2021

CCI
ControlCavi Industria

OFFSHORE / FPSO CABLES

IEC 60092-350 series

with FIREBAR® the TOTAL SAFETY fire and water resistant cable

CABLESERVICE
CCI
ControlCavi Industria

CCI Quality

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: CERT-01719-96-AQ-ROM-SINCERT | Initial certification date: 03 December 1996 | Valid: 01 November 2020 - 31 October 2023

This is to certify that the management system of

CONTROLCAVI INDUSTRIA S.r.l.
S.S. Casilina Km. 78.600 - 03013 Ferentino (FR) - Italy

has been found to conform to the Quality Management System standard:
ISO 9001:2015

This certificate is valid for the following scope:
Design and manufacture of conductors and electrical cables for low and medium voltages, through the phases of drawing, stranding, insulation, twisting, extrusion, packing and testing (IAF 19, 14)

Place and date: **Vimercate (MB), 13 July 2020**

ACCREDIA

For the issuing office: **DNV GL - Business Assurance, Via Energy Park, 14, - 20871 Vimercate (MB) - Italy**

Zeno Beltrami
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

CCI Environmental

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate no./Certificato No.: 117618-2012-AE-ITA-ACCREDIA | Data prima emissione/Initial date: 25 giugno 2012 | Validità/Valid: 25 giugno 2018 - 25 giugno 2021

Si certifica che il sistema di gestione di/This is to certify that the management system of

CONTROLCAVI INDUSTRIA S.r.l.- Sede Amministrativa ed Operativa
S.S. Casalina Km. 78.600 - 03013 Ferentino (FR) - Italy

È conforme ai requisiti della norma per il Sistema di Gestione Ambientale/
Has been found to conform to the Environmental Management System standard:
ISO 14001:2015

Valutato secondo le prescrizioni del Regolamento Tecnico RT-09/
Evaluated according to the requirements of Technical Regulations RT-09

Questa certificazione è valida per il seguente campo applicativo:
Progettazione e produzione di conduttori e cavi elettrici per bassa e media tensione, attraverso le fasi di trafilatura, trefolatura, isolamento, spiralatura, estrusione, confezionamento e collaudo (EA 19, 14)

This certificate is valid for the following scope:
Design and manufacture of conductors and electrical cables for low and medium voltages, through the phases of drawing, stranding, insulation, twisting, extrusion, packing and testing (EA 19, 14)

Luogo e Data/Place and date: **Vimercate (MB), 25 maggio 2018**

ACCREDIA

Per l'Organismo di Certificazione/For the Certification Body: **DNV GL - Business Assurance, Via Energy Park, 14 - 20871 Vimercate (MB) - Italy**

Zeno Beltrami
Management Representative

La validità del presente Certificato è subordinata al rispetto delle condizioni contenute nel Contratto di Certificazione/Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

CCI Health & Safety

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 113920-2012-AHSO-ITA-ACCREDIA | Initial certification date: 12 September 2012 | Valid: 12 September 2018 - 11 September 2021

This is to certify that the management system of

CONTROLCAVI INDUSTRIA S.r.l.- Sede Amministrativa e Operativa
S.S. Casilina Km. 78.600 - 03013 Ferentino (FR) - Italy

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following scope:
Design and manufacturing of conductors and electrical cables for low and medium voltages (IAF 19, 14)

Place and date: **Vimercate (MB), 01 July 2020**

ACCREDIA

For the issuing office: **DNV GL - Business Assurance, Via Energy Park, 14, - 20871 Vimercate (MB) - Italy**

Zeno Beltrami
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

CABLE SERVICE Quality

RINA

CISQ is a member of IQNet

CERTIFICATO N. 108/94/S
CERTIFICATE No.

SI CERTIFICA CHE IL SISTEMA DI GESTIONE PER LA QUALITÀ DI
IT IS HEREBY CERTIFIED THAT THE QUALITY MANAGEMENT SYSTEM OF

CABLE SERVICE S.R.L.

VIALE CAMPANIA, 31 20133 Milano (MI) ITALIA

NELLE SEGUENTI UNITÀ OPERATIVE / *IN THE FOLLOWING OPERATIONAL UNITS*

STRADA PROVINCIALE, 117 20010 Bernate Ticino (MI) ITALIA

È CONFORME ALLA NORMA / *IS IN COMPLIANCE WITH THE STANDARD*
ISO 9001:2015

PER I SEGUENTI CAMPI DI ATTIVITÀ / *FOR THE FOLLOWING FIELD(S) OF ACTIVITIES*

TAGLIO, MISURAZIONE, CONFEZIONAMENTO E COMMERCIALIZZAZIONE DI CAVI ELETTRICI

IAF 29
IAF 19

CUTTING, MEASURING, PACKAGING AND TRADE OF ELECTRIC CABLES

Prima emissione / *First issue*: 09.05.1994 | Data decisione di rinnovo / *Renewal decision date*: 18.05.2018
Data scadenza / *Expiry Date*: 27.05.2021 | Data revisione / *Revision date*: 03.04.2019

Fabrizio Frei
Milan Management System Certification, Head

ACCREDIA SGQ N° 002 A

IAF

RINA Services S.p.A.
Via Corsica 12 - 16128 Genova, Italy

CISQ FEDERAZIONE

OFFSHORE/FPSO cables

Halogen free
Low smoke
Flame retardant
Fire resistant
FIREBAR® Fire and water resistant
Low temperature (- 40°C)

CABLESERVICE
CCI
ControlCavi Industria

CCI OFFSHORE / FPSO(*) cables

according to IEC 60092-350 series

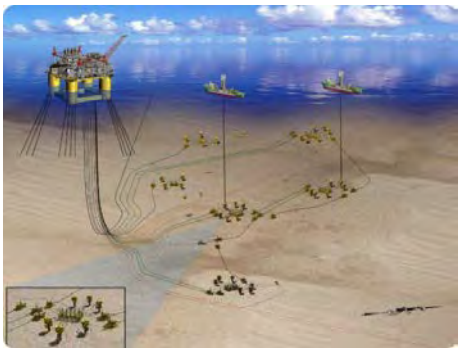
Are designed and manufactured for installations in the inhospitable conditions where platforms and vessels are usually working (saline atmosphere, UV radiation, extremes of temperature) still maintaining the highest levels of performance. Recognized by the most acknowledged Certification Bodies (see page 8), they present remarkable characteristics such as:

■ CONDUCTOR: an unique flexible Class 2 conductor, originally patented by CCI and still utilised in all ships and offshore cables designs, allows for such ease of installation and thus reducing the time and cost, an ease of handling in the restrictions and confines of vessels and offshore platforms.
The formation and manufacture process of our conductors, not only allows for the cables to safely be handled/installed at 4 times the Outer Diameter of the cable (normally allowed by Class 5 conductors), but with a cable affording superior handling characteristics (normally found with Class 5 conductors) we still maintain the Class 2 electrical characteristics, giving the added advantage over Class 5 conductors, which have higher resistance values and thus reduced ampacity.

■ INSULATION: improved XLPE (cross-linked Polyethylene) or, alternatively, EPR (Ethylene Propylene Rubber) and HEPR (Hard Ethylene Propylene Rubber) for MV cables, are formulated and proven for conductor operating temperature greater than 100 °C (refer to page 7)

■ FLAMEBAR®: CCI has never compromised in choosing the components used to produce its cables, and Flamebar® tapes used in all constructions are testament of this. The high temperature resistance of these fibre glass tapes affords a very good heat barrier and further enhance non propagation of the flame of all our cables.

■ LOW OPERATING TEMPERATURE: CCI's compounds, used in the production of ship and offshore cables, are formulated and proven, according to CSA standards, to operate down to -40 °C.



■ SUNLIGHT, UV & OZONE RESISTANCE: the whole range of sheathing compounds have been independently type tested to pass the most severe requirements of the standards for these critical factors when cables are installed externally on-board ships and offshore units.

on request

■ OUTER SHEATH SHF2 H-M oils & Muds resistant: is compliant with SHF2, as stated in IEC 60092-360, together with the highest level of resistance when tested in Mineral, Hydraulic oils and Muds (type H-M) as defined in Table 1 Category d of NEK 606:2016 (refer to Generals section).

CCI cable Fire resistance

When fire breaks out in remote locations, such as oil/gas platforms or ships, the survival of all on board, and the containment of damage to equipment and structure, depends on the effectiveness of anti-fire devises, which are undoubtedly powered and controlled by electrical cables.
The cables installed in areas, with an assessed potential risk of fire, are always specified to be fire resistant.
At CCI, our manufacturing programme includes two cable constructions with substantial differences in their capabilities of maintaining circuit integrity, whilst sustain fire damage and the effects of extinguishing:

traditional

Until recently, standards have legislated for a resistance to fire, and maintaining circuit integrity against the effects of fire ONLY.

Once these cable types are attempted to be extinguished with water (the usual method for fire extinguishing) the cables fail, as the protection of conductors relies solely upon a mica glass tape which do not support water.

Mica glass tape, as a sole fire barrier, also has limitations in that it is only useful for voltages up to 1kV.

Fire tests are according to IEC 60331-1 or IEC 60331-2 applicable to the appropriate diameter of cable under test, with a requirement of Fire (at least 830°C) only and Mechanical shocks for a duration up to 2 hours.

FIREBAR®

The research and development to the 'age old' issue of installing a fire resistant cable that survives all aspects of fire and the extinguishing effects and is as easy to install as a conventional cable, has culminated in the CCI patented design of FIREBAR®.

The extensive proving and re-proving of the design allowed CCI to offer a guarantee for all TOTAL SAFETY on board, with unequalled performance.

FIREBAR® not only continues to operate in fire conditions, as you would expect, but, due to an unique design, fully functions whilst subject simultaneously attack of Fire, Mechanical shocks and a Water spray or Water jets combination.

What this means is that FIREBAR® provides, for an extended time to 2 hours, for safe evacuation of personnel and subsequent fire extinguishing.

FIREBAR® cables are already installed on platforms operated by BP, Total & Saipem, Shell & Technip, on SBM FPSOs and FNLGs and also where significant numbers of people would potentially be contained on Cruise ships operated by Carnival Group and built by Fincantieri.

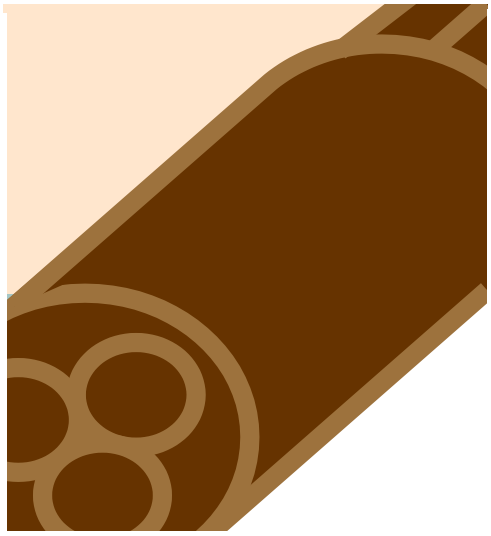
FIREBAR® constructions, when manufactured to IEC standards, cover the range from 150/250 Volt (Instrument types) up to 12/20 kV (Medium Voltage), and all in between.

The most stringent requirements set for cable testing have been in accordance to:

- BS7846:2000 Category F3 for Instrumentation and Low voltage power cables
- BS8491 for Medium voltage power cables

When submitted to the requirements of the a.m. standards, FIREBAR® cables, powered at nominal voltage rate, demonstrate their survival and continued operation against the combined effects of Fire (at least 830°C) + Mechanical Shocks + Water Spray or Water Jets, for a test timing of 2 hours, even when considering Medium Voltage cables.

Furthermore, beyond the requirements of any fire resistant international standard, FIREBAR® burned cables, after fully surviving 2 hours tests, as detailed above, are then immersed in water, still powered, to demonstrate the integrity of the construction (even after the effects of fire damage and extinguishing) and continued operation.



Insulating compound

The maximum operating temperature allowed in an electrical cable depends on the insulating material.

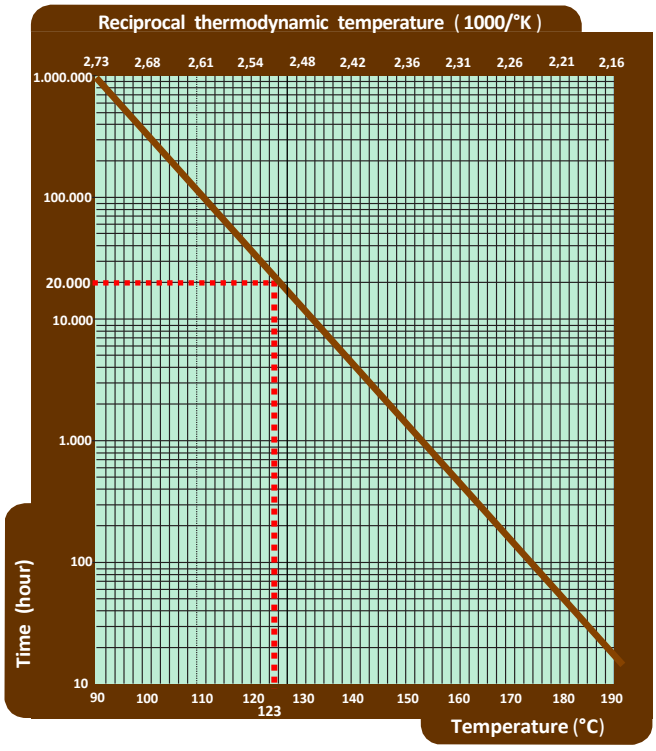
CCI developed improved XLPE, EPR and HEPR insulating compounds allowing a continuous working temperature greater than 100°C instead of 90°C requested by IEC 60092-360 Tab 2.

