm cable
Bd	Unit stranding.
FE180	Insulation integrity (950°C 180 minutes)
STA	Corrugated steel tape
SWB	Steel wire braid
H	Halogen free & zero halogen
(St)	Static shield of Aluminum tape
E30	30 minutes system circuit integrity
SWA	Steel wire armour

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter (unarmoured cable)
10 x Overall Diameter (armoured cables)

ELECTRICAL PROPERTIES

Conductor Diameter	mm	0.6	0.8	0.9
Conductor Size	mm^2	0.283	0.5	0.312
Maximum Conductor Resistance @20°C	Ω/km	63	34.6	28.0
Maximum Loop Resistance @20°C	Ω/km	130	73.2	60
Minimum Insulation Resistance @500V DC @20°C	MΩ.km	100	100	100
Maximum Average Attenuation @0.8KHz	dB/km	1.7	1.2	0.74
Nominal Mutual Capacitance @0.8KHz	nF/km	120	120	120
Maximum Capacitance Unbalance K1 @0.8KHz pair-to-pair	pF/100m	200	200	200
Working Voltage	V	225	225	225
Nominal Insulation Thickness	mm	0.3	0.4	0.45
Nominal Insulated Conductor Diameter	mm	1.2	1.6	1.7

CONSTRUCTION PARAMETERS

VDE CODE: JE-SH(St)H…x2x0.8 Bd FE180/E30

Cable Code	No.of Pairs	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
		mm	mm	mm	kg/km
0.8mm Conductor, 1.6mm Insulated Wire					
JE-H(St)H...1x2x0.8 Bd FE180/E30	1	0.4	1.0	6.0	46
JE-H(St)H...2x2x0.8 Bd FE180/E30	2	0.4	1.0	6.6	61
JE-H(St)H...4x2x0.8 Bd FE180/E30	4	0.4	1.0	8.8	104
JE-H(St)H...6x2x0.8 Bd FE180/E30	6	0.4	1.0	10.8	160
JE-H(St)H...8x2x0.8 Bd FE180/E30	8	0.4	1.0	12.8	218
JE-H(St)H...10x2x0.8 Bd FE180/E30	10	0.4	1.2	13.1	220
JE-H(St)H...12x2x0.8 Bd FE180/E30	12	0.4	1.2	13.5	235
JE-H(St)H...16x2x0.8 Bd FE180/E30	16	0.4	1.2	14.7	297
JE-H(St)H...20x2x0.8 Bd FE180/E30	20	0.4	1.2	16.1	367
JE-H(St)H...24x2x0.8 Bd FE180/E30	24	0.4	1.4	18.1	440
JE-H(St)H...30x2x0.8 Bd FE180/E30	30	0.4	1.4	20.1	645
JE-H(St)H...32x2x0.8 Bd FE180/E30	32	0.4	1.4	20.6	645
JE-H(St)H...40x2x0.8 Bd FE180/E30	40	0.4	1.4	22.5	656
JE-H(St)H...50x2x0.8 Bd FE180/E30	50	0.4	1.6	24.3	840

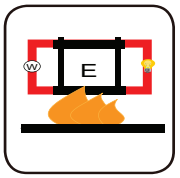
VDE CODE: JE-SH(St)HSWAH…x2x0.6/0.8/0.9 Bd FE180/E30

Cable Code	No. of Pairs	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight

		mm	mm	mm	kg/km
0.6mm Conductor,1.2mm Insulated Wire					
JE-H(St)HSWAH...2x2x0.6 Bd FE180/E30	2	0.3	1.0/1.8	12.1	305
JE-H(St)HSWAH...3x2x0.6 Bd FE180/E30	3	0.3	1.0/1.8	12.6	325
JE-H(St)HSWAH...6x2x0.6 Bd FE180/E30	6	0.3	1.0/1.8	12.6	380
JE-H(St)HSWAH...8x2x0.6 Bd FE180/E30	8	0.3	1.0/1.8	14.6	415
JE-H(St)HSWAH...10x2x0.6 Bd FE180/E30	10	0.3	1.0/1.8	16.5	450
JE-H(St)HSWAH...12x2x0.6 Bd FE180/E30	12	0.3	1.0/1.8	17.0	500
JE-H(St)HSWAH...20x2x0.6 Bd FE180/E30	20	0.3	1.0/1.8	20.5	580
JE-H(St)HSWAH...25x2x0.6 Bd FE180/E30	25	0.3	1.0/1.8	21.5	940
JE-H(St)HSWAH...30x2x0.6 Bd FE180/E30	30	0.3	1.0/1.8	22.5	1300
0.8mm Conductor, 1.6mm Insulated Wire					
JE-H(St)HSWAH...2x2x0.8 Bd FE180/E30	2	0.4	1.0/1.8	14.0	415
JE-H(St)HSWAH...3x2x0.8 Bd FE180/E30	3	0.4	1.0/1.8	14.0	425
JE-H(St)HSWAH...6x2x0.8 Bd FE180/E30	6	0.4	1.0/1.8	15.0	485
JE-H(St)HSWAH...8x2x0.8 Bd FE180/E30	8	0.4	1.0/1.8	17.5	520
JE-H(St)HSWAH...10x2x0.8 Bd FE180/E30	10	0.4	1.2/1.8	19.0	540
JE-H(St)HSWAH...12x2x0.8 Bd FE180/E30	12	0.4	1.2/1.8	20.5	600
JE-H(St)HSWAH...20x2x0.8 Bd FE180/E30	20	0.4	1.4/1.8	24.5	1050
JE-H(St)HSWAH...25x2x0.8 Bd FE180/E30	25	0.4	1.4/1.8	27.0	1250
JE-H(St)HSWAH...30x2x0.8 Bd FE180/E30	30	0.4	1.4/1.8	28.5	1450
0.9mm Conductor, 1.8mm Insulated Wire					
JE-H(St)HSWAH...10x2x0.9 Bd FE180/E30	10	0.45	1.2/1.8	19.7	600
JE-H(St)HSWAH...15x2x0.9 Bd FE180/E30	15	0.45	1.2/1.8	23.0	1020
JE-H(St)HSWAH...20x2x0.9 Bd FE180/E30	20	0.45	1.4/1.8	25.3	1160
JE-H(St)HSWAH...25x2x0.9 Bd FE180/E30	25	0.45	1.4/1.8	27.3	1330
JE-H(St)HSWAH...30x2x0.9 Bd FE180/E30	30	0.45	1.4/1.8	29.3	1520

Rated Voltage

Standard

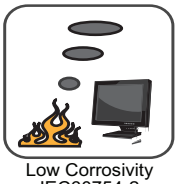


Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

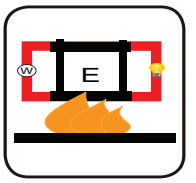

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

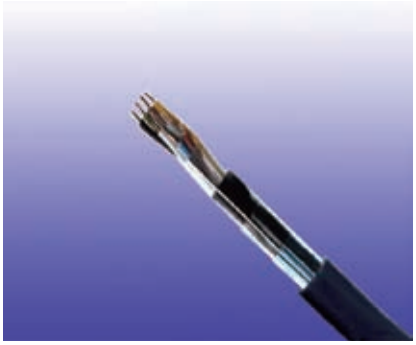
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300V Mica+LSZH Insulated & LSZH Sheathed Fire Alarm Cables

JE-H(St)H…Bd FE180 E90. (CU/MICA+LSZH/OSCR/LSZH 300V Class 1)
JE-H(St)H…Bd FE180 E90 BMK* (CU/MICA+LSZH/OSCR/LSZH 300V Class 1)



APPLICATION

The cables are used for the internal wiring of building when the circuit integrity during fire is paramount. The cables are intended for use in fire fighting plants with mica tapes, with and without Aluminum foil and LSZH outer sheath.The fire alarm cables with 30 to 90 minutes circuit integrity should be used for control voltages and data transfer in alarm and fire alarm systems, where a system circuit integrity E30/E60/E90 depending on lay system in accordance with DIN 4102-12 is required. The circuit integrity is guaranteed with a test voltage of 110V.

STANDARDS

Basic design to VDE 0815

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E90 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Solid annealed bare or tinned copper sized 0.8mm as per class 1 of VDE 0295/IEC 60228.
Fire Barrier: Mica glass tape.
Insulation: Thermoplastic LSZH compound HI1 as per DIN VDE 0207-23.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together. In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, the bunches are then cabled together.
Cable Core Assembly: The twisted pairs are stranded to the core in layers.
Core Wrapping: One or more non hygroscopic polyester tapes are helically or longitudinally laid with an overlap prior to sheathing.
Screen: A laminated Aluminum/Polyester tape in contact with solid copper 0.6mm or 0.8mm drain wire.
Ripcord: Nylon ripcord may be placed parallel to the cores to facilitate sheath removal.
Drain Wire: A solid tinned earth/continuity wire shall be laid longitudinally for screened cables.
Outer Sheath: Thermoplastic LSZH compound HM2 as per DIN VDE 0207-24. UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Quad colour in each bundle:
Pair 1: Blue-Red
Pair 2: Green-Yellow
Pair 3: Green-Brown
Pair 4: White-Black
The individual bundles are identified by a numbered helix.

TYPE CODE

JE-	Fire alarm cable	(St)	Static shield of Aluminum tape
H	Halogen free & zero halogen	FE180	Insulation integrity (950°C 180 minutes)
Bd	Unit stranding	E90	90 minutes circuit integrity

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

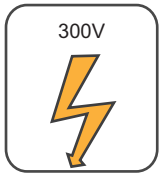
Nominal Conductor Diameter	mm	0.8
Conductor Size	mm^2	0.5
Maximum Conductor Resistance @20°C	Ω/km	34.6
Maximum Loop Resistance @20°C	Ω/km	73.2
Minimum Insulation Resistance @500V DC @20°C	MΩ.km	100
Maximum Average Attenuation @0.8KHz	dB/km	1.1
Average Mutual Capacitance	nF/km	120

Capacitance Unbalance K1 @0.8KHz pair-to-pair	pF/100m	200
Working Voltage	V	300
Nominal Insulation Thickness	mm	0.4
Nominal Insulated Conductor Diameter	mm	1.6

CONSTRUCTION PARAMETERS

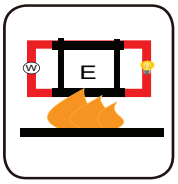
VDE CODE: JE-mH(St)H…x2x0.8 Bd FE180 E90 /JE-H(St)H…x2x0.8 Bd FE180/E90 BMK*

Cable Code	No. of Pairs	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
		mm	mm	mm	kg/km
0.8mm Conductor, 1.6mm Insulated Wire					
JE-H(St)H...2x2x0.8 Bd FE180/E90 BMK*	2	0.4	1.0	12.8	177
JE-H(St)H...4x2x0.8 Bd FE180/E90 BMK*	4	0.4	1.0	16.3	284
JE-H(St)H...8x2x0.8 Bd FE180/E90 BMK*	8	0.4	1.0	20.3	447
JE-H(St)H...12x2x0.8 Bd FE180/E90 BMK*	12	0.4	1.2	23.9	615
JE-H(St)H...16x2x0.8 Bd FE180/E90 BMK*	16	0.4	1.2	26.6	756
JE-H(St)H...20x2x0.8 Bd FE180/E90 BMK*	20	0.4	1.2	29.4	921
JE-H(St)H...32x2x0.8 Bd FE180/E90 BMK*	32	0.4	1.4	30.7	1074
JE-H(St)H...40x2x0.8 Bd FE180/E90 BMK*	40	0.4	1.4	33.6	1278
JE-H(St)H...52x2x0.8 Bd FE180/E90 BMK*	52	0.4	1.6	43.7	2011



Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

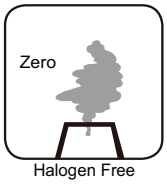

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

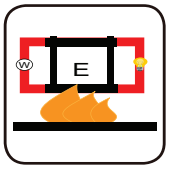

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



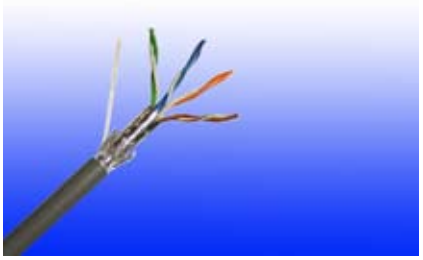
Halogen Free
IEC60754-1
EN50267-2-1

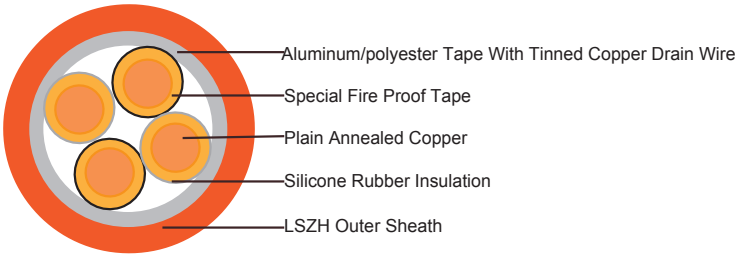


Functional Integrity
DIN 4102-12

225V SR Insulated & LSZH Sheathed Fire Alarm Cables BMK*

JE-SH(St)H…Bd FE180 E30 BMK (CU/MICA+SR/OSCR/LSZH 225V Class 1)





APPLICATION

The cables are used for the internal wiring of building when the circuit integrity during fire is paramount. The cables are intended for use in fire fighting plants with mica tapes, with and without Aluminum foil and LSZH outer sheath.The fire alarm cables with 30 to 90 minutes circuit integrity should be used for control voltages and data transfer in alarm and fire alarm systems, where a system circuit integrity E30/E60/E90 depending on lay system in accordance with DIN 4102-12 is required. The circuit integrity is guaranteed with a test voltage of 110V.

STANDARDS

Basic design to VDE 0815

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, sized 0.8mm solid according to IEC(EN) 60228 class 1.
Flame barrier: Special fire proof tape.
Insulation: Fire resistant silicone rubber type HJ1 as per DIN VDE 0207-23.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together. In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, the bunches are then cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Outer Sheath: Thermoplastic LSZH compound HM2 as per DIN VDE 0207-24. UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:
Each bunch blue - red / grey - yellow / green - brown / white - black
Bunch identication plastic numbered tape
Sheath Colour:
Colour red with printed " BMK - BRANDMELDEKABEL" denoting fire alarms.

TYPE CODE

JE-	Fire alarm cable
Bd	Unit stranding.
FE180	Insulation integrity (950°C 180 minutes)
STA	Corrugated steel tape
SWB	Steel wire braid
H	Halogen free & zero halogen
(St)	Static shield of Aluminum tape
E30	30 minutes system circuit integrity
SWA	Steel wire armour

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

ELECTRICAL PROPERTIES

Conductor Diameter	mm	0.8
Conductor Size	mm^2	0.5
Maximum Conductor Resistance @20°C	Ω/km	34.6
Maximum Loop Resistance @20°C	Ω/km	73.2
Minimum Insulation Resistance @500V DC @20°C	MΩ.km	100
Maximum Average Attenuation @0.8KHz	dB/km	1.2
Nominal Mutual Capacitance @0.8KHz	nF/km	120
Maximum Capacitance Unbalance K1 @0.8KHz pair-to-pair	pF/100m	200
Working Voltage	V	225

Nominal Insulation Thickness	mm	0.4
Nominal Insulated Conductor Diameter	mm	1.6

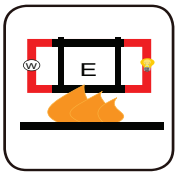
CONSTRUCTION PARAMETERS

Cable Code	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
mm^2	mm	mm	mm	kg/km
0.8mm Conductor, Solid 0,5 mm^2 Section				
JE-SH(St)H...1X2x0.8 FE180/E30 BMK	0.4	1.0	6.1	52
JE-SH(St)H...2X2x0. 8(quad) FE180/E30 BMK	0.4	1.0	7.5	77
JE-SH(St)H...4X2x0. 8 FE180/E30 BMK	0.4	1.0	10.5	133
0.8mm Conductor, Solid 0,5 mm^2 Section				
JE-SH(St)H...8X2x0.8 Bd FE180/E30 BMK	0.4	1.0	17. 4	296
JE-SH(St)H...12X2x0.8 Bd FE180/E30 BMK	0.4	1.2	18. 9	368
JE-SH(St)H...16X2x0.8 Bd FE180/E30 BMK	0.4	1.2	20. 7	442
JE-SH(St)H...20X2x0.8 Bd FE180/E30 BMK	0.4	1.2	22. 7	508
JE-SH(St)H...32X2x0.8 Bd FE180/E30 BMK	0.4	1.4	24. 5	772
JE-SH(St)H...40X2x0.8 Bd FE180/E30 BMK	0.4	1.4	26. 5	946
JE-SH(St)H...52X2x0.8 Bd FE180/E30 BMK	0.4	1.6	28. 0	1016

approximate values

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

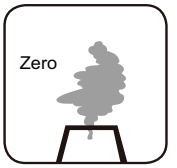

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

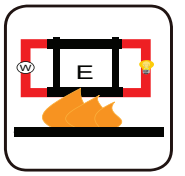

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



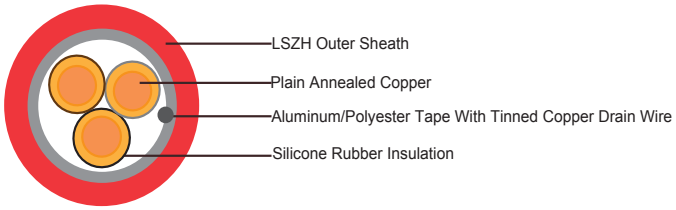
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V SR Insulated & LSZH Sheathed Fire Alarm Cables

FFX200P 05SOZ1-U (PH30) (CU/SR/OSCR/LSZH 300/500V Class 1)
FFX200P 05SOZ1-R (PH30) (CU/SR/OSCR/LSZH 300/500V Class 2)



APPLICATION

The cables are designed, manufactured and tested as data transmission cables for emergency services. These are primarily intended for for indoor instrumentation and control cabling, electrically noisy environments and fire alarm systems in office buildings when high frequency signal transmission has to be assured in the event of a fire.

STANDARDS

Basic design to BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); BS 8434-1 (30mins); BS 5839-1 Clause 26 2d; CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
Circuit Integrity with mechanical shock	EN 50200(PH30); CEI 20-36/4-0
Circuit Integrity with mechanical shock & water spray	EN 50200 annex E
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*

Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, solid according to IEC(EN) 60228 class 1, stranded according to IEC(EN) 60228 class 2.
Insulation: Fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers with suitable non-hygroscopic fillers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour:
Cables up to 6 pairs black-red / black-blue / red-blue / yellow-black /yellow-red / yellow-blue
Cables above 6 pairs all pairs black-red numbered on the wrapping tape.
Sheath Colour: Colour red (other colours on request).

PHYSICAL AND THERMAL PROPERTIES

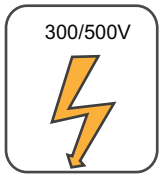
Temperature range during operation (fixed state): -30°C – +90°C
Temperature range during installation (mobile state): -20°C – +50°C
Minimum bending radius: 7.5 x Overall Diameter

CONSTRUCTION PARAMETERS

Cable Code	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
mm^2	mm	mm	mm	kg/km
1 Pairs				
1x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	0.9	7.4	77
1x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	0.9	8,7	100
2 Pairs				
2x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.0	10.6	130
2x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.0	10.2	188
3 Pairs				

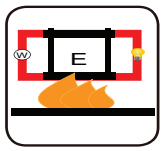
3x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.1	11.2	196
3x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.1	12.9	223
5 Pairs				
5x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.2	13.7	245
5x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.3	16.7	346
6 Pairs				
6x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.2	14.8	300
6x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.3	17.5	426
10 Pairs				
10x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.4	18.9	378
10x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.5	23.4	541
15 Pairs				
15x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.5	23.2	567
15x2x1.5 stranded FFX200P 05SOZ1-R (PH30)	0.7	1.6	28.9	892
20 Pairs				
20x2x1 stranded FFX200P 05SOZ1-R (PH30)	0.6	1.6	26.2	831
20x2x1.5stranded FFX200P 05SOZ1-R (PH30)	0.7	1.8	32.5	1182

approximate values



Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
EN 50200
NF C32-070-2.3(CR1)


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

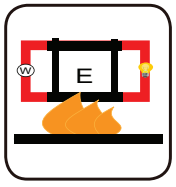

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

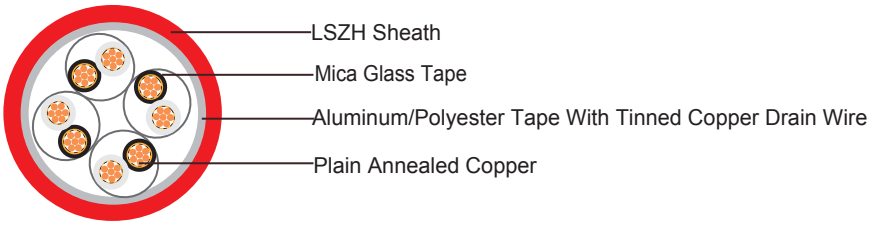
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

300/500V Mica+XLPE Insulated & LSZH Sheathed Fire Alarm Cables

FFX200P 05mROZ1-R (CU/MICA+XLPE/OSCR/LSZH 300/500V Class 2)



APPLICATION

The cables are designed, manufactured and tested as data transmission cables for emergency services. These are primarily intended for for indoor instrumentation and control cabling, electrically noisy environments and fire alarm systems in office buildings when high frequency signal transmission has to be assured in the event of a fire.