The Arrhenius graphs, hereunder reported, show the Temperature Index Ti(*) obtained by performing, on both of them, a Thermal Endurance Evaluation (witnessed by ABS - DNV and LR Surveyors) in accordance to IEC 60216 standards.

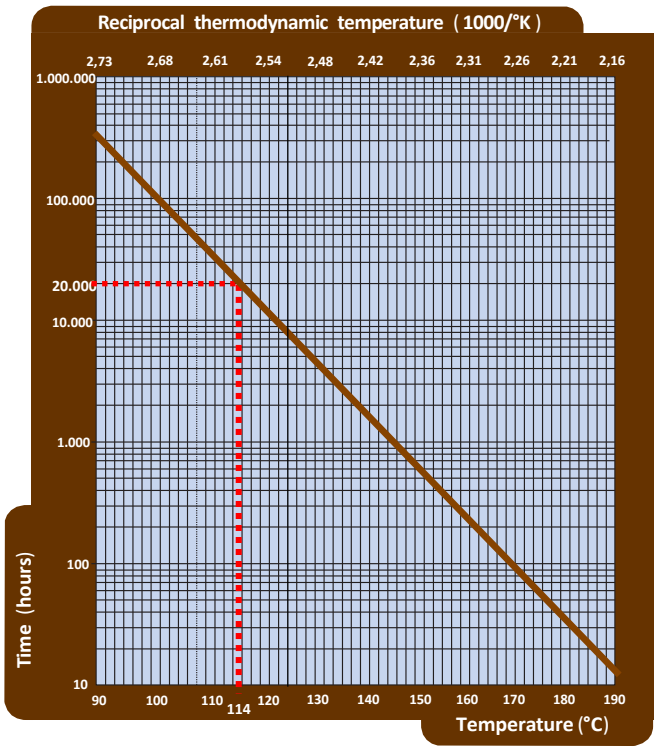
XLPE Ti = 123 °C - (H)EPR Ti = 114 °C

(*) The Temperature Index (Ti) is the maximum continous working temperature at which full insulation characteristics are still maintained.

CCI XLPE compund



CCI (H)EPR compunds



Product type approvals

American Bureau of Shipping (USA)

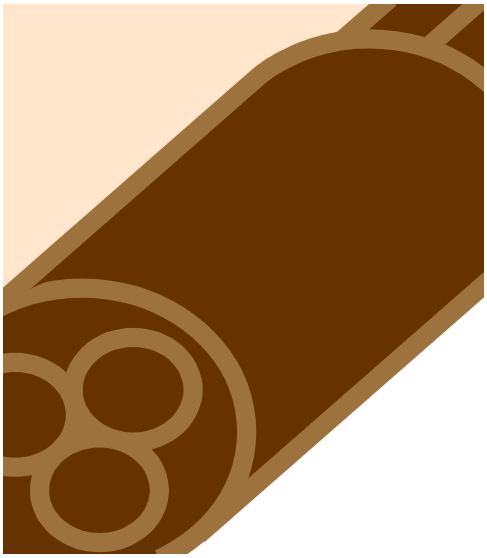
Bureau Veritas (France)

Det Norske Veritas - Germanischer Lloyd (Norway)

Lloyd's Register (UK)

Registro Italiano Navale (Italy)

Canada Transport



Reference standards

IEC 60092-350	General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications. Choice and installation of cables for low-voltage power system.
IEC 60092-352	Electrical installations in ships – Choice and installation of electrical cables
IEC 60092-353	Electrical installations in ships - Power cables for rated voltages 1 kV and 3 kV
IEC 60092-354	Single and three core power cables with extruded solid insulation for rated voltages 6 kV up to 30 kV.
IEC 60092-360	Insulation and sheathing materials for shipboard and offshore units, power control and instrumentation cables.
IEC 60092-376	Electrical installations in ships - Cables for control and instrumentation circuits 150 / 250 V (300 V).
IEC 60331-1	Tests for electric cables under fire conditions. 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 0,6/1,0 kV and with an overall diameter exceeding 20 mm.
IEC 60331-2	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 0,6/1,0 kV and with an overall diameter not exceeding 20 mm.
IEC 60331-1-2	Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame
IEC 60332-3-22	Tests on electric cables under fire conditions. Tests for vertical flame spread of vertically-mounted bunched wires of cables - Category A.
IEC 60754-1	Test on gases evolved during combustion of electric cables. Part 1: Determination of the halogen acid gas
IEC 60754-2	Part 2: Determination of acidity (by pH measurement) and conductivity.
IEC 60684-2	Flexible insulating sleeving – Fluorine content
IEC 61034-1 & 2	Measurement of smoke density of cables burning under defined conditions.
IEC 60533	Electrical and electronic installations in ships. Electromagnetic compatibility (EMC). Ships with a metallic hull
IEC 60079-14	Explosive atmospheres – Annex E Electrical installations design, selection and erection
CSA C 22.2 N° 0.3-09	Test methods for electrical wires and cables
CSA C 22.2 N° 38-18	Thermoset insulated wires and cables Cold bend and impact @ - 40 Deg C
UL 1581	§ 1200 - Sunlight (UV) resistance
NEK 606	Cables for offshore installations
BS 7846:2000	Annex L – Fire resistance test Cat F3
BS 8491	Method for assessment of fire integrity of large diameter power cables …..
HD 308 S2	Identification of cores in cables and flexible cords

Index

Flame Retardant

Type P — page 13
Power & control — 0,6/1 kV

Type P VDF EMC — page 15
Power, electromagnetic shields — 0,6/1 kV

Type E — page 17
Earth — 0,6/1 kV

Type O — page 18
Medium Voltage — 3,6/6 - 6/10 - 8,7/15 - 12/20 - 18/30 kV

Type R — page 21
Instrumentation, common screen — 150/250 V

Type S — page 23
Instrumentation, individual screen — 150/250 V

Flame Retardant Fire Resistant

Type PF — page 27
Power & control — 0,6/1 kV

Type RF — page 29
Instrumentation, common screen — 150/250 V

Type SF — page 31
Instrumentation, individual screen — 150/250 V

FIREBAR®
Flame Retardant Fire & Water Resistant

FIREBAR® type PF — page 35
Power & control — 0,6/1 kV

FIREBAR® type O — page 37
Medium voltage — 3,6/6 - 6/10 - 8,7/15 - 12/20 kV

FIREBAR® type RF — page 39
Instrumentation, common screen — 250 V

FIREBAR® type SF — page 41
Instrumentation, ind. & common screen — 250 V

Electrical data
Flame retardant & Fire resistant
LV power and control — page 44
Medium voltage — page 46
Instrumentation — page 48

FIREBAR® Fire & water resistant:
LV power and control — page 49
Medium voltage — page 51
Instrumentation — page 52

Generals — page 53

Flame retardant

Flame retandant tests

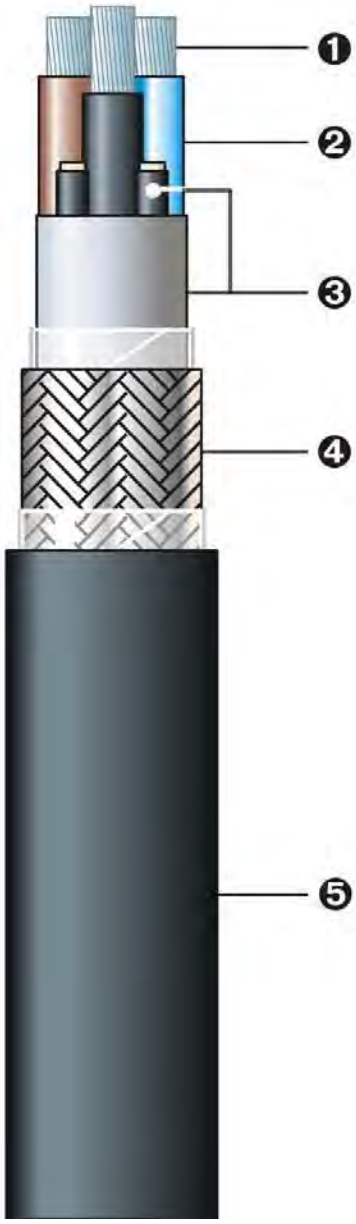
IEC 60332-1-2
on single cable

IEC 60332-3-22 Category A
on bunched cables

power & control 0,6/1 kV
halogen free flame retardant
armoured

Type approved XAI 0,6/1 kV

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-353
Nominal voltage Uo/U	0,6/1 kV
Max operating voltage Umax	1,2 kV
Maximum conductor temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5	IEC 60228
2 INSULATION	XLPE or EPR HF compound	IEC 60092-360
3 INNER SHEATH + FILLERS	SHF1 or SHF2 compound acc. to outer sheath fiberglass ropes XLPE sheathed when 3 cores (sect. > 16 mm²)	
4 ARMOUR	tinned copper wire braid	
5 OUTER SHEATH	SHF1 or SHF2 compound	IEC 60092-360

Cores identification according to HD 308 S2 and IEC 60445

1 core	white or black	4 cores	blue brown black grey
2 cores	blue brown	multicores	white numbered
3 cores	brown black grey	earth	green / yellow

Sheath colour

black

Sheath marking

CCI Type P XAI 0,6/1 kV n x sect mm² IEC 60092-353
IEC 60332-3-22 Cat A meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

0,6 / 1 kV

CONSTRUCTION			CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx.
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	10	4,1	0,7	7,0	10	220
1	x	16	5,2	0,7	8,1	12	310
1	x	25	6,5	0,9	10,4	15	470
1	x	35	7,5	0,9	11,4	16	580
1	x	50	8,3	1,0	12,4	17	720
1	x	70	10,0	1,1	14,3	19	950
1	x	95	11,8	1,1	16,1	21	1.260
1	x	120	13,2	1,2	18,3	23	1.550
1	x	150	14,6	1,4	20,1	25	1.870
1	x	185	16,5	1,6	22,4	28	2.320
1	x	240	19,0	1,7	25,1	30	2.940
1	x	300	21,8	1,8	28,5	34	3.530
2	x	1,5	1.6	0.7	7.5	11	180
2	x	2,5	2,0	0,7	8,3	12	210
2	x	4	2,8	0,7	10,5	15	330
2	x	6	3,3	0,7	11,6	16	410
2	x	10	4,1	0,7	13,1	17	550
2	x	16	5,2	0,7	15,3	20	750
3	x	1,5	1.6	0.7	8,5	12	190
3	x	2,5	2,0	0,7	9,5	14	260
3	x	4	2,8	0,7	11,4	16	280
3	x	6	3,3	0,7	12,8	17	480
3	x	10	4,1	0,7	14,5	20	680
3	x	16	5,2	0,7	17,5	22	960
3	x	25	6,5	0,9	21,2	26	1.420
3	x	35	7,5	0,9	23,4	28	1.790
3	x	50	8,3	1,0	25,2	30	2.230
3	x	70	10,0	1,1	29,4	35	3.070
3	x	95	11,8	1,1	33,9	40	4.240
3	x	120	13,2	1,2	37,9	45	5.140
3	x	150	14,6	1,4	41,8	49	6.360
3	x	185	16,5	1,6	46,7	54	7.890
3	x	240	19,0	1,7	52,5	60	10.160
3	x	300	21,8	1,8	59,8	68	12.290
4	x	1,5	1.6	0.7	9.3	13	260
4	x	2,5	2,0	0,7	10,4	14	360
4	x	4	2,8	0,7	12,3	17	480
4	x	6	3,3	0,7	13,5	18	600
4	x	10	4,1	0,7	15,4	20	810
4	x	16	5,2	0,7	18,7	23	1180
4	x	25	6,5	0,9	22,7	28	1690
4	x	35	7,5	0,9	25,0	30	2230
4	x	50	8,3	1,0	28,0	33	2840
4	x	70	10,0	1,1	33,0	39	3970
4	x	95	11,8	1,1	37,3	44	5330
4	x	120	13,2	1,2	41,8	49	6530
4	x	150	14,6	1,4	46,1	54	7990
4	x	185	16,5	1,6	51,7	60	9990
4	x	240	19,0	1,7	58,2	67	12780
4	x	300	21,8	1,8	66,4	76	15570
5	x	1,5	1.6	0,7	10.2	14	340
6	x	1,5	1.6	0,7	11,1	15	380
7	x	1,5	1.6	0,7	12,1	16	400
12	x	1,5	1.6	0,7	14,6	19	590
19	x	1,5	1.6	0,7	17,7	22	840
24	x	1,5	1.6	0,7	19,7	25	1030
37	x	1,5	1.6	0,7	23,7	29	1370
5	x	2,5	2.0	0,7	11,4	15	410
7	x	2,5	2,0	0,7	12,4	17	500
12	x	2,5	2,0	0,7	16,3	21	740
19	x	2,5	2,0	0,7	19,8	25	1090
24	x	2,5	2,0	0,7	22,2	28	1340
37	x	2,5	2,0	0,7	27,0	33	1880

power 1,8/3 kV

for Variable Frequency Drive systems

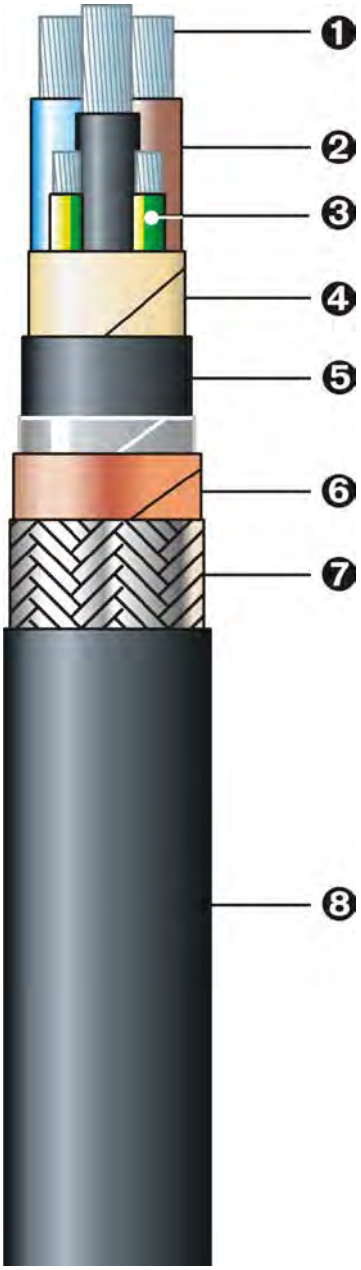
halogen free flame retardant

electromagnetic shield armoured

operating temperature over 100 °C

(see page 7)