STANDARDS

Basic design to BS 7629-1

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-21; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape covered by extruded cross-linked XLPE compound or cross-linked compound type EI5 as per BS 7655: section 5.1.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together. In cables with 8 pairs or more, 4 pairs are assembled to form a bunch, the bunches are then cabled together.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE

Insulation Colour: According to IEC 60189-2 (other colour code on request).
Sheath Colour: Colour red (other colours on request).

PHYSICAL AND THERMAL PROPERTIES

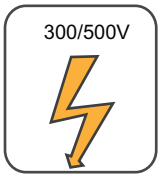
Temperature range during operation (fixed state): -30°C - +90°C
Temperature range during installation (mobile state): -20°C - +50°C
Minimum bending radius: 8 x Overall Diameter

CONSTRUCTION PARAMETERS

Cable Code	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
mm^2	mm	mm	mm	kg/km
1 Pairs				
1x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	0.8	7.8	64
1x2x1 stranded FFX200P 05mROZ1-R (PH30)	0.6	0.9	8.4	73
1x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	0.9	9.3	87
2 Pairs				
2x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	0.9	10.7	118
2x2x1stranded FFX200P 05mROZ1-R (PH30)	0.6	1.0	11.5	136
2x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	1.0	13.0	165
5 Pairs				
5x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.1	14.8	218
5x2x1 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.2	15.7	266
5x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	1.3	18.1	342
10 Pairs				

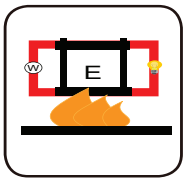
10x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.3	20.1	380
10x2x1 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.4	21.3	455
10x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	1.5	24.8	606
15 Pairs				
15x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.4	24.9	535
15x2x1 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.5	26.5	646
15x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	1.6	30.8	862
20 Pairs				
20x2x0.75 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.5	28.2	680
20x2x1 stranded FFX200P 05mROZ1-R (PH30)	0.6	1.6	30.2	839
20x2x1.5 stranded FFX200P 05mROZ1-R (PH30)	0.7	1.8	34.9	1121

approximate values



Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

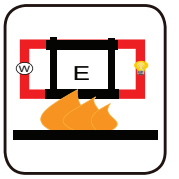

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

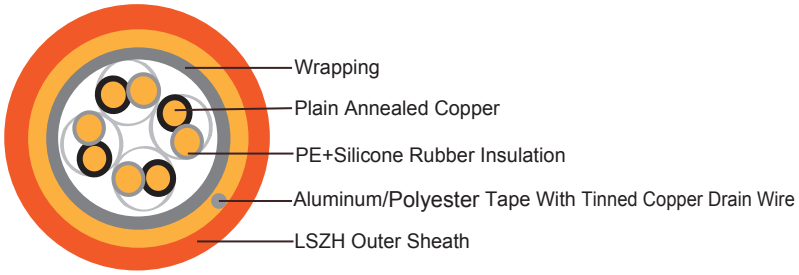
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant FTP CAT3 Data Cables

FFX-CAT3FTPXP22FR



APPLICATION

The cables are desgined for structure wiring, compatible with all known connection systems according to EN 50173. Based on the design for structured wiring (found in IEC 61156 and BS EN 50288), this cable brings together high frequency data transmission and circuit integrity in a one pair, two pair and four pair cable that will continue to transmit data even when being directly attacked by fire.

STANDARDS

Basic design to EN 50173

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

60V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, sized 0.64mm and solid according to IEC(EN) 60228 class 1.
Insulation: PE wrapping with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layer.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.) . UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

COLOUR CODE:

Sheath Colour: Red, white or black

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -20°C - +90°C
Temperature range during installation (mobile state): -5°C - +50°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Characteristic Impedance	100 Ohm±15%
Nominal Velocity Of Propagation (NVP)	69%
Max. Dc Resistance	5.8 Ohm/100m
Max. Resistance Unbalance	5%
Max. Propagation Delay Skew	30 ns/100m
Max. Propagation Delay	536 ns/100m@100 mhz
Max. Pulling Load	80N

TRANSMISSION PROPERTIES

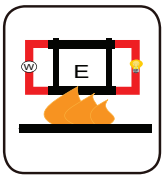
FREQ (MHz)	NEXT(dB/100m) Minmum Value/Typical Value/Standard Value	IL (dB/100m)	SRL(dB/100m) Minmum Value/Typical Value/Standard Value
1	43.0/48.0/41.0	2.6	13.0/16.0/12.0
4	34.0/38.0/32.0	5.6	13.0/16.0/12.0
8	29.0/33.0/26.0	8.5	13.0/16.0/12.0
10	28.0/33.0/26.0	9.8	13.0/16.0/12.0
16	25.0/30.0/23.0	13.1	11.0/14.0/10.0

CONSTRUCTION PARAMETERS

Cable Code	Nominal Insulation Thickness	Nominal Overall Diameter	Approx. Weight
	mm	mm	kg/km
FFX-CAT3FTP1P22FR	0.25	6.8	48
FFX-CAT3FTP2P22FR	0.25	8.1	97
FFX-CAT3FTP4P22FR	0.25	10.4	122

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

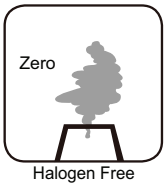

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

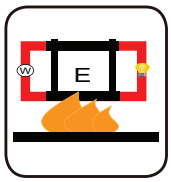

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



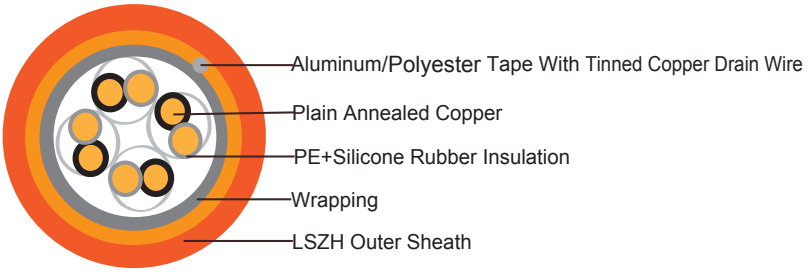
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant UTP CAT5 Data Cables

FFX-CAT5UTP4P24FR



APPLICATION

The cables are desgined for structure wiring, compatible with all known connection systems according to EN 50173.

Based on the design for structured wiring (found in IEC 61156 and BS EN 50288), this cable brings together high frequency data transmission and circuit integrity in four pair cable that will continue to transmit data even when being directly attacked by fire.

STANDARDS

Basic design to EN50173

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*

No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

VOLTAGE RATING

60V

CABLE CONSTRUCTION

Conductors: Plain annealed copper wire, solid according to IEC(EN) 60228 class 1.
Insulation: PE wrapped with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1.
Twisted Pairs: Insulated conductors are twisted into pairs with varying lay length to minimize crosstalk.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two-pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -5°C - +50°C
Temperature range during installation (mobile state): -20°C - +90°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Characteristic Impedance	100 Ohm±15%
Nominal Velocity of Propagation (NVP)	69%
Max. Dc Resistance	9.38 Ohm/100m
Max. Resistance Unbalance	5%
Max. Mutual Capacitance:	5.6 nF/100m
Maximum Capacitance Unbalance	330 pF/100m
Max. Propagation Delay Skew	30 ns/100m
Max. Propagation Delay	536 ns/100m@100 mhz
Max. Pulling Load	80N

TRANSMISSION PROPERTIES

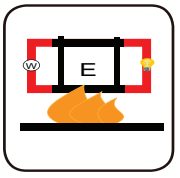
FREQ (MHz)	NEXT(dB/100m) Minimum Value/Typical Value/ Standard Value	IL (dB/100m)	SRL (dB/100m) Minimum Value/Typical Value/ Standard Value
1	64.0/71.0/62.0	2.0	24.5/26.0/23.0
4	55.0/62.0/53.0	4.0	24.5/26.0/23.0
8	49.5/57.0/48.0	5.7	24.5/26.0/23.0
10	49.0/56.0/47.0	6.4	24.5/26.0/23.0
16	44.9/52.0/44.0	8.2	24.5/26.0/23.0
20	42.5/48.0/42.0	9.2	24.5/26.0/23.0
25	42.0/48.0/41.0	10.3	24.5/26.0/23.0
31.25	40.6/48.0/39.0	11.6	22.5/24.0/21.0
62.5	36.1/43.0/35.0	16.9	19.5/22.0/18.0
100	34.0/40.0/32.0	21.8	17.5/20.0/16.0

CONSTRUCTION PARAMETERS

Cable Code	Conductor Diameter	Nominal Insulation Thickness	Nominal Overall Diameter
	mm	mm	mm
FFX-CAT5UTP4P24FR	0.5	0.25	5.3

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

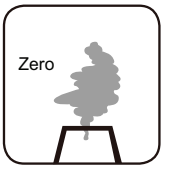

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

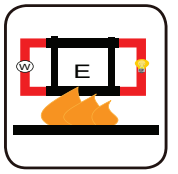

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

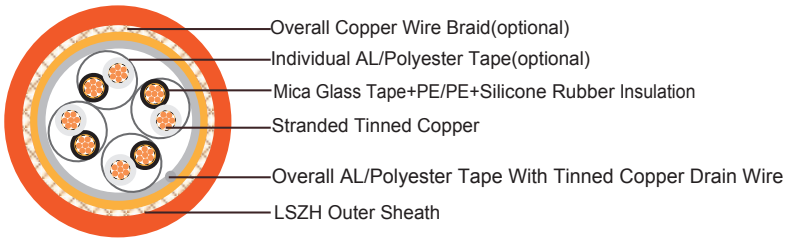


Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant RS485 Databus Cables



APPLICATION

The cables are designed for RS485 data connections where continued functionality is required during a fire situation. This cable combines low capacitance insulation with one of the highest levels of screening to provide high speed, interference free, data transmission where continued functionality is required during a fire situation.

STANDARDS

Basic design to EIA/TIA 485

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard..

CABLE CONSTRUCTION

Multipair RS 485 Overall Screened Databus Cable
Conductors: Tinned copper wire, stranded according to IEC(EN) 60228 class 2.

Insulation: Mica glass tape wrapped with PE or PE wrapped with silicone rubber insulation.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers.
Overall Screen: Aluminum/polyester tape with tinned copper drain wire.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

Multipair RS 485 Overall Double Screened Databus Cable
Conductors: Tinned copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape wrapped with PE or PE wrapped with silicone rubber insulation.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers.
Overall Screen: Aluminium/polyester tape+copper wire braid.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

Multipair RS 485 Individual & Overall Screened Databus Cable
Conductors: Tinned copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape wrapped with PE or PE wrapped with silicone rubber insulation.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers.
Individual Screen: Individual aluminium/polyester tape.
Overall Screen: Copper wire braid.
outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

Multipair RS 485 Overall Screened Databus Cable
Conductors: Tinned copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Mica glass tape wrapped with PE or PE wrapped with silicone rubber insulation.
Cabling Elements: Insulated cores are twisted to form pairs with varying lay length to minimize crosstalk. Two pair cable had four cores laid in quad formation.
Cabling: Pairs are cabled together in concentric layers.
Overall Screen: Copper wire braid.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.) . UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -20°C - +90°C
Temperature range during installation (mobile state): -5°C - +60°C
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Dielectric test	1000 V r.m.s. for 5' (core-core)
	1000 V r.m.s. for 5' (core-screen)
Impedance	120Ω
Capacitance	45 nF/km conductor to conductor
	90 nF/km conductor to shield

CONSTRUCTION PARAMETERS

Multipair RS 485 Overall Screened Databus Cable

RE-m02Y(ST)H-FR / RE-m02YS(ST)H-FR

RE-S02Y(ST)H-FR / RE-S02YS(ST)H-FR

No.of pair x	Nominal Cross Sectional Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	No/mm	mm	mm	mm	kg/km
1	0.22	7/0.2	0.55	0.40	4.6	29
2	0.22	7/0.2	0.55	0.40	8.1	60
4	0.22	7/0.2	0.55	0.40	9.6	100
1	0.50	16/0.2	0.55	0.40	5.2	44
2	0.50	16/0.2	0.55	0.40	9.3	91
4	0.50	16/0.2	0.55	0.40	11.1	158
1	0.75	24/0.2	0.55	0.40	5.6	56
2	0.75	24/0.2	0.55	0.40	10.3	117
4	0.75	24/0.2	0.55	0.40	12.2	207
1	1.00	30/0.2	0.55	0.40	5.8	61.4
2	1.00	30/0.2	0.55	0.40	10.6	128
4	1.00	30/0.2	0.55	0.40	12.5	228

Multipair RS 485 Overall Double Screened Databus Cable

RE-m02Y(ST)CH-FR / RE-m02YS(ST)CH-FR

RE-S02Y(ST)CH-FR / RE-S02YS(ST)CH-FR

No.of pair x	Nominal Cross Sectional Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	No/mm	mm	mm	mm	kg/km
1	0.22	7/0.2	0.55	0.40	5.0	45
2	0.22	7/0.2	0.55	0.40	8.6	88

4	0.22	7/0.2	0.55	0.40	10.1	134
1	0.50	16/0.2	0.55	0.40	5.6	61
2	0.50	16/0.2	0.55	0.40	9.8	124
4	0.50	16/0.2	0.55	0.40	11.5	197
1	0.75	24/0.2	0.55	0.40	6.1	75
2	0.75	24/0.2	0.55	0.40	10.7	154
4	0.75	24/0.2	0.55	0.40	12.7	250
1	1.00	30/0.2	0.55	0.40	6.3	81
2	1.00	30/0.2	0.55	0.40	11.0	166
4	1.00	30/0.2	0.55	0.40	13.0	273

Multipair RS 485 Individual & Overall Screened Databus Cable

RE-m02Y(ST)H PiMF-FR / RE-m02YS(ST)H PiMF-FR

RE-S02Y(ST)H PiMF-FR / RE-S02YS(ST)H PiMF-FR

No.of pair x	Nominal Cross Sectional Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	No/mm	mm	mm	mm	kg/km
1	0.22	7/0.2	0.55	0.40	4.9	46
2	0.22	7/0.2	0.55	0.40	8.6	91
4	0.22	7/0.2	0.55	0.40	10.1	144
1	0.50	16/0.2	0.55	0.40	5.5	62
2	0.50	16/0.2	0.55	0.40	9.8	127
4	0.50	16/0.2	0.55	0.40	11.6	209
1	0.75	24/0.2	0.55	0.40	6.0	76
2	0.75	24/0.2	0.55	0.40	10.7	157
4	0.75	24/0.2	0.55	0.40	12.7	263
1	1.00	30/0.2	0.55	0.40	6.2	83
2	1.00	30/0.2	0.55	0.40	11.0	170
4	1.00	30/0.2	0.55	0.40	13.0	286

Multipair RS 485 Overall Screened Databus Cable

RE-m02YCH-FR / RE-m02YSCH-FR

RE-S02YCH-FR / RE-S02YSCH-FR

No.of pair x	Nominal Cross Sectional Area	No./Nominal Diameter of Strands	Nominal Insulation Thickness	Nominal Sheath Thickness	Nominal Overall Diameter	Approx. Weight
	mm^2	No/mm	mm	mm	mm	kg/km
1	0.22	7/0.2	0.55	0.40	4.8	41

2	0.22	7/0.2	0.55	0.40	8.4	82
4	0.22	7/0.2	0.55	0.40	9.9	127
1	0.50	16/0.2	0.55	0.40	5.4	57
2	0.50	16/0.2	0.55	0.40	9.6	117
4	0.50	16/0.2	0.55	0.40	11.4	189
1	0.75	24/0.2	0.55	0.40	5.9	71
2	0.75	24/0.2	0.55	0.40	10.5	146
4	0.75	24/0.2	0.55	0.40	12.4	241
1	1.00	30/0.2	0.55	0.40	6.0	77
2	1.00	30/0.2	0.55	0.40	10.8	158
4	1.00	30/0.2	0.55	0.40	12.8	264

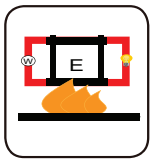
TYPE CODES

RE-A-B-D-FR

- FR: Fire Resisting
- D: Outer Sheath
  - H: LSZH
- B: Screen
  - St: Aluminum tape
  - C: Copper braid
- A: Insulation
  - m02Y: Mica Tape+Foam PE
  - S2Y: Silicone Rubber+Foam PE
  - m02YS: Mica Tape+Foam Skin PE
  - S2YS: Silicone Rubber+Foam Skin PE

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

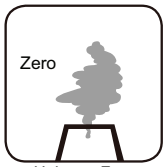

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

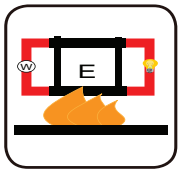

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



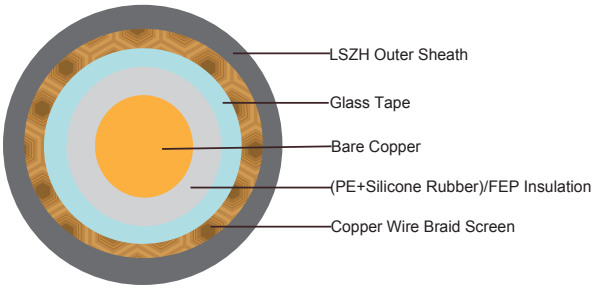
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant RG59 B/U Coaxial Cables

RG59 B/U FR



APPLICATION

The cables are designed for CCTV, security, smoke detection and evacuation monitoring applications, where continued functionality is required during a fire situation. Due to the zero halogen low smoke construction, this cable is ideal for use in public, commercial and industrial environments.