Type approved XAI VFD EMC 1,8/3 kV



Design and construction	IEC 60092-353
Nominal voltage Uo/U	1,8/3 kV (Umax 3,6 kV)
Operating voltage rate Uo/U	0,6/1 kV (with VFD)
Max. operating voltage Umax	1,2 kV
Maximum rated temperature	90° C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Weather (UV) resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
ElectroMagnetic protection	IEC 60533 – IEC 62153-4-3
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction Data

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60228
2 INSULATION	XLPE or EPR HF compound IEC 60092-360
3 EARTH CONDUCTORS	plain or tinned copper flexible Cl 2 XLPE sheathed
4 BEDDING	FLAMEBAR® fiberglass tape
5 INNER SHEATH	SHF1 or SHF2 acc. to outer sheath
6 ELECTROMAGNETIC SHIELD	plain copper tape
7 ARMOUR	plain/ tinned copper or galvanized steel wire braid
8 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores Identification according to HD 308 S2-2001 and IEC 60445

3 cores	brown black grey
earth	green / yellow

Sheath colour

black (other colours on request)

Sheath marking

CCI Type P VFD EMC 1,8/3 kV n x sect mm² IEC 60092-353
IEC 60332-3-22 Cat A meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

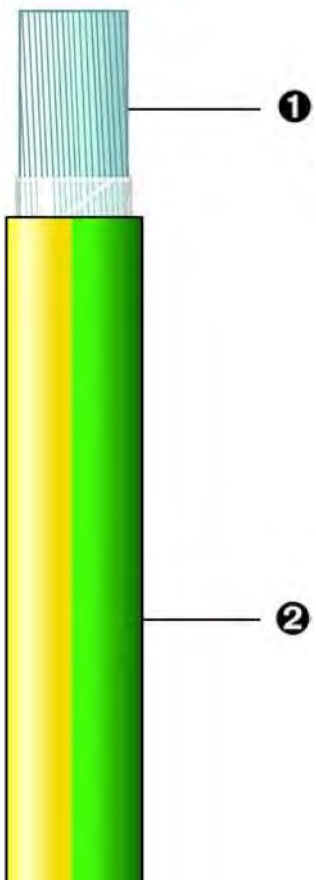
1,8/3 kV

CONSTRUCTION						CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
CONDUCTORS			EARTHS			nominal	nominal	nominal	approx	approx
n		[mm²]	n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
3	x	10	3	x	2,5	4,1	2,0	22,5	28	1.280
3	x	16	3	x	4	5,2	2,0	23,8	30	1.620
3	x	25	3	x	6	6,5	2,0	25,6	32	2.020
3	x	35	3	x	6	7,5	2,0	26,8	35	2580
3	x	50	3	x	10	8,3	2,0	28,5	38	2.950
3	x	70	3	x	16	10,0	2,0	31,2	43	3.850
3	x	95	3	x	16	11,8	2,0	35,1	48	4.950
3	x	120	3	x	25	13,2	2,0	38,2	51	6.000
3	x	150	3	x	25	14,6	2,0	40,4	53	6.840
3	x	185	3	x	35	16,5	2,0	45,4	56	7.830
3	x	240	3	x	35	19,0	2,0	49,5	61	9.100

earth 0,6/1 kV
halogen free - flame retardant
unarmoured

Type approved XI 0,6/1 kV

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-353
Nominal voltage Uo/U	0,6/1 kV
Max operating voltage Umax	1,2 kV
Maximum conductor temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 & 2 IEC 60684-2
Smoke density	IEC 61034-1 & 2
Vapour and gases migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned compacted copper flexible Class 2	IEC 60228
2 OUTER SHEATH	SHF1 or SHF2 compound	IEC 60092-360

Sheath colour green/yellow

Sheath marking

CCI Type E XI 0,6/1 kV sect mm² IEC 60092-353 IEC 60332-3-22 Cat A
meter marking year QA n°

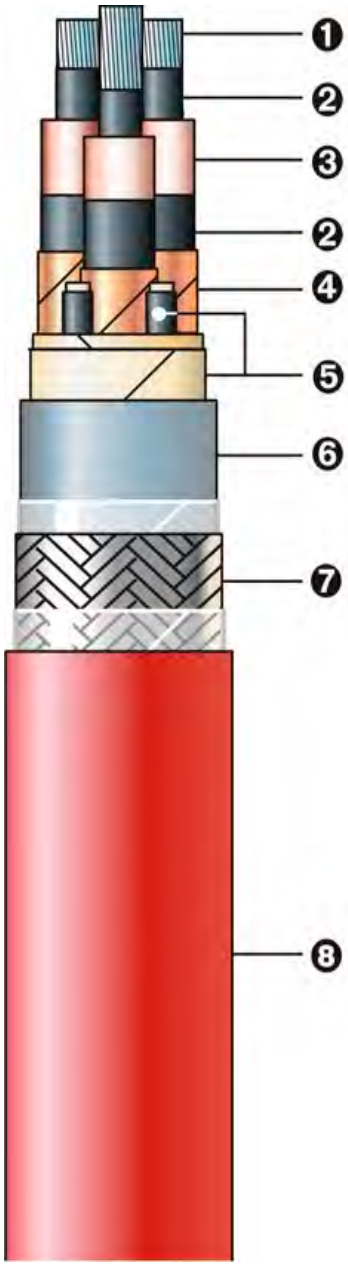
- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

CONSTRUCTION n		[mm²]	CONDUCTOR DIAMETER nominal [mm]	SHEATH THICKNESS nominal [mm]	OVERALL DIAMETER approx [mm]	WEIGHT approx. [kg/km]
1	x	2,5	2,0	0,9	4	40
1	x	4	2,8	1,0	5	60
1	x	6	3,3	1,0	5,5	80
1	x	10	4,1	1,0	6	120
1	x	16	5,2	1,1	7,5	190
1	x	25	6,5	1,1	9	280
1	x	35	7,5	1,2	10	380
1	x	50	8,3	1,2	11	490
1	x	70	10,0	1,3	13	690
1	x	95	11,8	1,4	15	970
1	x	120	13,2	1,5	16	1.200
1	x	150	14,6	1,5	18	1.460

radial field
(3,6/6 - 6/10 - 8,7/15 - 12/20 - 18/30) kV
halogen free flame retardant
armoured

Type approved XAI Uo/U kV

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-354
Nominal voltage Uo/U	3,6/6 - 6/10 - 8,7/15 - 12/20 - 18/30 kV
Max operating voltage Umax	7,2 12 17,5 24 36 kV
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardance	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned compacted copper flexible Class 2 or Class 5 IEC 60228
2 SEMICONDUTIVE LAYERS	HF extruded compound
3 INSULATION	HEPR extruded compound IEC 60092-360
4 CORE SCREEN	plain copper tape
5 BEDDING & FILLERS	FLAMEBAR® fiberglass tapes + fiberglass ropes HEPR sheathed when 3 cores
6 INNER SHEATH	SHF1 or SHF2 compound acc. to outer sheath
7 ARMOUR	tinned copper wire braid
8 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

1 core	off-white
3 cores	off-white (coloured or numbered tapes)

Sheath colour

red

Sheath Marking

CCI Type O XAI Uo/U kV n x sect mm² IEC 60092-354
IEC 60332-3-22 Cat A meter marking year QA n°

- Minimum Bending Radius: 4/5D depending on Overall Diameter – see Generals section

3,6/6 kV

CONSTRUCTION			CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
			nominal	nominal	nominal	approx	approx
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	25	6,5	2,5	17,5	23	890
1	x	35	7,5	2,5	18,5	24	1.020
1	x	50	8,3	2,5	19,4	25	1.160
1	x	70	10,0	2,5	22,0	27	1.500
1	x	95	11,8	2,5	23,5	29	1.850
1	x	120	13,2	2,5	25,5	31	2.130
1	x	150	14,6	2,5	26,5	32	2.450
1	x	185	16,5	2,5	28,5	35	2.900
1	x	240	19,0	2,6	31,5	38	3.670
1	x	300	21,8	2,8	34,9	41	4.370
3	x	25	6,5	2,5	36,5	43	2.840
3	x	35	7,5	2,5	38,0	45	3.240
3	x	50	8,3	2,5	40,5	48	3.850
3	x	70	10,0	2,5	44,3	52	4.780
3	x	95	11,8	2,5	48,2	56	5.800
3	x	120	13,2	2,5	51,2	59	6.730
3	x	150	14,6	2,5	54,2	62	7.840
3	x	185	16,5	2,5	58,4	67	9.180
3	x	240	19,0	2,6	65,2	74	11.780
3	x	300	21,8	2,8	72,1	81	13.700

6/10 kV

1	x	25	6,5	3,4	19,3	24	1.000
1	x	35	7,5	3,4	21,4	27	1.200
1	x	50	8,3	3,4	22,2	27	1.360
1	x	70	10,0	3,4	23,6	29	1.610
1	x	95	11,8	3,4	25,3	31	1.950
1	x	120	13,2	3,4	27,2	33	2.270
1	x	150	14,6	3,4	28,3	34	2.600
1	x	185	16,5	3,4	30,3	37	3.130
1	x	240	19,0	3,4	33,3	40	3.850
1	x	300	21,8	3,4	36,1	43	4.500
3	x	25	6,5	3,4	40,2	47	3.300
3	x	35	7,5	3,4	42,5	50	3.780
3	x	50	8,3	3,4	44,4	52	4.300
3	x	70	10,0	3,4	48,2	56	5.200
3	x	95	11,8	3,4	51,8	60	6.300
3	x	120	13,2	3,4	55,1	63	7.250
3	x	150	14,6	3,4	58,1	67	8.250
3	x	185	16,5	3,4	63,2	72,0	9.960
3	x	240	19,0	3,4	68,0	78	12.270
3	x	300	21,8	3,4	74,5	85	14.300

8,7/15 kV

1	x	25	6,5	4,5	22,6	28	1.200
1	x	35	7,5	4,5	23,6	29	1.360
1	x	50	8,3	4,5	24,0	30	1.520
1	x	70	10,0	4,5	25,8	31	1.800
1	x	95	11,8	4,5	27,9	34	2.170
1	x	120	13,2	4,5	29,2	35	2.450
1	x	150	14,6	4,5	30,5	37	2.860
1	x	185	16,5	4,5	32,9	39	3.420
1	x	240	19,0	4,5	35,3	42	4.070
1	x	300	21,8	4,5	39,0	46	4.820
3	x	25	6,5	4,5	45,4	53	3.900
3	x	35	7,5	4,5	47,5	55	4.350
3	x	50	8,3	4,5	49,1	57	4.900
3	x	70	10,0	4,5	52,9	61	5.850
3	x	95	11,8	4,5	56,6	65	6.950
3	x	120	13,2	4,5	60,4	69	8.100
3	x	150	14,6	4,5	63,3	73	9.300
3	x	185	16,5	4,5	67,5	77	10.900
3	x	240	19,0	4,5	73,4	83	13.050

12/20 kV

CONSTRUCTION			CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	**x**	**35**	7,5	5,5	25,6	31	1.520
1	**x**	**50**	8,3	5,5	26,0	32	1.640
1	**x**	**70**	10,0	5,5	28,2	34	1.970
1	**x**	**95**	11,8	5,5	29,9	36	2.430
1	**x**	**120**	13,2	5,5	31,2	38	2.720
1	**x**	**150**	14,6	5,5	33,2	40	3.100
1	**x**	**185**	16,5	5,5	35,1	42	3.620
1	**x**	**240**	19,0	5,5	37,3	45	4.300
1	**x**	**300**	21,8	5,5	40,9	48	5.050
3	**x**	**35**	7,5	5,5	51,0	59	4.920
3	**x**	**50**	8,3	5,5	53,5	61	5.480
3	**x**	**70**	10,0	5,5	57,2	65	6.360
3	**x**	**95**	11,8	5,5	42,2	71	7.800
3	**x**	**120**	13,2	5,5	65,2	74	8.820
3	**x**	**150**	14,6	5,5	68,2	78	10.040
3	**x**	**185**	16,5	5,5	72,3	82	11.500