STANDARDS

Basic design to MIL-C-17

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Copper clad steel, solid according to IEC(EN) 60228 class 1.
Insulation: PE wrapped with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1 or fluoropolymer(FEP) compound.
Binder: Glass tape
Overall Screen: Plain copper wire braid
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C - +70°C
Temperature range during installation (mobile state): -5ºC - +60ºC
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Impedance	75±5Ω
Capacitance	67 nF/km
Velocity ratio(%)	66
Insulation resistance	>2000 Mohm.Km
Shield coverage	95%
DC resistance	
Inner conductor	158 Ω/km
Outer conductor	9.0 Ω/km

ATTENUATION

Frequency(MHz)	Attenuation (dB/100 m)	Attenuation (dB/100ft)
50	7.4	2.26
100	10.7	3.26
200	15.7	4.79
400	22.7	6.92
500	25.7	7.84
600	28.7	8.75
860	34.8	10.61
1000	38.0	11.59

RETURN LOSS

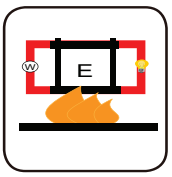
Frequency(MHz)	Return Loss (dB)
30-300 MHz	>31dB
300-600 MHz	>28dB
600-900 MHz	>24dB

CONSTRUCTION PARAMETERS

Cable Code	Conductor Diameter	Nominal Insulation Diameter	Nominal Screen No.x Diameter	Nominal Overall Diameter	Approx. Weight
	mm	mm	No. x mm	mm	kg/km
RG59 B/U FR	0.58 ± 0.03	3.70 ± 0.10 m	120 x 0.15	6.20 ± 0.10	60.3

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

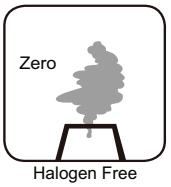

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

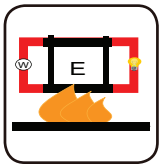

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



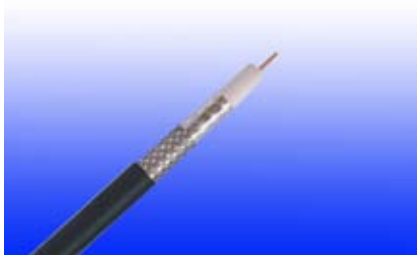
Halogen Free
IEC60754-1
EN50267-2-1

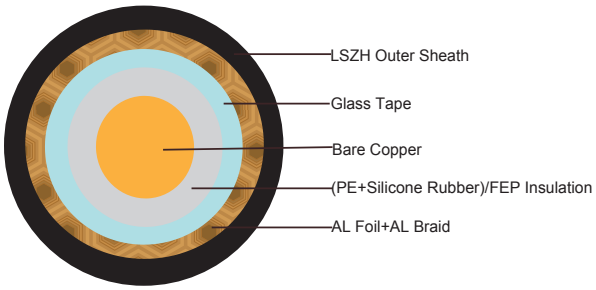


Functional Integrity
DIN 4102-12

Fire Resistant RG6 A/U Coaxial Cables

RG6 A/U FR





APPLICATION

The cables are designed for CCTV, security, smoke detection and evacuation monitoring applications, where continued functionality is required during a fire situation. Due to the zero halogen low smoke construction, this cable is ideal for use in public, commercial and industrial environments.

STANDARDS

Basic design to MIL-C-17

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Bare copper copper wire, solid according to IEC(EN) 60228 class 1.
Insulation: Foamed PE wrapped with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1 or fluoropolymer(FEP) compound.

Binder: Glass tape

Overall Screen: AL foil(100%)+AL braid (70%)

Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C - +70°C
Temperature range during installation (mobile state): -5ºC - +60ºC
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Impedance	75±5Ω
Capacitance	54 nF/km
Velocity ratio(%)	82
Insulation resistance	>5000 Mohm.Km
Shield coverage	AL foil(100%)+AL 70%
DC resistance	
Inner conductor	23.1 Ω/km
Outer conductor	31 Ω/km

ATTENUATION

Frequency(MHz)	Attenuation (dB/100 m)	Attenuation (dB/100ft)
50	5.0	1.5
100	6.4	1.96
200	9.2	2.8
500	14.5	4.4
600	15.9	4.9
800	17.7	5.4
1000	21.9	6.7
1350	24.9	7.6
1750	29.0	8.8
2050	33.1	10.1

2400	36.4	11.1

RETURN LOSS

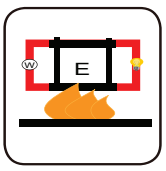
Frequency(MHz)	Return Loss (dB)
30-300	>28dB
300-600	>24dB
600-900	>22dB

CONSTRUCTION PARAMETERS

Cable Code	Conductor Diameter	Nominal Insulation Diameter	Nominal Screen No.x Diameter	Nominal Overall Diameter	Approx. Weight
	mm	mm	No. x mm	mm	kg/km
RG6 A/U FR	1.02	4.57 ± 0.20	96 x 0.12	7.00 ± 0.20	81.6

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

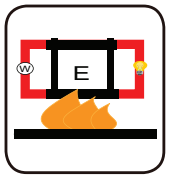

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

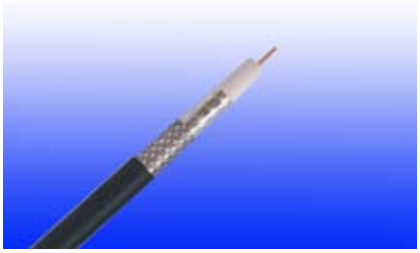
Halogen Free
IEC60754-1
EN50267-2-1

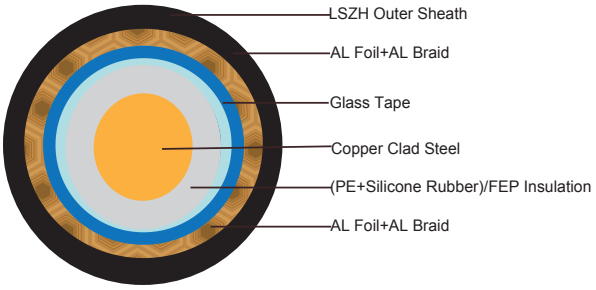


Functional Integrity
DIN 4102-12

Fire Resistant RG6 QUAD Coaxial Cables

RG6 QUAD FR





APPLICATION

The cables are designed for CCTV, security, smoke detection and evacuation monitoring applications, where continued functionality is required during a fire situation. Due to the zero halogen low smoke construction, this cable is ideal for use in public, commercial and industrial environments.

STANDARDS

Basic design to MIL-C-17

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Copper clad steel, solid according to IEC(EN) 60228 class 1.
Insulation: Foamed PE wrapped with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1 or fluoropolymer(FEP) compound.

Binder: Glass tape

Overall Screen:

Screen1: Al-maylar Tape ≥25%
Screen2: Aluminium Braid
Screen3: Al-maylar Tape ≥25%
Screen4: Aluminium Braid

Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C - +70°C
Temperature range during installation (mobile state): -5ºC - +60ºC
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Impedance	75±5Ω
Capacitance	54 nF/km
Velocity ratio(%)	82
Insulation resistance	>5000 Mohm.Km
Shield coverage	≥60%
Max.conductor resistance	24.1 Ω/km

ATTENUATION

Frequency(MHz)	Attenuation (dB/100 m)	Attenuation (dB/100ft)
50	4.8	1.5
100	6.7	2.0
200	9.3	2.8
500	15.0	4.6
600	16.9	5.1
800	19.4	5.9
1000	21.6	6.6
1350	24.2	7.4
1750	28.0	8.4

2150	31.5	9.6
2400	32.8	10.0
3000	37.9	11.5

RETURN LOSS

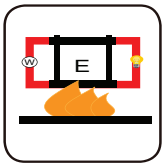
Frequency(MHz)	Return Loss (dB)
30-300	>28dB
300-600	>24dB
600-900	>22dB

CONSTRUCTION PARAMETERS

Cable Code	Conductor Diameter	Nominal Insulation Diameter	Nominal Screen2 No.x Diameter	Nominal Screen4 No.x Diameter	Nominal Overall Diameter	Approx. Weight
	mm	mm	No. x mm	No. x mm	mm	kg/km
RG6 QUAD FR	1.02	4.60 ± 0.20	80 x 0.12	64 x 0.12	7.55 ± 0.20	92.4

Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

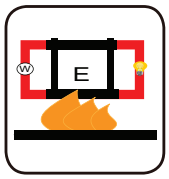

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

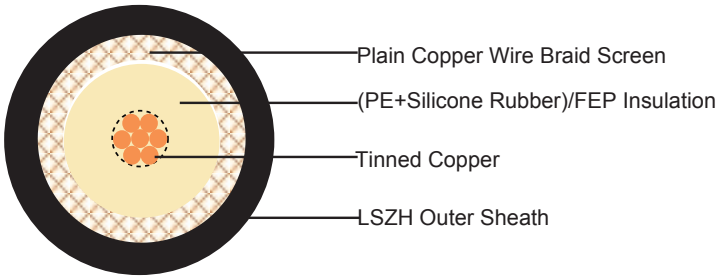
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant RG11 A/U Coaxial Cables

RG11 A/U FR



APPLICATION

The cables are designed for CCTV, security, smoke detection and evacuation monitoring applications, where continued functionality is required during a fire situation. Due to the zero halogen low smoke construction, this cable is ideal for use in public, commercial and industrial environments.

STANDARDS

Basic design to MIL-C-17

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-23; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Conductors: Tinned copper copper wire, stranded according to IEC(EN) 60228 class 2.
Insulation: Low density PE wrapped with fire resistant silicone rubber compound type EI2 as per BS 7655-1.1 or fluoropolymer(FEP) compound.
Binder: Glass tape
Overall Screen: Plain copper wire braid
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655:section 2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -30°C - +70°C
Temperature range during installation (mobile state): -5ºC - +60ºC
Minimum bending radius: 8 x Overall Diameter

ELECTRICAL PROPERTIES

Impedance	75±5Ω
Capacitance	67 nF/km
Velocity ratio(%)	66
Insulation resistance	>2000 Mohm.Km
Shield coverage	97%
DC resistance	
Inner conductor	20.5 Ω/km
Outer conductor	4.5 Ω/km

ATTENUATION

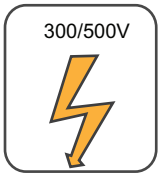
Frequency(MHz)	Attenuation (dB/100 m)	Attenuation (dB/100ft)
50	4.2	1.28
100	6.2	1.89
200	9.3	2.84
400	13.8	4.21
500	15.5	4.73
600	17.1	5.21
860	20.1	6.13
1000	23.4	7.13

RETURN LOSS

Frequency(MHz)	Return Loss (dB)
30-300 MHz	>30dB
300-600 MHz	>27dB
600-900 MHz	>25dB

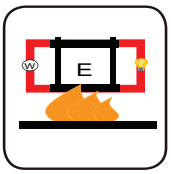
CONSTRUCTION PARAMETERS

Cable Code	Conductor Diameter	Nominal Insulation Diameter	Nominal Screen No.x Diameter	Nominal Overall Diameter	Approx. Weight
	mm	mm	No. x mm	mm	kg/km
RG11 A/U FR	7 x 0.40	7.25 ± 0.18	192 x 0.18	10.3 ± 0.18	150



Rated Voltage

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)

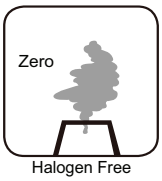

Reduced Fire Propagation
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


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

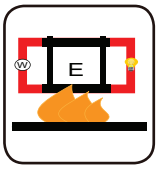

Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073



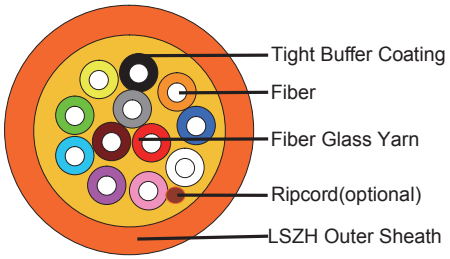
Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant Tight Buffered Distribution Fiber Optic Cables

MTA-B-C-D-H-FR



APPLICATION

This cables are used for interconnection of distribution boxes and end devices, where continued functionality is required during a fire situation. The cables are very suitable for various indoor and outdoor applications, including routing between buildings within ducts and inside building up to riser shafts.