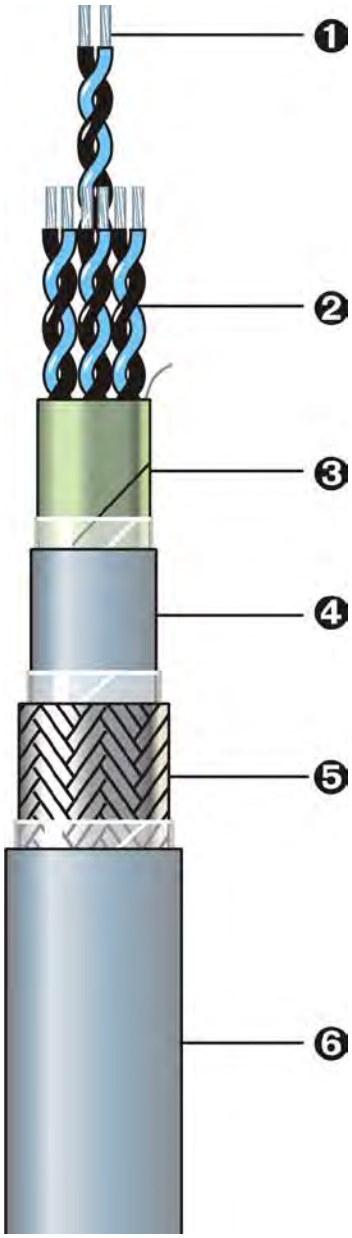
18/30 kV

1	**x**	**50**	8,3	8,0	31,4	38	2.210
1	**x**	**70**	10,0	8,0	33,6	40	2.580
1	**x**	**95**	11,8	8,0	35,3	42	2.950
1	**x**	**120**	13,2	8,0	36,6	43	3.280
1	**x**	**150**	14,6	8,0	38,2	45	3.630
1	**x**	**185**	16,5	8,0	40,5	48	4.230
1	**x**	**240**	19,0	8,0	43,2	50	4.990
1	**x**	**300**	21,8	8,0	45,9	53	5.680
3	**x**	**50**	8,3	8,0	65,3	74	7.050
3	**x**	**70**	10,0	8,0	69,0	78	8.030
3	**x**	**95**	11,8	8,0	72,7	82	9.330
3	**x**	**120**	13,2	8,0	75,5	85	10.400
3	**x**	**150**	14,6	8,0	79,0	89	11.690

instrumentation 150/250 V
halogen free flame retardant
common screen armoured

Type approved XAI(c) 250 V

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092.360
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction	
1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60092-376
2 INSULATION	XLPE or EPR HF compound IEC 60092-360
CORES TWISTING	in pairs / triples
3 COMMON SCREEN	Al/PE tape + tinned copper drain wire
4 INNER SHEATH	SHF1 or SHF2 compound acc. to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification	
pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour	grey (blue for intrinsically safe)

Sheath marking

CCI Type R XAI(c) 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

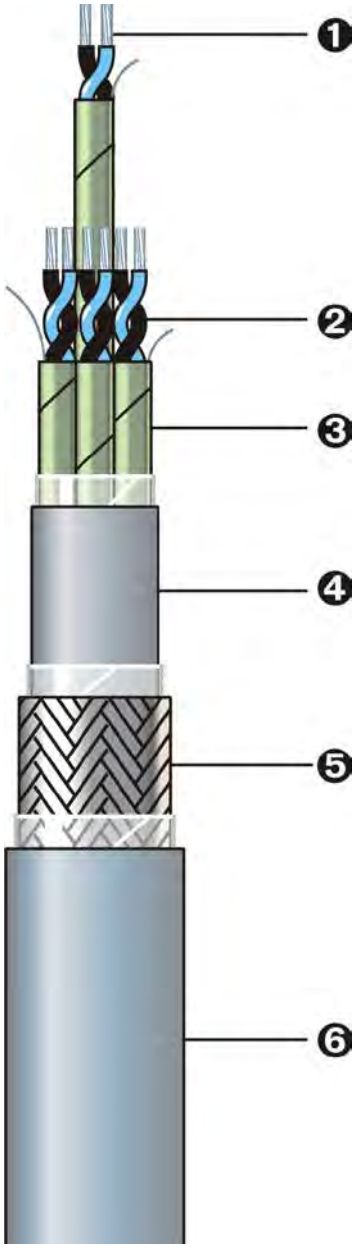
150/250 V

CONSTRUCTION					CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
					nominal	nominal	nominal	approx	approx
n		pair triple		[m m²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	2	x	0,75	1,1	0,5	5.9	9	140
2	x	2	x	0,75	1,1	0,5	9.6	13	250
4	x	2	x	0,75	1,1	0,5	11.1	15	370
8	x	2	x	0,75	1,1	0,5	14.1	18	500
12	x	2	x	0,75	1,1	0,5	16.8	21	650
19	x	2	x	0,75	1,1	0,5	21.2	26	960
24	x	2	x	0,75	1,1	0,5	23.4	29	1.140
30	x	2	x	0,75	1,1	0,5	25.8	31	1.340
1	x	3	x	0,75	1,1	0,5	6.3	9	150
3	x	3	x	0,75	1,1	0,5	11.1	15	370
6	x	3	x	0,75	1,1	0,5	15.2	20	310
12	x	3	x	0,75	1,1	0,5	19.7	25	900
19	x	3	x	0,75	1,1	0,5	24,0	29	1.230
1	x	2	x	1	1,3	0,5	6.5	10	160
2	x	2	x	1	1,3	0,5	10.6	15	340
4	x	2	x	1	1,3	0,5	12.3	17	440
8	x	2	x	1	1,3	0,5	15.7	20	600
12	x	2	x	1	1,3	0,5	19.4	24	840
19	x	2	x	1	1,3	0,5	23.6	29	1.160
24	x	2	x	1	1,3	0,5	26.2	32	1.390
30	x	2	x	1	1,3	0,5	29.3	35	1.680
1	x	3	x	1	1,3	0,5	6.9	10	170
3	x	3	x	1	1,3	0,5	12.3	17	450
6	x	3	x	1	1,3	0,5	17,0	22	740
12	x	3	x	1	1,3	0,5	21.9	27	1.080
19	x	3	x	1	1,3	0,5	27.2	33	1.580
1	x	2	x	1,5	1,6	0,6	7.2	10	180
2	x	2	x	1,5	1,6	0,6	11.9	16	400
4	x	2	x	1,5	1,6	0,6	13.8	18	530
8	x	2	x	1,5	1,6	0,6	18.3	23	800
12	x	2	x	1,5	1,6	0,6	21.8	27	1050
19	x	2	x	1,5	1,6	0,6	27.1	33	1540
24	x	2	x	1,5	1,6	0,6	30,0	35	1.920
30	x	2	x	1,5	1,6	0,6	33.7	40	2.330
1	x	3	x	1,5	1,6	0,6	7.7	11	210
3	x	3	x	1,5	1,6	0,6	13.8	18	540
6	x	3	x	1,5	1,6	0,6	19.7	25	980
12	x	3	x	1,5	1,6	0,6	24.7	30	1.390
19	x	3	x	1,5	1,6	0,6	30.7	37	2.100

instrumentation 150/250 V
halogen free flame retardant
individual & common screen armoured

Type approved XAI(i) 250 V

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardance	IEC 60332-1-2 IEC 60332-3-22 Cat A
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned compacted copper flexible Class 2 or Class 5 IEC 60092-376
2 INSULATION	XLPE or EPR compound IEC 60092-360
CORES TWISTING	in pairs / triples
3 INDIVIDUAL SCREEN	Al/PE tape + tinned copper drain wire
4 INNER SHEATH	SHF1 or SHF2 compound acc. to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour: grey (blue for intrinsically safe)

Sheath marking

CCI Type S XAI(i) 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

150/250 V

CONSTRUCTION					CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx
n		pair triple		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	2	x	0,75	1,1	0,5	5,9	9	140
2	x	2	x	0,75	1,1	0,5	9,8	13	270
4	x	2	x	0,75	1,1	0,5	11,3	15	400
8	x	2	x	0,75	1,1	0,5	14,5	19	570
12	x	2	x	0,75	1,1	0,5	17,9	23	800
19	x	2	x	0,75	1,1	0,5	21,8	27	1.100
24	x	2	x	0,75	1,1	0,5	24,1	29	1.320
30	x	2	x	0,75	1,1	0,5	27,1	33	1.620
1	x	3	x	0,75	1,1	0,5	6,3	9	150
3	x	3	x	0,75	1,1	0,5	11,3	15	390
6	x	3	x	0,75	1,1	0,5	15,5	20	660
12	x	3	x	0,75	1,1	0,5	20,1	25	990
19	x	3	x	0,75	1,1	0,5	24,6	30	1.400
1	x	2	x	1	1.3	0,5	6,5	10	160
2	x	2	x	1	1.3	0,5	10,7	15	350
4	x	2	x	1	1.3	0,5	12,5	17	480
8	x	2	x	1	1.3	0,5	16,1	21	680
12	x	2	x	1	1.3	0,5	19,8	25	970
19	x	2	x	1	1.3	0,5	24,3	29	1.350
24	x	2	x	1	1.3	0,5	27,3	33	1.680
30	x	2	x	1	1.3	0,5	30,2	36	2.080
1	x	3	x	1	1.3	0,5	6.9	10	170
3	x	3	x	1	1.3	0,5	12.5	17	470
6	x	3	x	1	1.3	0,5	17.9	23	840
12	x	3	x	1	1.3	0,5	22.4	28	1.210
19	x	3	x	1	1.3	0,5	27.9	33	1.760
1	x	2	x	1,5	1,6	0,6	7,2	10	180
2	x	2	x	1,5	1,6	0,6	12,0	16	420
4	x	2	x	1,5	1,6	0,6	14,0	18	570
8	x	2	x	1,5	1,6	0,6	18,6	23	870
12	x	2	x	1,5	1,6	0,6	22,3	27	1.190
19	x	2	x	1,5	1,6	0,6	27,7	33	1.730
24	x	2	x	1,5	1,6	0,6	30,8	37	2.160
30	x	2	x	1,5	1,6	0,6	34,5	41	2.660
1	x	3	x	1,5	1,6	0,6	7,7	11	210
3	x	3	x	1,5	1,6	0,6	14,0	18	570
6	x	3	x	1,5	1,6	0,6	20,0	25	1.040
12	x	3	x	1,5	1,6	0,6	25,2	31	1.510
19	x	3	x	1,5	1,6	0,6	31,4	38	2.330

Fire Resistant

Fire resistance tests

IEC 60331-2 (EN 50200)

overall diameter not exceeding 20 mm
flame @ 830 °C for 120 minutes
with mechanical shocks every 5 minutes

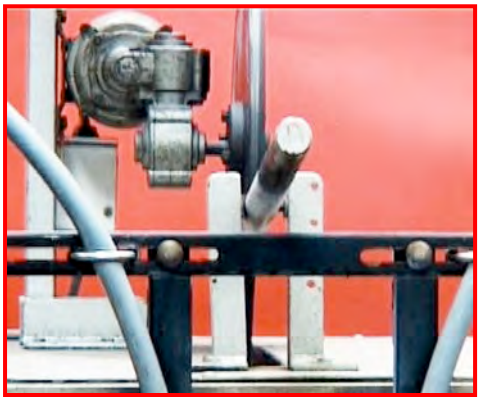
EN 50200 Annex E

BS EN 50200 with water spray protocol
flame for 30 minutes with water spray
during last 15 min

IEC 60331-1

overall diameter exceeding 20 mm
flame @ 830 °C for 120 minutes
with mechanical shocks every 5 minutes

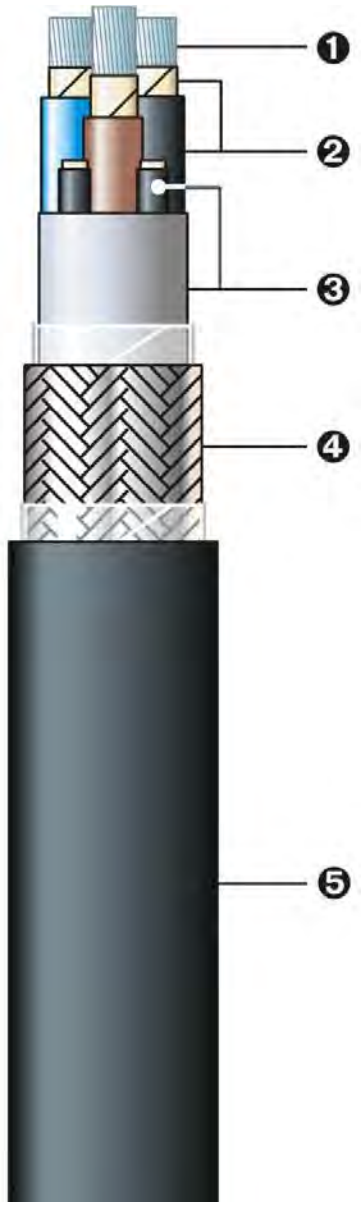
Shock-producing device



power & control 0,6/1 kV
halogen free flame retardant
fire resistant
armoured

operating temperature over 100 °C
(see page 7)

Type approved XAI 331 0,6/1 kV



Design and construction	IEC 60092-353
Nominal voltage Uo/U	0,6/1 kV
Max operating voltage Umax	1,2 kV
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance (see page 26)	IEC 60331-1 or 2 EN 50200 Annex E
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (-40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned compacted copper flexible Class 2 or Class 5 IEC 60228
2 INSULATION	mica tape + XLPE or EPR HF comp. IEC 60092-360
3 INNER SHEATH + FILLERS	SHF1 or SHF2 compound acc. to outer sheath fiberglass ropes, XLPE sheathed when 3 cores (sect. > 16 mm²)
4 ARMOUR	tinned copper wire braid
5 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification according to HD 308 S2 and IEC 60445

1 core	white or black	4 cores	blue brown black grey
2 cores	blue brown	multicores	white numbered
3 cores	brown black grey	earth	green / yellow

Sheath colour

black

Sheath marking

CCI Type PF 0,6/1 kV n x sect mm² IEC 60092-353
IEC 60332-3-22 Cat A IEC 60331-1 or 2 meter marking year QA n

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

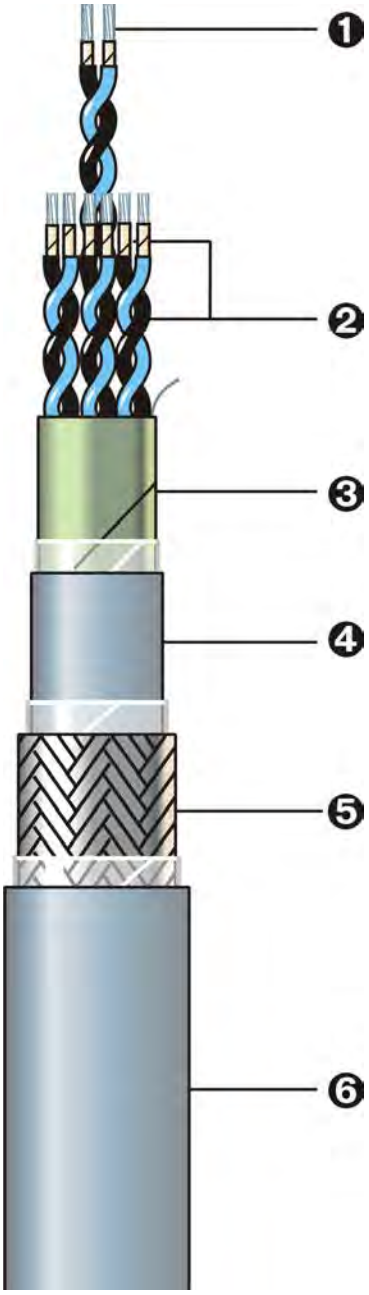
0,6 / 1 kV

CONSTRUCTION			CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	10	4,1	0,7	7,6	11	240
1	x	16	5,2	0,7	9,3	13	330
1	x	25	6,5	0,9	11,1	15	500
1	x	35	7,5	0,9	12,1	16	630
1	x	50	8,3	1,0	13,0	17	760
1	x	70	10,0	1,1	14,9	19	1.000
1	x	95	11,8	1,1	16,7	21	1.300
1	x	120	13,2	1,2	18,9	24	1.600
1	x	150	14,6	1,4	20,7	26	1.920
1	x	185	16,5	1,6	23,0	28	2.380
1	x	240	19,0	1,7	25,7	31	3.000
1	x	300	21,8	1,8	29,1	35	3.600
2	x	1,5	1,6	0,7	8,3	12	200
2	x	2,5	2,0	0,7	9,7	13	250
2	x	4	2,8	0,7	11,5	16	370
2	x	6	3,3	0,7	12,8	17	460
2	x	10	4,1	0,7	14,3	19	600
2	x	16	5,2	0,7	16,7	21	820
3	x	1,5	1,6	0,7	9,4	13	240
3	x	2,5	2,0	0,7	10,4	14	320
3	x	4	2,8	0,7	12,3	17	430
3	x	6	3,3	0,7	13,6	18	530
3	x	10	4,1	0,7	15,3	20	760
3	x	16	5,2	0,7	18,5	23	1.090
3	x	25	6,5	0,9	22,2	27	1.530
3	x	35	7,5	0,9	24,2	29	1.890
3	x	50	8,3	1,0	26,2	32	2.320
3	x	70	10,0	1,1	30,7	37	3.270
3	x	95	11,8	1,1	35,0	42	4.390
3	x	120	13,2	1,2	39,1	46	5.380
3	x	150	14,6	1,4	43,0	50	6.510
3	x	185	16,5	1,6	47,9	56	8.060
3	x	240	19,0	1,7	53,8	62	10.350
3	x	300	21,8	1,8	61,3	70	12.510
4	x	1,5	1,6	0,7	10,3	14	330
4	x	2,5	2,0	0,7	11,3	15	400
4	x	4	2,8	0,7	13,5	18	530
4	x	6	3,3	0,7	14,9	19	680
4	x	10	4,1	0,7	16,8	21	880
4	x	16	5,2	0,7	20,3	25	1.300
4	x	25	6,5	0,9	24,4	30	1.820
4	x	35	7,5	0,9	27,1	33	2.420
4	x	50	8,3	1,0	29,3	35	2.970
4	x	70	10,0	1,1	34,3	41	4.150
4	x	95	11,8	1,1	39,3	46	5.580
4	x	120	13,2	1,2	43,1	50	6.120
4	x	150	14,6	1,4	47,5	55	8.180
4	x	185	16,5	1,6	53,0	61	10.180
4	x	240	19,0	1,7	60,5	69	13.180
4	x	300	21,8	1,8	67,7	77	15.770
5	x	1,5	1,6	0,7	11,3	15	380
7	x	1,5	1,6	0,7	12,3	17	450
12	x	1,5	1,6	0,7	16,3	21	670
19	x	1,5	1,6	0,7	19,7	25	970
27	x	1,5	1,6	0,7	23,1	29	1.190
37	x	1,5	1,6	0,7	26,5	32	1.590
5	x	2,5	2,0	0,7	12,4	17	460
7	x	2,5	2,0	0,7	13,5	18	550
12	x	2,5	2,0	0,7	18,6	23	880
19	x	2,5	2,0	0,7	21,7	27	1.210
27	x	2,5	2,0	0,7	25,5	31	1.510
37	x	2,5	2,0	0,7	29,7	35	2.120

instrumentation 150/250 V
halogen free flame retardant
fire resistant
common screen armoured

operating temperature over 100 °C
(see page 7)

Type approved XAI(c) 331 250 V



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance (see page 26)	IEC 60331-1 or 2 EN 50200 Annex E
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 60079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60092-376
2 INSULATION	mica tape + XLPE or EPR HF comp. IEC 60092-360
CORES TWISTING	in pairs / triples
3 COMMON SCREEN	Al/PE tape + tinned copper drain wire
4 INNER SHEATH	SHF1 or SHF2 compound acc. to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour

grey (blue for intrinsically safe)

Sheath marking

CCI Type RF XAI(c)331 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A IEC 60331-1 or 2 meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

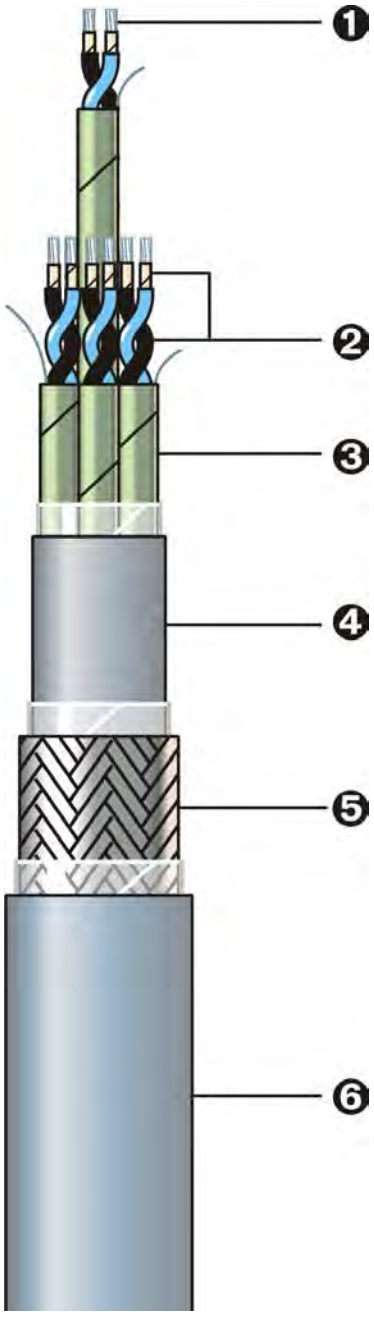
150/250 V

CONSTRUCTION						CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
						nominal	nominal	nominal	approx	approx
n		pair triple		[mm²]		[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	2	x	0,75		1,1	0,5	6,4	10	150
2	x	2	x	0,75		1,1	0,5	10,5	15	330
4	x	2	x	0,75		1,1	0,5	12,2	17	430
8	x	2	x	0,75		1,1	0,5	15,6	20	580
12	x	2	x	0,75		1,1	0,5	19,2	24	810
19	x	2	x	0,75		1,1	0,5	23,4	28	1.110
24	x	2	x	0,75		1,1	0,5	25,9	31	1.330
30	x	2	x	0,75		1,1	0,5	29,0	35	1.610
1	x	3	x	0,75		1,1	0,5	6,8	10	170
3	x	3	x	0,75		1,1	0,5	12,2	17	430
6	x	3	x	0,75		1,1	0,5	16,8	21	700
12	x	3	x	0,75		1,1	0,5	21,7	27	1.030
19	x	3	x	0,75		1,1	0,5	26,5	32	1.440
1	x	2	x	1		1,3	0,5	6,8	10	170
2	x	2	x	1		1,3	0,5	11,2	15	360
4	x	2	x	1		1,3	0,5	13,0	17	480
8	x	2	x	1		1,3	0,5	16,7	21	660
12	x	2	x	1		1,3	0,5	20,5	25	940
19	x	2	x	1		1,3	0,5	25,1	30	1.310
24	x	2	x	1		1,3	0,5	28,2	34	1.600
30	x	2	x	1		1,3	0,5	31,1	37	1.970
1	x	3	x	1		1,3	0,5	7,3	10	190
3	x	3	x	1		1,3	0,5	13,0	17	490
6	x	3	x	1		1,3	0,5	18,6	23	850
12	x	3	x	1		1,3	0,5	23,2	28	1.200
19	x	3	x	1		1,3	0,5	28,9	34	1.750
1	x	2	x	1,5		1,6	0,6	8,0	11	210
2	x	2	x	1,5		1,6	0,6	13,3	18	470
4	x	2	x	1,5		1,6	0,6	15,5	20	620
8	x	2	x	1,5		1,6	0,6	20,6	25	920
12	x	2	x	1,5		1,6	0,6	24,6	30	1.230
19	x	2	x	1,5		1,6	0,6	30,6	37	1.870
24	x	2	x	1,5		1,6	0,6	34,5	41	2.310
30	x	2	x	1,5		1,6	0,6	38,1	45	2.720
1	x	3	x	1,5		1,6	0,6	9,2	13	260
3	x	3	x	1,5		1,6	0,6	15,5	20	640
6	x	3	x	1,5		1,6	0,6	22,2	27	1.150
12	x	3	x	1,5		1,6	0,6	28,3	34	1.650
19	x	3	x	1,5		1,6	0,6	35,3	42	2.530

instrumentation 150/250 V
halogen free - flame retardant
fire resistant
individual screen - armoured

operating temperature over 100 °C
(see page 7)

Type approved XAI(i) 331 250 V



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance (see page 26)	IEC 60331-1 or 2
	EN 50200 Annex E
Halogen content & corrosivity	IEC 60754-1 / 2 IEC 60684-2
Smoke density	IEC 61034-1 / 2
Vapour and gas migration	IEC 6079-14 Annex E
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned compacted copper flexible Class 2 IEC 60092-376
2 INSULATION	mica tape + XLPE or EPR comp. IEC 60092-360
CORES TWISTING	in pairs / triples
3 INDIVIDUAL SCREEN	Al/PE tape + tinned copper drain wire
4 BEDDING (INNER SHEATH)	SHF1 or SHF2 compound acc. to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour

grey (blue for intrinsically safe)

Sheath marking

CCI Type SF XAI(i) 331 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A IEC 60331-1 or 2 meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