STANDARDS

Basic design to Telcordia GR409-CORE / TIA/EIA 568B.3 / ICEA-S-83-596

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-25; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Optical fibers: Singlemode and multimode tight fibers, with tight buffer coating.
Fire Barrier: The tight buffered fibers are wrapped with fire blocking fiber glass yarns.
Inner Sheath(optional): Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1
Ripcord(optional): An optional ripcord can be located under the outer sheath to facilitate jacket removal.
Armouring(optional):
STA: Corrugated steel tape armour
SWB: Steel wire braid
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1 (Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -20°C - +60°C
Temperature range during installation (mobile state): 0°C - +50°C
Minimum bending radius: 10 times the outer diameter for unarmoured cables
20 times the outer diameter for armoured cables

CONSTRUCTION PARAMETERS

Cable Code	N° of Fibers	Nominal Overall Diameter	Max Tensile Strength	Minimum Bending Radius	Approx. Weight
		mm	N	mm	kg/km
MTA-B-2-0-H-FR	2	7,6	250	76	55
MTA-B-4-0-H-FR	4	7,8	250	78	67
MTA-B-6-0-H-FR	6	8,6	400	86	77
MTA-B-8-0-H-FR	8	8,8	400	88	81
MTA-B-12-0-H-FR	12	9,3	400	93	90

TYPE CODES

MTA-B-C-D-E-F-G-H-FR

FR: Fire Resisting

Outer Sheath
2Y: PE
Y: PVC
H: LSZH

Armour
Blank: No armour
STA: Corrugated steel tape armour
SWB: Steel wire braid

Inner Sheath
2Y: PE
Y: PVC
H: LSZH

Central strength member
Blank: No Central strength member
A: Aramid yarn
F: Fiber reinforced plastic(FRP)

Sub Unit
0: No Sub Unit
Y: PVC
H: LSZH

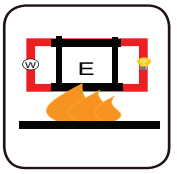
C No of Fibers

Fiber Type
4: 50/125 um(OM3) 7: NZDS SM fiber per ITU-T G.656
5: 50/125 um(OM2) 8: NZDS SM fiber per ITU-T G.655
6: 62.5/125um(OM1) 9: Standard SM fiber per ITU-T G.652.D

Sub Unit Diameter
A: 0.9mm (up to 12 fibers)
B: 3.6mm (12-36 fibers)
C: 4.2mm (24-72 fibers)

Standard

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

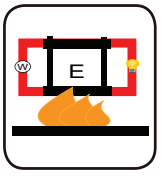

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant Central Loose Tube Fiber Optic Cables

APPLICATION

These cables are characterized by light weight and small diameter, suitable for both aerial and duct installation. They are mainly installed inside buildings, tunnels,subways or closed areas in general, specially designed to guarantee the signal transmission even in case of fire. The cable can also be used for direct burial for armoured version.

STANDARDS

Basic design to Telcordia GR-20 / RUS 7 CFR 1755.900 (REA PE-90) / ICEA S 87-640

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-25; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Fibers: Singlemode and multimode fibers, with loose tube technology.
Structure: Central loose tube cable contains one tube with 2-24 single or multimode fibers, which are filled with water blocking gel.
Fire barrier: The jelly filled tube with up to 24 fibers is wrapped with a fire blocking mica glass tapes.
Water blocking: The jelly filled tube is waterblocked by using swellable tape and thread.
Reinforcement: Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength, with added fire protection.
Inner Sheath (optional): The cable can be jacketed with either PE or thermoplastic LSZH inner sheath. PE is the preferred option in outdoor environment for water protection purpose.
Moisture Barrier Tape (optional): An aluminum moisture tape can be incorporated under the sheath for water blocking and shielding purpose.
Armouring(optional):
For diect burial, either galvanized steel wire braid, corrugated steel tape armour or galvanized

steel wire armour is applied over an inner polyethylene or LSZH sheath. For steel tape armour, the 0.15mm thick steel tape is coated with a copolymer and applied with an overlap. For steel wire braid or armour, single layer of galvanized steel wire braid or armour is applied.

Ripcord (optional): An optional ripcord can be located under the jacket to facilitate jacket removal.

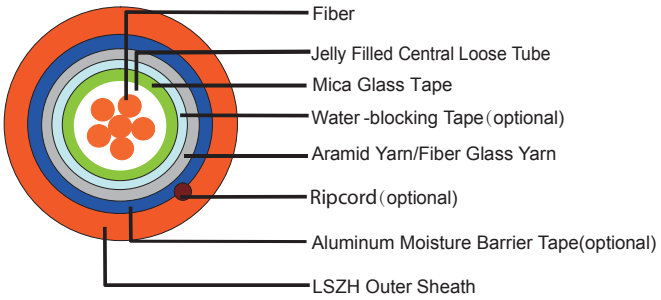
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

FIBER COLOUR CODE

Fiber colour code	1	Red	7	Brown
	2	Green	8	Violet
	3	Blue	9	Turquoise
	4	Yellow	10	Black
	5	White	11	Orange
	6	Grey	12	Pink

CONSTRUCTION

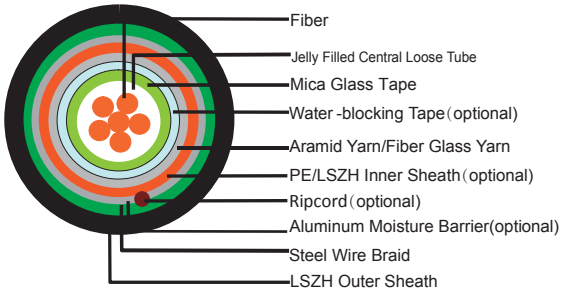
UNARMOURED TYPE



CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
CLA-B-C-H-J-FR	02-06	2.7	8.0	70	1000	1500
CLA-B-C-H-J-FR	08-16	3.5	9.0	90	1200	1500
CLA-B-C-H-J-FR	18-24	4.2	10.0	100	1500	1500

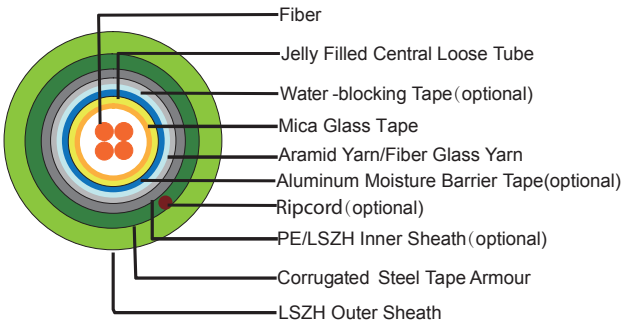
STEEL WIRE BRAID



CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
CLA-B-C-2Y(SWB)H-J-FR	02-06	2.7	11.5	160	1000	2000
CLA-B-C-2Y(SWB)H-J-FR	08-16	3.5	12.0	180	1200	2000
CLA-B-C-2Y(SWB)H-J-FR	18-24	4.2	13.0	200	1500	2000

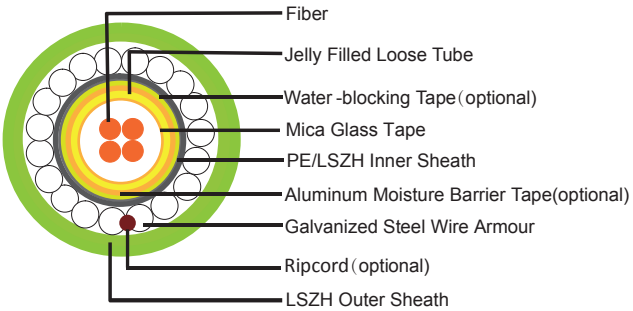
CORRUGATED STEEL TAPE ARMOUR



CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
CLA-B-C-2Y(STA)H-J-FR	02-06	2.7	13.0	200	1000	2500
CLA-B-C-2Y(STA)H-J-FR	08-16	3.5	14.0	220	1200	2500
CLA-B-C-2Y(STA)H-J-FR	18-24	4.2	14.5	250	1500	2500

STEEL WIRE ARMOUR



CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
CLA-B-C-2Y(SWA)H-J-FR	02-12	2.7	10.5	180	2500	4000
CLA-B-C-2Y(SWA)H-J-FR	16-24	3.5	11.0	210	2500	4000

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -20°C - +60°C
Temperature range during installation (mobile state): 0°C - +50°C
Minimum Operation Bending Radius: 10 times the outer diameter for unarmoured cables
20 times the outer diameter for armoured cables
Minimum Installation Bending Radius: 20 times the outer diameter

MECHANICAL PROPERTIES

Maximum Compressive Load	4000N for unarmoured cables 5000N for armoured cables
Repeated Impact:	4.4 N.m (J)
Twist (Torsion):	180×10 times, 125×OD
Cyclic Flexing:	25 cycles for armoured cables; 100 cycles for unarmoured cables.
Crush Resistance:	263N/cm (150lb/in)

FIBER COMPLIANCE

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4

Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

TYPE CODES

CLA-B-C-D-E-F-G-FR

FR: Fire Resisting

Water blocking gel in tubes
X: No water-blocking J: Water blocking gel between jackets;
D: Dry water-blocking between cable jackets

Outer Sheath
2Y: PE
Y: PVC
H: LSZH

Armour
Blank: No armour
STA: Corrugated steel tape armour
SWA: Steel wire armour
SWB: Steel wire braid

Inner Sheath
2Y: PE
Y: PVC
H: LSZH

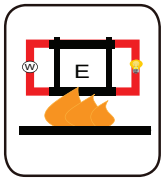
C No of Fibers

B Fiber Type
4: 50/125 um(OM3) 7: NZDS SM fiber per ITU-T G.656
5: 50/125 um(OM2) 8: NZDS SM fiber per ITU-T G.655
6: 62.5/125um(OM1) 9: Standard SM fiber per ITU-T G.652.D

Tube Diameter
A: 2.7mm
B: 3.5mm
C: 4.2mm

Standard

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

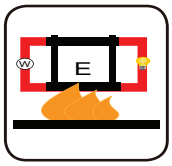

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Fire Resistant Multi Loose Tube Fiber Optic Cables

APPLICATION

The multi loose tube non metallic cables are designed for outside plant, which is prone to electrical interference. They are mainly installed inside buildings, tunnels,subways or closed areas in general, specially designed to guarantee the signal transmission even in case of fire. The cable can also be used for direct burial for armoured version.