150 / 250 V

CONSTRUCTION					CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx
n		pair triple		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	2	x	0,75	1,1	0,5	6,4	10	150
2	x	2	x	0,75	1,1	0,5	10,6	15	450
4	x	2	x	0,75	1,1	0,5	12,4	17	640
8	x	2	x	0,75	1,1	0,5	15,9	20	910
12	x	2	x	0,75	1,1	0,5	19,6	25	1.260
19	x	2	x	0,75	1,1	0,5	24,0	29	1.560
24	x	2	x	0,75	1,1	0,5	27,0	33	1.750
30	x	2	x	0,75	1,1	0,5	29,9	36	2.230
1	x	3	x	0,75	1,1	0,5	6,8	10	170
3	x	3	x	0,75	1,1	0,5	12,4	17	450
6	x	3	x	0,75	1,1	0,5	17,7	22	800
12	x	3	x	0,75	1,1	0,5	22,2	27	1.130
19	x	3	x	0,75	1,1	0,5	27,6	33	1.650
1	x	2	x	1	1,3	0,5	6,8	10	170
2	x	2	x	1	1,3	0,5	11,3	15	380
4	x	2	x	1	1,3	0,5	13,2	18	510
8	x	2	x	1	1,3	0,5	17,0	22	740
12	x	2	x	1	1,3	0,5	21,0	26	1.050
19	x	2	x	1	1,3	0,5	25,7	31	1.490
24	x	2	x	1	1,3	0,5	28,9	34	1.930
30	x	2	x	1	1,3	0,5	32,4	39	2.350
1	x	3	x	1	1,3	0,5	7,3	10	190
3	x	3	x	1	1,3	0,5	13,2	18	510
6	x	3	x	1	1,3	0,5	18,9	24	920
12	x	3	x	1	1,3	0,5	23,7	29	1320
19	x	3	x	1	1,3	0,5	29,6	35	1950
1	x	2	x	1,5	1,6	0,6	8,0	11	210
2	x	2	x	1,5	1,6	0,6	13,4	18	480
4	x	2	x	1,5	1,6	0,6	15,7	20	660
8	x	2	x	1,5	1,6	0,6	20,9	26	1.000
12	x	2	x	1,5	1,6	0,6	25,0	30	1.350
19	x	2	x	1,5	1,6	0,6	31,2	37	2.060
24	x	2	x	1,5	1,6	0,6	35,1	42	2.550
30	x	2	x	1,5	1,6	0,6	39,5	47	3.140
1	x	3	x	1,5	1,6	0,6	9,2	13	260
3	x	3	x	1,5	1,6	0,6	15,6	20	660
6	x	3	x	1,5	1,6	0,6	22,5	28	1.220
12	x	3	x	1,5	1,6	0,6	28,8	34	1.770
19	x	3	x	1,5	1,6	0,6	35,9	43	2.730

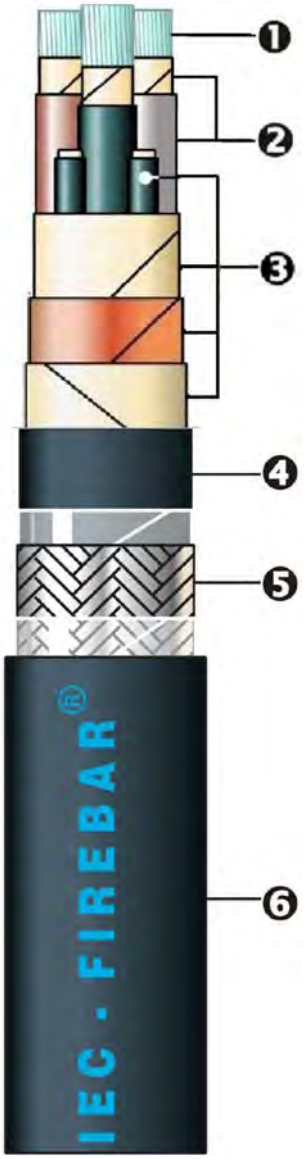
FIREBAR®

Fire & Water resistant


FIREBAR®
the TOTAL SAFETY
FIRE AND WATER RESISTANT CABLE
in accordance with
instrumentation
power low voltage
medium voltage
BS 7846:2000 Cat F3
BS 8491 F120
when submitted to
fire + mechanical shocks + water spray / water jets
followed by
water immersion of burned sample still powered

power & control 0,6/1 kV
halogen free flame retardant armoured
fire + mechanical shocks + water spray + water immersion resistant

Type approved
ABS - BV - LR ➡ FIREBAR® IEC 0,6/1 kV
RINA ➡ FIREBAR® XAI 0,6/1 kV



Design and construction Nominal voltage Uo/U	IEC 60092-353 0,6/1 kV
Max operating voltage Umax	1,2 kV
Maximum rated temperature Flame retardancy	95 °C according to IEC 60092-360 IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance	BS 7846 :2000 Cat F3 (see **NOTE**) IEC 60331-1 or 2 (see page 26)
Halogen content & corrosivity	IEC 60754-1 & 2 IEC 60684-2
Smoke density	IEC 61034-1 & 2
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60228
2 INSULATION	mica tape + S95 HF comp. IEC 60092-360
3 FIREBAR® protection	• FLAMEBAR® fiberglass tapes + fiberglass ropes S95 sheathed when 3 cores (sect. > 16 mm²) • Cu/PE tape
4 INNER SHEATH	SHF1 or SHF2 according to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification according to HD 308 S2 and IEC 60445

1 core	white or black	4 cores	blue brown black grey
2 cores	blue brown	multicores	white numbered
3 cores	brown black grey	earth	green / yellow

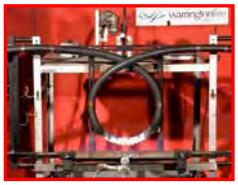
Sheath colour black (other colours on request)

Sheath marking

CCI FIREBAR® type PF 0,6/1 kV n x sect mm² IEC 60092-353
IEC 60332-3-22 Cat A BS 7846:2000 Cat F3 meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

FIRE & MECHANICAL SHOCKS



WATER SPRAY

WATER IMMERSION

NOTE BS 7846 Cat F3 : 2000 - test parameters
> FIRE 830 (+40/-0)°C x 120 minutes @ 1 kV, while:
> MECHANICAL SHOCKS every 5 minutes hitting the frame with sample mounted in bent formation at Minim. Bending Radius
> WATER SPRAY 1 l/m² s^{-1} (2,4 l/min) during last 15 minutes
Furthermore, not requested by any fire resistant standard:
WATER IMMERSION (15 min) of burned sample still powered

0,6 / 1 kV

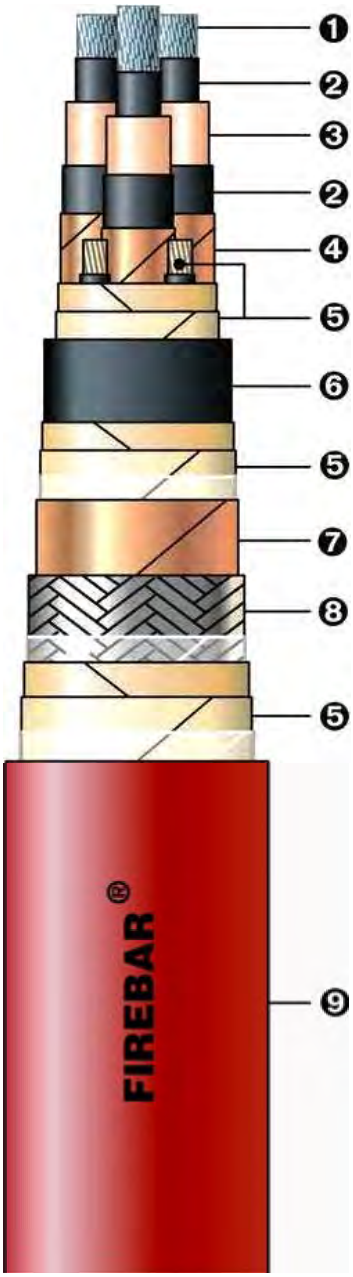
CONSTRUCTION			CONDUCTOR DIAMETER nominal	INSULATION THICKNESS nominal	DIAMETER UNDER ARMOUR nominal	OVERALL DIAMETER approx	WEIGHT approx
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	10	4,1	1.0	9.2	14	340
1	x	16	5,2	1.0	10.4	15	420
1	x	25	6,5	1.2	12,6	17	620
1	x	35	7,5	1.2	13,6	18	740
1	x	50	8,3	1.4	14,7	20	900
1	x	70	10,0	1.4	16,4	21	1.140
1	x	95	11,8	1.6	18,6	24	1.500
1	x	120	13,2	1.6	20,4	26	1.800
1	x	150	14,6	1.8	22,2	28	2.150
1	x	185	16,5	2.0	24,5	30	2.630
1	x	240	19,0	2.2	27,8	34	3.320
1	x	300	21,8	2.4	31	38	4.030
2	x	1,5	1,6	1.0	10,5	15	330
2	x	2,5	2,0	1.0	11,7	16	390
2	x	4	2,6	1.0	13,6	18	490
2	x	6	3,2	1.0	14,9	20	600
2	x	10	4,1	1.0	16,5	21	800
2	x	16	5,2	1.0	18,9	24	1.060
3	x	1,5	1,6	1.0	11,2	15	370
3	x	2,5	2,0	1.0	12,4	17	450
3	x	4	2,6	1.0	14,5	19	570
3	x	6	3,2	1.0	15,8	21	700
3	x	10	4,1	1.0	17,5	23	980
3	x	16	5,2	1.0	20,5	26	1.350
3	x	25	6,5	1.2	24,4	30	1.860
3	x	35	7,5	1.2	26,4	32	2.140
3	x	50	8,3	1.4	29	35	2.670
3	x	70	10,0	1.4	32,7	40	3.540
3	x	95	11,8	1.6	37,4	45	4.710
3	x	120	13,2	1.6	40,8	49	5.640
3	x	150	14,6	1.8	45,1	54	6.930
3	x	185	16,5	2.0	50,1	59	8.550
3	x	240	19,0	2.2	56,8	66	10.830
3	x	300	21,8	2.4	63,7	74	12.980
4	x	1,5	1,6	1.0	12,1	17	430
4	x	2,5	2,0	1.0	13,5	18	510
4	x	4	2,6	1.0	15,8	21	670
4	x	6	3,2	1.0	17,3	22	840
4	x	10	4,1	1.0	19,6	25	1.150
4	x	16	5,2	1.0	22,5	28	1.560
4	x	25	6,5	1.2	26,8	33	2.150
4	x	35	7,5	1.2	29,1	35	2.930
4	x	50	8,3	1.4	31,9	39	3.440
4	x	70	10,0	1.4	36	43	4.460
4	x	95	11,8	1.6	41,3	49	5.960
4	x	120	13,2	1.6	45,1	53	7.180
4	x	150	14,6	1.8	48.9	58	8.670
4	x	185	16,5	2.0	54.9	65	10.910
4	x	240	19,0	2.2	61.9	72	13.900
4	x	300	21,8	2.4	69.6	80	16.650
5	x	1,5	1,6	1.0	13,4	18	500
7	x	1,5	1,6	1.0	14,6	19	590
12	x	1,5	1,6	1.0	19,4	25	930
19	x	1,5	1,6	1.0	22,7	28	1.240
27	x	1,5	1,6	1.0	27,3	33	1.710
37	x	1,5	1,6	1.0	30,8	37	2.240
5	x	2,5	2,0	1.0	14,8	19	600
7	x	2,5	2,0	1.0	16,1	21	720
12	x	2,5	2,0	1.0	21,5	27	1.150
19	x	2,5	2,0	1.0	25,4	31	1.570
27	x	2,5	2,0	1,0	30,6	37	2.270
37	x	2,5	2,0	1.0	34,4	41	2.850

(3,6/6 - 6/10 - 8,7/15 - 12/20) kV radial field halogen free flame retardant armoured

fire + mechanical shocks + water jets + water immersion resistant

Type approved:
ABS - BV - DNVGL - LR ➡ FIREBAR® IEC MV
RINA ➡ FIREBAR® XAI MV

operating temperature over 100 °C
(see page 7)



Design and construction	IEC 60092-354 (as applicable)
Nominal voltage Uo/U	3,6/6 - 6/10 - 8,7/15 - 12/20 kV
Max operating voltage Umax	7,2 12 17,5 24 KV
Maximum rated temperature	90 °C according to IEC 60092-360
Flame retardance	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance	BS 8491:2008 F120 (see **NOTE**)
Halogen content & corrosivity	IEC 60754-1 & 2 IEC 60684-2
Smoke density	IEC 61034-1 & 2
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Electromagnetic compatibility	IEC 60533 Annex B
Cold bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60228
2 SEMICONDUCTIVES	LSOH extruded compound
3 INSULATION	HEPR HF compound IEC 60092-360 + HF heat resistant rubber compound
4 PHASE SCREEN	tinned copper tape
5 FIREBAR® protection	FLAMEBAR® fiberglass tape + fiberglass ropes HEPR sheathed when 3 cores
6 INNER SHEATH	HF heat resistant rubber compound
7 ELECTROMAGNETIC SHIELD	plain copper tape
8 ARMOUR	tinned copper wire braid
9 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

1 core	off-white
3 cores	off-white (coloured or numbered tapes)

Sheath colour

red (other colours on request)

Sheath marking

CCI FIREBAR® type O Uo/U kV n x sect mm² IEC 60092-354
IEC 60332-3-22 Cat A BS 8491 F120 meter marking year QA n°

- Minimum Bending Radius: 4/5 D depending on Overall Diameter - see Generals section