STANDARDS

Basic design to Telcordia GR-20 / RUS 7 CFR 1755.900 (REA PE-90) / ICEA S 87-640

FIRE PERFORMANCE

Circuit Integrity	IEC 60331-25; BS 6387 CWZ; DIN VDE 0472-814(FE180); CEI 20-36/2-1; SS229-1; NBN C 30-004 (cat. F3); NF C32-070-2.3(CR1)
System circuit integrity	DIN 4102-12, E30 depending on lay system
Flame Retardance (Single Vertical Wire Test)	EN 60332-1-2; IEC 60332-1-2; BS EN 60332-1-2; VDE 0482-332-1 ; NBN C 30-004 (cat. F1); NF C32-070-2.1(C2); CEI 20-35/1-2; EN 50265-2-1*; DIN VDE 0482-265-2-1*
Reduced Fire Propagation (Vertically-mounted bundled wires & cable test)	EN 60332-3-24 (cat. C); IEC 60332-3-24; BS EN 60332-3-24; VDE 0482-332-3; NBN C 30-004 (cat. F2); NF C32-070-2.2(C1); CEI 20-22/3-4; EN 50266-2-4*; DIN VDE 0482-266-2-4
Halogen Free	IEC 60754-1; EN 50267-2-1; DIN VDE 0482-267-2-1; CEI 20-37/2-1 ; BS 6425-1*
No Corrosive Gas Emission	IEC 60754-2; EN 50267-2-2; DIN VDE 0482-267-2-2; CEI 20-37/2-2 ; BS 6425-2*
Minimum Smoke Emission	IEC 61034-1&2; EN 61034 -1&2; DIN VDE 0482-1034-1&2; CEI 20-37/3-1&2; EN 50268-1&2*; BS 7622-1&2*
No Toxic gases	NES 02-713; NF C 20-454

Note: Asterisk * denotes superseded standard.

CABLE CONSTRUCTION

Fibers: Singlemode and multimode fibers, with loose tube technology.
Structure: The cable consists of 5 to 36 fibers containing tubes or fillers stranded in up to 3 layers around a central strength member and bound under a LSZH sheath. Each tube contains 4 -12 fibers, which is filled with water blocking gel.
Central Strength Member: Solid or stranded steel wire coated with polyethylene is usually used as central strength member. Fiber glass reinforced plastics (FRP) will be used as central strength member if non metallic construction is required.
Fire Barrier: The jelly filled tubes containing the fibers are individually wound with fire blocking mica glass tape and are cabled around a central strength member
Water Blocking: The jelly filled tube is waterblocked by using swellable tape and thread.
Reinforcement: Either aramid yarn or fiber glass is wound around the tube to provide physical protection and tensile strength, with added fire protection.

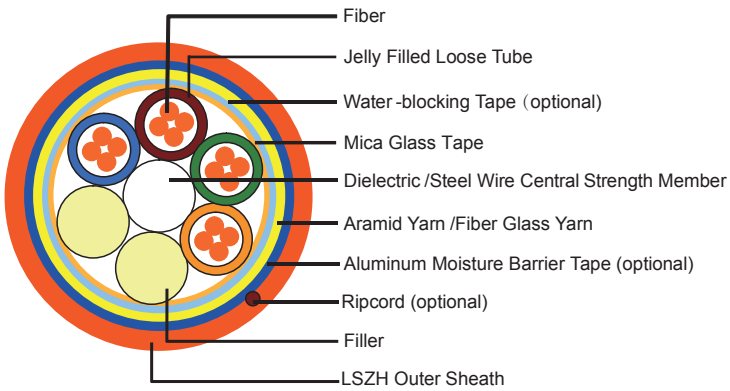
Inner Sheath (optional): The cable can be jacketed with either PE or Thermoplastic LSZH inner sheath. PE is the preferred option in outdoor environment for water protection purpose.
Armouring(optional): For diect burial, either galvanized steel wire braid, corrugated steel tape armour or galvanized steel wire armour is applied over an inner polyethylene or LSZH sheath. For steel tape armour, the 0.15mm thick steel tape is coated with a copolymer and applied with an overlap. For steel wire braid or armour, single layer of galvanized steel wire braid or armour is applied.
Moisture Barrier Tape (optional): An aluminum moisture tape can be incorporated under the sheath for water blocking and shielding purpose.
Ripcord (optional): An optional ripcord can be located under the jacket to facilitate jacket removal.
Outer Sheath: Thermoplastic LSZH compound type LTS3 as per BS 7655-6.1(Thermosetting LSZH compound type SW2-SW4 as per BS 7655-2.6 can be offered.). UV resistance, hydrocarbon resistance, oil resistance, anti rodent and anti termite properties can be offered as option.

FIBER COLOUR CODE

Fiber colour code	1	Red	7	Brown
	2	Green	8	Violet
	3	Blue	9	Turquoise
	4	Yellow	10	Black
	5	White	11	Orange
	6	Grey	12	Pink

CONSTRUCTION

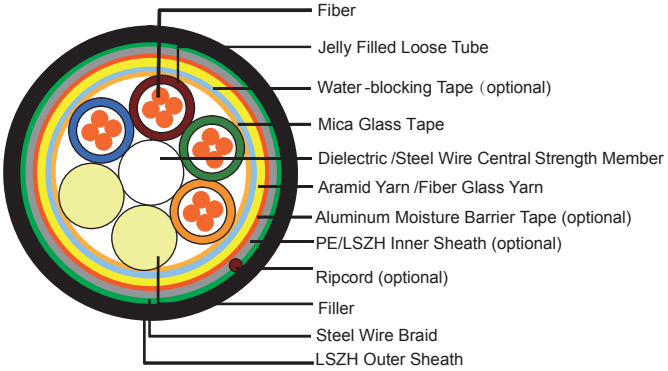
UNARMOURED TYPE



CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
MLA-B-C×D-F-H-J-FR	72	2.5	15.0	230	4000	3000
MLA-B-C×D-F-H-J-FR	96	2.5	16.5	250	4000	3000
MLA-B-C×D-F-H-J-FR	144	2.5	20.5	280	4000	3000

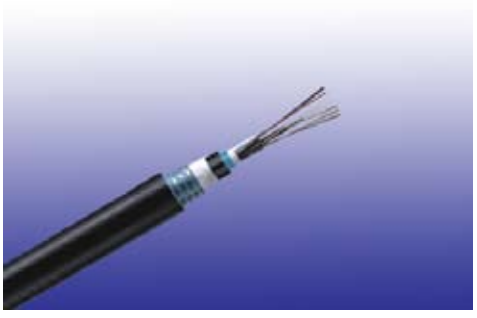
STEEL WIRE BRAID

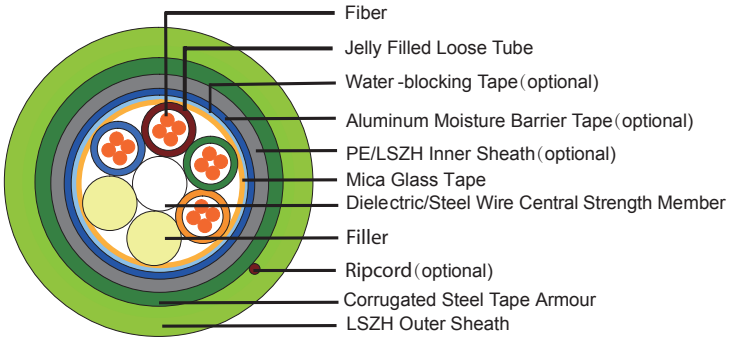


CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
MLA-B-C×D-F-2Y(SWB)H-J-FR	72	2.5	15.0	280	3000	3500
MLA-B-C×D-F-2Y(SWB)H-J-FR	96	2.5	17.5	310	3000	3500
MLA-B-C×D-F-2Y(SWB)H-J-FR	144	2.5	21.5	350	3500	3500

CORRUGATED STEEL TAPE ARMOUR

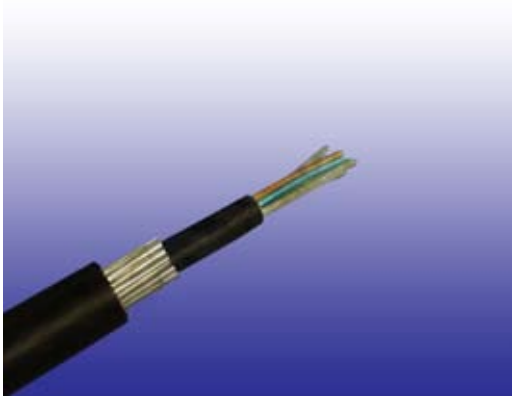


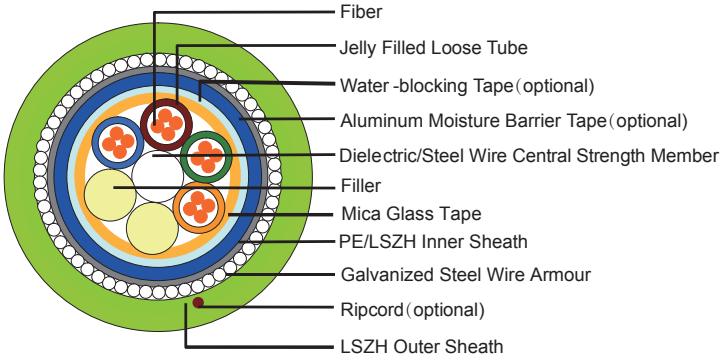


CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
MLA-B-C×D-F-2Y(STA)H-J-FR	72	2.5	16.5	290	3000	7500
MLA-B-C×D-F-2Y(STA)H-J-FR	96	2.5	18.5	350	3000	7500
MLA-B-C×D-F-2Y(STA)H-J-FR	144	2.5	22.5	450	3500	7500