FIRE & MECHANICAL SHOCKS

WATER JETS

WATER IMMERSION

NOTE BS 8491 F120 - test parameters
> FIRE 830 (+40/-0)°C x 120 minutes @ Uo kV, while:
> MECHANICAL SHOCKS directly hitting the sample in bent formation at Minimum Bending Radius every 10 min.
> WATER JETS 5 bursts (5 sec. each) @ 12,5 l/min during last 5 min.
Furthermore, not requested by any fire resistance standard:
> WATER IMMERSION (15 min) of burned sample still powered

3,6/6 kV

CONSTRUCTION			CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
			nominal	nominal	nominal	approx	approx
n		[mm²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	50	8,3	2,5	30,3	41	2.460
1	x	70	10,0	2,5	32,0	43	2.780
1	x	95	11,8	2,5	33,8	44	3.180
1	x	120	13,2	2,5	35,2	46	3.510
1	x	150	14,6	2,5	36,6	47	3.880
1	x	185	16,5	2,5	38,5	50	4.400
1	x	240	19,0	2,5	41,2	52	5.160
1	x	300	21,8	2,5	44,4	56	5.900
3	x	50	8,3	2,5	54,1	66	5.950
3	x	70	10,0	2,5	57,8	70	6.910
3	x	95	11,8	2,5	61,6	74	8.210
3	x	120	13,2	2,5	64,7	78	9.130
3	x	150	14,6	2,5	67,7	81	10.300
3	x	185	16,5	2,5	71,8	85	11.840
3	x	240	19,0	2,5	77,6	91	14.250

6/10 kV

1	x	50	8,3	3,4	32,5	43	2.690
1	x	70	10,0	3,4	34,2	45	3.020
1	x	95	11,8	3,4	36,0	47	3.430
1	x	120	13,2	3,4	37,4	48	3.770
1	x	150	14,6	3,4	38,8	50	4.140
1	x	185	16,5	3,4	40,7	52	4.670
1	x	240	19,0	3,4	43,2	55	5.420
1	x	300	21,8	3,4	46,0	58	6.120
3	x	50	8,3	3,4	58,8	71	6.620
3	x	70	10,0	3,4	62,5	75	7.680
3	x	95	11,8	3,4	66,4	79	8.870
3	x	120	13,2	3,4	69,4	83	9.920
3	x	150	14,6	3,4	72,4	86	11.120
3	x	185	16,5	3,4	76,5	90	12.790

8,7/15 kV

1	x	50	8,3	4,5	34,7	45	2.930
1	x	70	10,0	4,5	36,4	47	3.280
1	x	95	11,8	4,5	38,2	49	3.700
1	x	120	13,2	4,5	39,6	51	4.040
1	x	150	14,6	4,5	41,0	52	4.420
1	x	185	16,5	4,5	42,9	54	4.960
1	x	240	19,0	4,5	45,4	57	5.720
1	x	300	21,8	4,5	48,2	60	6.440
3	x	50	8,3	4,5	63,6	76	7,370
3	x	70	10,0	4,5	67,3	80	8,440
3	x	95	11,8	4,5	71,1	84	9,680
3	x	120	13,2	4,5	74,2	88	10,930
3	x	150	14,6	4,5	77,2	91	11,980
3	x	185	16,5	4,5	81,3	95	13,680

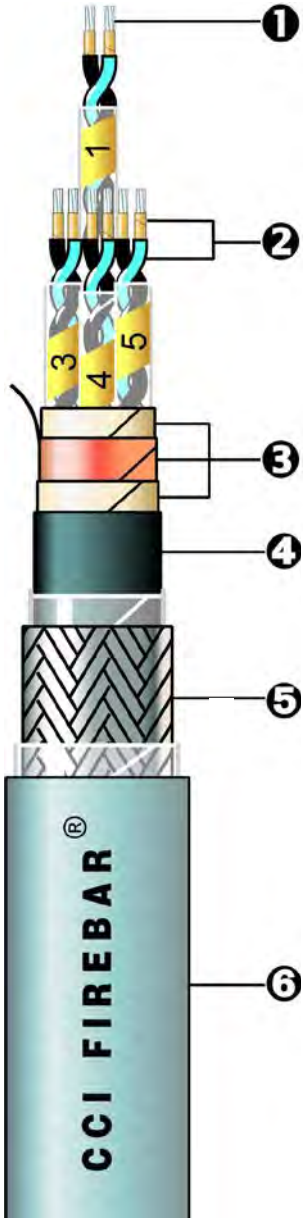
12/20 kV

1	x	50	8,3	5,5	36,7	48	3.170
1	x	70	10,0	5,5	38,4	49	3.520
1	x	95	11,8	5,5	40,2	51	3.950
1	x	120	13,2	5,5	41,6	53	4.290
1	x	150	14,6	5,5	43,0	54	4.440
1	x	185	16,5	5,5	44,9	56	5.230
1	x	240	19,0	5,5	47,4	59	6.000
1	x	300	21,8	5,5	50,2	62	6.730
3	x	50	8,3	5,5	67,9	81	8.090
3	x	70	10,0	5,5	71,6	85	9.110
3	x	95	11,8	5,5	75,5	89	10.630
3	x	120	13,2	5,5	78,5	92	11.560
3	x	150	14,6	5,5	81,5	96	12.820

FIREBAR® type RF

instrumentation 150/250 V
halogen free flame retardant
common screen armoured
fire + mechanical shocks + water spray + water immersion resistant

Type approved
ABS - BV - LR ➡ FIREBAR® IEC (c) 250 V
RINA ➡ FIREBAR® XAI (c) 250 V



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	95°C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance	BS 7846 :2000 Cat F3 (see **NOTE**)
	IEC 60331-1 or 2 (see page 26)
Halogen content & corrosivity	IEC 60754-1 & 2 IEC 60684-2
Smoke density	IEC 61034-1 & 2
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60092-376
2 INSULATION	mica tape + S95 HF compound IEC 6092-360
3 FIREBAR® protection with COMMON SCREEN	• FLAMEBAR® fiberglass tapes • Cu/PE tape + tinned coper drain wire
4 INNER SHEATH	SHF1 or SHF2 acc. to outer sheath
5 ARMOUR	tinned copper wire braid
6 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour

grey (other colours on request)

Sheath marking

CCI FIREBAR® type RF 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A BS 7846:2000 Cat F3 meter marking year QA n°

- Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

FIRE & MECHANICAL SHOCKS

WATER SPRAY

WATER IMMESION

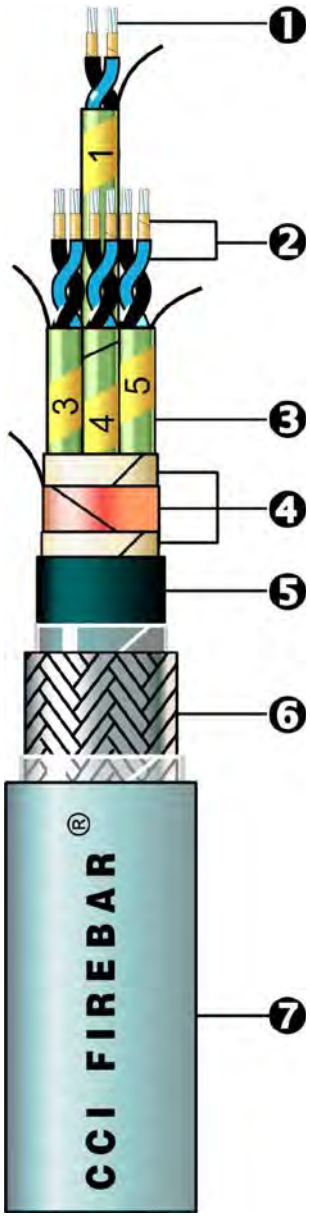
NOTE BS 7846 Cat F3 : 2000 - test parameters
> FIRE 830 (+40/-0)°C x 120 minutes @ 1 kV, while:
> MECHANICAL SHOCKS every 5 minutes hitting the frame with sample mounted in bent formation at Minim. Bending Radius
> WATER SPRAY 1 l/m² s⁻¹ (2,4 l/min) during last 15 minutes
Furthermore, not requested by any fire resistant standard:
WATER IMMERSION (15 min) of burned sample still powered

150 / 250 V

CONSTRUCTION						CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
						nominal	nominal	nominal	approx	approx
n		pair			[m m²]	[mm]	[mm]	[mm]	[mm]	[kg/km]
1	x	2	x		0,75	1,1	0,9	9,5	14	300
2	x	2	x		0,75	1,1	0,9	14,8	19	550
4	x	2	x		0,75	1,1	0,9	17,1	22	710
7	x	2	x		0,75	1,1	0,9	20,8	26	960
8	x	2	x		0,75	1,1	0,9	22,1	28	1.080
12	x	2	x		0,75	1,1	0,9	26,7	32	1.450
16	x	2	x		0,75	1,1	0,9	30,4	37	1.910
19	x	2	x		0,75	1,1	0,9	32,7	40	2.170
27	x	2	x		0,75	1,1	0,9	38,5	46	2.880
37	x	2	x		0,75	1,1	0,9	44,6	52	3.700
1	x	3	x		0,75	1,1	0,9	10,0	14	330
2	x	3	x		0,75	1,1	0,9	16,2	21	650
4	x	3	x		0,75	1,1	0,9	18,9	24	860
7	x	3	x		0,75	1,1	0,9	23,8	29	1.210
12	x	3	x		0,75	1,1	0,9	30,3	37	1.950
1	x	2	x		1	1,3	0,9	9,9	14	320
2	x	2	x		1	1,3	0,9	15,3	20	600
4	x	2	x		1	1,3	0,9	17,9	23	770
7	x	2	x		1	1,3	0,9	21,6	27	1.060
8	x	2	x		1	1,3	0,9	23,2	29	1.170
12	x	2	x		1	1,3	0,9	27,7	34	1.590
16	x	2	x		1	1,3	0,9	31,5	38	2.090
19	x	2	x		1	1,3	0,9	34,2	41	2.370
27	x	2	x		1	1,3	0,9	40,2	48	3.170
37	x	2	x		1	1,3	0,9	46,6	54	4.090
1	x	3	x		1	1,3	0,9	10,6	15	370
2	x	3	x		1	1,3	0,9	16,9	22	700
4	x	3	x		1	1,3	0,9	19,6	25	930
7	x	3	x		1	1,3	0,9	24,9	30	1.340
12	x	3	x		1	1,3	0,9	31,5	39	2.130
1	x	2	x		1,5	1,6	1,0	11,3	16	390
2	x	2	x		1,5	1,6	1,0	17,0	22	700
4	x	2	x		1,5	1,6	1,0	20,0	25	930
7	x	2	x		1,5	1,6	1,0	24,1	30	1.280
8	x	2	x		1,5	1,6	1,0	25,9	32	1.440
12	x	2	x		1,5	1,6	1,0	31,3	38	2.100
16	x	2	x		1,5	1,6	1,0	35,6	43	2.610
19	x	2	x		1,5	1,6	1,0	38,6	46	2.990
27	x	2	x		1,5	1,6	1,0	45,5	53	4.010
37	x	2	x		1,5	1,6	1,0	52,7	61	5.200
1	x	3	x		1,5	1.6	1,0	11,9	16	420
2	x	3	x		1,5	1.6	1,0	18,8	24	850
4	x	3	x		1,5	1.6	1,0	22,1	28	1.120
7	x	3	x		1,5	1.6	1,0	27,9	33	1.650
12	x	3	x		1,5	1.6	1,0	35,6	43	2.640

instrumentation 150/250 V
halogen free flame retardant
individual screen armoured
fire + mechanical shocks + water spray + water immersion resistant

Type approved
ABS - BV - LR ➡ FIREBAR® IEC (ic) 250 V
RINA ➡ FIREBAR® XAI(ic) 250 V



Design and construction	IEC 60092-376
Nominal voltage Uo/U	150/250 V
Max operating voltage Umax	300 V
Maximum rated temperature	95 °C according to IEC 60092-360
Flame retardancy	IEC 60332-1-2 IEC 60332-3-22 Cat A
Fire resistance	BS 7846 :2000 Cat F3 (see **NOTE**)
	IEC 60331-1 or 2 (see page 26)
Halogen content & corrosivity	IEC 60754-1 & 2 IEC 60684-2
Smoke density	IEC 61034-1 & 2
UV resistance	UL 1581 § 1200
Ozone resistance	IEC 60092-360
Cold Bend and Impact test (- 40° C)	CSA C 22.2 N° 0.3-09 & N° 38-18

Construction

1 CONDUCTOR	tinned annealed copper flexible Class 2 or Class 5 IEC 60092-376
2 INSULATION	mica tape + S95 HF compound IEC 6092-360
3 INDIVIDUAL SCREEN	Al/PE tape + tinned copper drain wire
4 FIREBAR® protection	• FLAMEBAR® fiberglass tapes • Cu/PE tape
5 INNER SHEATH	SHF1 or SHF2 acc. to outer sheath
6 ARMOUR	tinned copper wire braid
7 OUTER SHEATH	SHF1 or SHF2 compound IEC 60092-360

Cores identification

pair	black light blue
triple	black light blue brown
multi pairs/triples	progressive number printed on insulation or tape

Sheath colour

grey (other colours on request)

Sheath marking

CCI FIREBAR® type SF 150/250 V n x (pair/triple) x sect mm² IEC 60092-376
IEC 60332-3-22 Cat A BS 7846:2000 Cat F3 meter marking year QA n°