STEEL WIRE ARMOUR





CONSTRUCTION PARAMETERS

Cable Code	Fiber Count	Tube Diameter	Nominal Overall Diameter	Approx. Weight	Tension load	Crush
	(n°)	mm	mm	kg/km	N	N/100mm
MLA-B-C×D-F-2Y(SWA)H-J-FR	72	2.0	15.0	360	3500	5000
MLA-B-C×D-F-2Y(SWA)H-J-FR	96	2.0	16.5	390	4000	5000
MLA-B-C×D-F-2Y(SWA)H-J-FR	144	2.0	18.5	430	4500	5000

PHYSICAL AND THERMAL PROPERTIES

Temperature range during operation (fixed state): -20°C - +60°C
Temperature range during installation (mobile state): 0°C - +50°C
Minimum Installation Bending Radius: 20 times the outer diameter
Minimum Operation Bending Radius: 10 times the outer diameter for unarmoured cables
20 times the outer diameter for armoured cables

MECHANICAL PROPERTIES

Maximum Compressive Load:	4000N for unarmoured cables 6000N for armoured cables
Repeated Impact:	4.4 N.m (J)
Twist (Torsion):	180×10 times, 125×OD
Cyclic Flexing:	25 cycles for armoured cables 100 cycles for unarmoured cables
Crush Resistance:	220N/cm(125lb/in)

FIBER COMPLIANCE

Temperature Cycling	IEC60794-1-2-F2
Tensile Strength	IEC60794-1-2-E1A
Crush	IEC60794-1-2-E3
Impact	IEC60794-1-2-E4
Repeated Bending	IEC60794-1-2-E6
Torsion	IEC60794-1-2-E7
Kink	IEC60794-1-2-E10
Cable Bend	IEC60794-1-2-E11
Cool Bend	IEC60794-1-2-E11

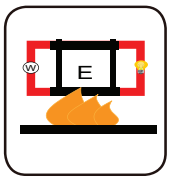
TYPE CODES

MLA-B-CxD-E-F-G-H-I-FR

FR: Fire Resisting
Water blocking gel in tubes
X: No water-blocking J: Water blocking gel between jackets;
D: Dry water-blocking between cable jackets
Outer Sheath
2Y: PE
Y: PVC
H: LSZH
Armour
Blank: No armour
STA: Corrugated steel tape
SWA: Steel wire
SWB: Armour steel wire braided
Inner Sheath
2Y: PE
Y: PVC
H: LSZH
Central strength member
S: Solid steel
SR: Stranded steel
F: Fiber reinforced plastic(FRP)
Fiber per Tubes: 2-12
C No of tubes: 1-36
Fiber Type
4: 50/125 um(OM3) 7: NZDS SM fiber per ITU-T G.656
5: 50/125 um(OM2) 8: NZDS SM fiber per ITU-T G.655
6: 62.5/125um(OM1) 9: Standard SM fiber per ITU-T G.652.D
Loose Tube Diameter
A: 2.0mm D: 3.0mm
B: 2.5mm E: 3.2mm
C: 2.8mm

Standard

Standard



Circuit Integrity
IEC 60331/BS 6387
NF C32-070-2.3(CR1)


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

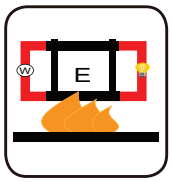

Flame Retardancy
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
NES 02-713/NF C 20-454


Low Corrosivity
IEC60754-2
EN50267-2-2/3
NF C 32-074


Low Smoke Emission
IEC 61034-1&2
EN 50268-1&2/NF C32-073

Halogen Free
IEC60754-1
EN50267-2-1



Functional Integrity
DIN 4102-12

Technical Information For Fiber Optic Cable

Optical & Geometrical Properties for Single Mode Fibers

Parameter		Standard Single Mode Fiber per ITU-T G.652D	Non-zero Dispersion Shifted fiber per ITU-T G.655	Non-zero Dispersion Shifted fiber per ITU-T G.656	Units
Fiber Code		9	8	7	
Attenuation, Loose Tube Cables		Standard	Metro Area	Long Haul	
	@1310nm	≤0.35	-	-	dB/km
	@1550nm	≤0.22	≤0.22	≤0.22	dB/km
	@1625nm	≤0.25	≤0.26	≤0.26	dB/km
Attenuation, Tight Buffer or Semi-Tight Cables					
	@1310nm	≤0.38	-		dB/km
	@1550nm	≤0.28	-		dB/km
Chromatic Dispersion	between 1260 and 1360nm (O Band)	≤3.5	NA-	-	ps/(nm*km)
	between 1460 and 1530nm (S Band)	-	-	2.0-7.0	ps/(nm*km)
	between 1530 and 1565nm (C Band)	≤18	1.0-10.0	7.0-10.0	ps/(nm*km)
	between 1565 and 1625nm (L Band)	≤22	7.0-12.0	10.0-14.0	ps/(nm*km)
Zero Dispersion Wavelength		1310±11	≤1520	≤1420	nm
Zero Dispersion Slope		0.093	0.093	0.093	ps/(nm2.km)
Point Discontinuity at 1300nm& 1550nm		0.1	0.1	0.1	dB
Mode Field Diameter	@1300nm	9.3±0.5	-		um
	@1550nm	10.4±0.8	8.5±0.6	9.0±0.5	um
Cable Cut-off Wavelength		≤1260	≤1450	≤1310	nm
PMD (Individual fiber)		≤0.2	≤0.2	≤0.2	ps/km 1/2
Cladding Diameter		125±1	125±1	125±1	um

Parameter		Standard Single Mode Fiber per ITU-T G.652D	Non-zero Dispersion Shifted fiber per ITU-T G.655	Non-zero Dispersion Shifted fiber per ITU-T G.656	Units
Core/Cladding Concentricity Error		≤0.5	≤0.5	≤0.6	um
Cladding Non-Circularity		≤1.0	≤1.0	≤1.0	%
Coating Non-Circularity		≤6.0	≤6.0	≤6.0	%
Primary Coating Diameter		245±10	245±10	245±10	um
Proof-Test Level		100 (0.7)	100 (0.7)	100 (0.7)	Kpsi/GN/m^2
Fatigue Coefficient		≥20	≥20	≥20	
Temperature Dependence between 0°C ~ +70°C @ 1310 & 1550nm		0.1	0.1	0.1	Db/km

Optical & Geometrical Properties for Multimode Fibers

Parameter		50/125		62.5/125	Units
Fiber Code		5	4	6	-
ISO/IEC 11801 Classification(2)		**OM2**	**OM3**	**OM1**	-
Attenuation, Loose Tube Cables					
@850nm		≤3.0		≤3.0	dB/km
@1300nm		≤0.8		≤0.8	dB/km
Attenuation, Tight Buffer and Semi-tight Cables					
@850nm		≤3.0		≤3.5	dB/km
@1300nm		≤1.0		≤1.0	dB/km
Bandwidth*	@850nm	≥500	≥2000	≥200	MHz*km
	@1300nm	≥800/500	≥500	≥500/600	MHz*km
Numerical Aperture		0.20±0.015		0.275±0.015	-
Core Diameter		50±3		62.5±3	um
Cladding Diameter		125±2		125±2	um
Core/Cladding Concentricity		≤1.5		≤1.5	um
Core Non-Circularity		≤6		≤6	%
Cladding Non-Circularity		≤2 1		≤2 1	%
Core/Cladding Offset		≤3		≤3	um
Coating Diameter		245±10		245±10	um
Proof-Test Level		100 (0.7)		100 (0.7)	Kpsi (GN/m^2)
Fatigue Coefficient		≥20		≥20	
Temperature Dependence between 0°C ~ +70°C		0.1		0.1	dB

Mechanical & Environmental Properties for Single Mode Fiber

Testing Parameters	EIA/ TIA-455 FOTP Number	IEC-794-1 Test Method	EN 187000 Test Method	Maximum Increased loss
Tensile Load & Bending	33	E1	501	<0.05dB (90%); <0.15dB (100%)
Low & High Temperature Bend	37	E11		<0.05dB (90%); <0.15dB (100%)
Compression loading (Crush)	41	E3	504	<0.05dB (90%); <0.15dB (100%) 440N/km(250lb/in) load
Impact Resistance	25	E4	505	<0.05dB (90%); <0.15dB (100%)
Twist (Torson)	85	E7	508	<0.05dB (90%); <0.15dB (100%)
Cyclic Flexing (Repeated Bending)	104	E6	509	<0.05dB (90%); <0.15dB (100%)
External freezing	98	F6		<0.05dB (90%); <0.15dB (100%)
Temperature Cycling	3	F1	601	<0.05dB (90%); <0.15dB (100%)
Fiber Stripability	178	B6		<8.9N(2lbf) on unaged and aged fiber; >1.3N(0.3lbf) on unaged and aged fiber
Cable Aging	82	F5		<0.1dB (90%); <0.25dB (100%)
Water Penetration	82	F5		No flow after 24 hours from 1 meter length of cable
Compound Flow (Drip)	81	E14		80°C 24 hours duration, no drip

Mechanical & Environmental Properties for Multi Mode Fiber

Testing Parameters	EIA/TIA-455 FOTP Number	IEC-794-1 Test Method	EN 187000 Test Method	Maximum Increased loss
Tensile Load & Bending	33	E1	501	<0.2dB
Low & High Temperature Bend	37	E11		<0.4dB
Compression loading (Crush)	41	E3	504	<0.2dB 440N/km(250lb/in) load
Cyclic Impact	25	E4	505	<0.4dB
Twist (Torsion)	85	E7	508	<0.2dB
Cyclic Flexing (Repeated Bending)	104	E6	509	<0.2dB
External freezing	98	F6		<0.2dB
Temperature Cycling	3	F1	601	<0.05dB (90%); <0.15dB (100%)
Fiber Stripability	178	B6		<13.4N(3lbf) on unaged fiber
Cable Aging	82	F5		<0.1dB (90%); <0.25dB (100%)
Water Penetration	82	F5		No flow after 24 hours from 1 meter length of cable
Compound Flow (Drip)	81	E14		80°C 24 hours duration, no drip

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