● Minimum Bending Radius: 4D (Overall Diameter) – see Generals section

FIRE & MECHANICAL SHOCKS

WATER SPRAY

WATER IMMERSION

NOTE BS 7846 Cat F3 : 2000 - test parameters
> FIRE 830 (+40/-0)°C x 120 minutes @ 1 kV, while:
> MECHANICAL SHOCKS every 5 minutes hitting the frame with sample mounted in bent formation at Minim. Bending Radius
> WATER SPRAY 1 l/m² s⁻¹ (2,4 l/min) during last 15 minutes
Furthermore, not requested by any fire resistant standard:
WATER IMMERSION (15 min) of burned sample still powered

150 / 250 V

CONSTRUCTION					CONDUCTOR DIAMETER	INSULATION THICKNESS	DIAMETER UNDER ARMOUR	OVERALL DIAMETER	WEIGHT
n		pair		[m m²]	nominal [mm]	nominal [mm]	nominal [mm]	approx [mm]	approx [kg/km]
2	x	2	x	0,75	1,1	0,9	14,6	19	570
4	x	2	x	0,75	1,1	0,9	17,1	22	750
7	x	2	x	0,75	1,1	0,9	20,6	26	1.020
8	x	2	x	0,75	1,1	0,9	22,1	28	1.150
12	x	2	x	0,75	1,1	0,9	26,4	33	1.640
16	x	2	x	0,75	1,1	0,9	30,2	37	2.060
19	x	2	x	0,75	1,1	0,9	32,5	40	2.330
27	x	2	x	0,75	1,1	0,9	38,2	46	3.080
37	x	2	x	0,75	1,1	0,9	44,3	52	3.990
2	x	3	x	0,75	1,1	0,9	16,2	21	660
4	x	3	x	0,75	1,1	0,9	18,9	24	890
7	x	3	x	0,75	1,1	0,9	23,7	29	1.270
12	x	3	x	0,75	1,1	0,9	30,1	37	2.040
2	x	2	x	1	1,3	0,9	15,3	20	610
4	x	2	x	1	1,3	0,9	18,1	23	830
7	x	2	x	1	1,3	0,9	21,8	27	1.150
8	x	2	x	1	1,3	0,9	23,2	29	1.260
12	x	2	x	1	1,3	0,9	27,9	35	1.850
16	x	2	x	1	1,3	0,9	31,8	39	2.310
19	x	2	x	1	1,3	0,9	34,4	42	2.600
27	x	2	x	1	1,3	0,9	40,4	48	3.500
37	x	2	x	1	1,3	0,9	46,8	55	4.530
2	x	3	x	1	1,3	0,9	16,9	22	730
4	x	3	x	1	1,3	0,9	19,8	25	970
7	x	3	x	1	1,3	0,9	25,1	31	1.420
12	x	3	x	1	1,3	0,9	31,7	39	2.290
2	x	2	x	1,5	1,6	1,0	17,5	23	750
4	x	2	x	1,5	1,6	1,0	20,6	26	1.010
7	x	2	x	1,5	1,6	1,0	24,9	30	1.400
8	x	2	x	1,5	1,6	1,0	26,7	32	1.580
12	x	2	x	1,5	1,6	1,0	32,2	39	2.300
16	x	2	x	1,5	1,6	1,0	36,6	44	2.890
19	x	2	x	1,5	1,6	1,0	36,6	44	2.890
27	x	2	x	1,5	1,6	1,0	46,9	55	4.450
37	x	2	x	1,5	1,6	1,0	54,4	63	5.780
2	x	3	x	1,5	1.6	1,0	19,4	25	910
4	x	3	x	1,5	1.6	1,0	22,8	28	1.200
7	x	3	x	1,5	1.6	1,0	28,7	35	1.790
12	x	3	x	1,5	1.6	1,0	36,6	44	2.900

Electrical data

Type P-PF power & control 0,6/1 kV

1 core

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	20°C	90°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
1 x	10	1,84	2,35	0,115	0,138	0,207	367	1,84	1,85	2,35	2,35	69	1,43
1 x	16	1,16	1,48	0,112	0,134	0,249	356	1,17	1,17	1,48	1,49	92	2,29
1 x	25	0,734	0,933	0,112	0,134	0,286	356	0,74	0,75	0,94	0,95	123	3,58
1 x	35	0,529	0,675	0,107	0,128	0,320	340	0,54	0,54	0,68	0,69	153	5,01
1 x	50	0,391	0,499	0,104	0,125	0,345	332	0,40	0,41	0,51	0,51	188	7,15
1 x	70	0,270	0,344	0,100	0,120	0,398	317	0,29	0,30	0,36	0,36	243	10,0
1 x	95	0,195	0,249	0,095	0,115	0,453	304	0,22	0,23	0,27	0,27	298	13,6
1 x	120	0,154	0,196	0,094	0,113	0,489	300	0,18	0,19	0,22	0,23	348	17,2
1 x	150	0,126	0,161	0,093	0,112	0,527	296	0,16	0,17	0,19	0,20	404	21,5
1 x	185	0,100	0,128	0,092	0,111	0,579	294	0,14	0,15	0,16	0,17	464	26,5
1 x	240	0,0762	0,0972	0,088	0,106	0,647	280	0,12	0,13	0,13	0,14	552	34,3
1 x	300	0,0607	0,0774	0,087	0,105	0,719	278	0,11	0,12	0,12	0,13	640	42,9

2 cores

2 x	1,5	12,2	15,6	0,099	0,119	0,150	314	12,2	12,2	15,6	15,6	23	0,21
2 x	2,5	7,56	9,64	0,093	0,111	0,168	295	7,56	7,56	9,64	9,64	31	0,36
2 x	4	4,70	5,99	0,085	0,102	0,200	270	4,70	4,70	6,00	6,00	43	0,57
2 x	6	3,11	3,97	0,081	0,098	0,216	259	3,11	3,11	3,97	3,97	55	0,86
2 x	10	1,83	2,32	0,078	0,093	0,240	247	1,84	1,84	2,35	2,35	75	1,43
2 x	16	1,15	1,45	0,074	0,089	0,266	236	1,16	1,16	1,48	1,48	100	2,29

3 cores

3 x	1,5	12,2	15,6	0,099	0,119	0,150	314	12,2	12,2	15,6	15,6	20	0,21
3 x	2,5	7,56	9,64	0,093	0,111	0,168	295	7,56	7,56	9,64	9,64	28	0,36
3 x	4	4,70	5,99	0,085	0,102	0,200	270	4,70	4,70	6,00	6,00	37	0,57
3 x	6	3,11	3,97	0,081	0,098	0,216	259	3,11	3,11	3,97	3,97	47	0,86
3 x	10	1,83	2,32	0,078	0,093	0,240	247	1,84	1,84	2,35	2,35	65	1,43
3 x	16	1,15	1,45	0,074	0,089	0,266	236	1,16	1,16	1,48	1,48	87	2,29
3 x	25	0,734	0,933	0,075	0,090	0,263	238	0,74	0,74	0,94	0,94	110	3,58
3 x	35	0,529	0,675	0,073	0,087	0,279	232	0,53	0,54	0,68	0,68	137	5,01
3 x	50	0,391	0,499	0,073	0,087	0,279	232	0,40	0,40	0,50	0,51	167	7,15
3 x	70	0,270	0,344	0,072	0,086	0,289	228	0,28	0,28	0,35	0,35	214	10,0
3 x	95	0,195	0,249	0,070	0,084	0,308	223	0,21	0,21	0,26	0,26	259	13,6
3 x	120	0,154	0,196	0,070	0,084	0,310	222	0,17	0,18	0,21	0,21	301	17,2
3 x	150	0,126	0,161	0,070	0,084	0,305	224	0,14	0,15	0,18	0,18	347	21,5
3 x	185	0,100	0,128	0,070	0,084	0,303	224	0,12	0,13	0,15	0,15	397	26,5
3 x	240	0,0762	0,0972	0,070	0,084	0,312	222	0,10	0,11	0,12	0,13	468	34,3
3 x	300	0,0607	0,0774	0,069	0,083	0,321	219	0,09	0,10	0,10	0,11	540	42,9

4 cores

4 x	1,5	12,2	15,6	0,106	0,127	0,133	337	12,2	12,2	15,6	15,6	20	0,21
4 x	2,5	7,56	9,64	0,100	0,120	0,147	317	7,56	7,56	9,64	9,64	28	0,36
4 x	4	4,70	5,99	0,092	0,110	0,171	292	4,70	4,70	6,00	6,00	37	0,57
4 x	6	3,11	3,97	0,089	0,106	0,183	282	3,11	3,11	3,97	3,97	47	0,86
4 x	10	1,83	2,32	0,085	0,102	0,199	270	1,84	1,84	2,35	2,35	65	1,43
4 x	16	1,15	1,45	0,081	0,098	0,217	259	1,16	1,16	1,48	1,48	87	2,29
4 x	25	0,734	0,933	0,082	0,098	0,215	260	0,74	0,74	0,94	0,94	110	3,58
4 x	35	0,529	0,675	0,080	0,096	0,226	254	0,53	0,54	0,68	0,68	137	5,01
4 x	50	0,391	0,499	0,080	0,096	0,225	254	0,40	0,40	0,51	0,51	167	7,15
4 x	70	0,270	0,344	0,079	0,095	0,232	251	0,28	0,29	0,35	0,36	214	10,0
4 x	95	0,195	0,249	0,077	0,093	0,244	245	0,21	0,22	0,26	0,27	259	13,6
4 x	120	0,154	0,196	0,077	0,092	0,246	245	0,17	0,18	0,21	0,22	301	17,2
4 x	150	0,126	0,161	0,077	0,093	0,242	246	0,15	0,16	0,18	0,19	347	21,5
4 x	185	0,100	0,128	0,078	0,093	0,241	247	0,13	0,14	0,15	0,16	397	26,5
4 x	240	0,0762	0,0972	0,077	0,092	0,247	244	0,11	0,12	0,12	0,13	468	34,3
4 x	300	0,0607	0,0774	0,076	0,091	0,252	242	0,10	0,11	0,11	0,12	540	42,9

Type P-PF power & control 0,6/1 kV

multicore

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE	INDUCTANCE	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	20°C	90°C	50 Hz	60 Hz	[µFarad/km] nominal	[µHenry/km] nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
5 x	1,5	12,2	15,6	0,109	0,130	0,127	346	12,2	12,2	15,6	15,6	12	0,21
7 x	1,5	12,2	15,6	0,142	0,171	0,084	453	12,2	12,2	15,6	15,6	11	0,21
12 x	1,5	12,2	15,6	0,142	0,171	0,065	545	12,2	12,2	15,6	15,6	9	0,21
19 x	1,5	12,2	15,6	0,171	0,205	0,059	592	12,2	12,2	15,6	15,6	8	0,21
27 x	1,5	12,2	15,6	0,186	0,223	0,053	642	12,2	12,2	15,6	15,6	7	0,21
37 x	1,5	12,2	15,6	0,202	0,242	0,050	673	12,2	12,2	15,6	15,6	6	0,21
5 x	2,5	7,56	9,64	0,102	0,123	0,140	326	7,56	7,56	9,64	9,64	17	0,36
7 x	2,5	7,56	9,64	0,136	0,163	0,090	433	7,56	7,56	9,64	9,64	15	0,36
12 x	2,5	7,56	9,64	0,165	0,198	0,069	525	7,56	7,56	9,64	9,64	12	0,36
19 x	2,5	7,41	9,64	0,180	0,216	0,061	572	7,56	7,56	9,64	9,64	11	0,36
27 x	2,5	7,41	9,64	0,196	0,235	0,055	623	7,56	7,56	9,64	9,64	10	0,36
37 x	2,5	7,41	9,64	0,205	0,246	0,052	653	7,56	7,56	9,64	9,64	9	0,36

*) Maximum current rate based on 90°C conductor temperature and 45°C ambient temperature IEC 60092-352 – see Generals section

Type P VFD EMC

1,8/3 kV

CONSTRUCTION CONDUCTORS		CONSTRUCTION EARTH		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	n	[mm²]	20°C	90°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
3 x	10	3 x	2,5	1,83	2,33	0,102	0,122	0,141	325	1,84	1,84	2,35	2,35	65	1,43
3 x	16	3 x	4	1,15	1,47	0,095	0,114	0,160	303	1,16	1,17	1,48	1,48	87	2,29
3 x	25	3 x	4	0,727	0,927	0,089	0,107	0,180	285	0,74	0,74	0,94	0,94	110	3,58
3 x	35	3 x	6	0,524	0,668	0,086	0,103	0,193	274	0,54	0,54	0,68	0,68	137	5,01
3 x	50	3 x	10	0,387	0,494	0,084	0,101	0,203	267	0,40	0,40	0,51	0,51	167	7,15
3 x	70	3 x	16	0,268	0,342	0,080	0,096	0,223	256	0,28	0,29	0,35	0,36	214	10,0
3 x	95	3 x	16	0,193	0,246	0,078	0,093	0,241	247	0,21	0,22	0,26	0,27	259	13,6
3 x	120	3 x	25	0,153	0,195	0,076	0,091	0,253	242	0,17	0,18	0,21	0,22	301	17,2
3 x	150	3 x	25	0,124	0,158	0,074	0,089	0,264	237	0,15	0,15	0,18	0,18	347	21,5
3 x	185	3 x	35	0,0991	0,1264	0,073	0,087	0,278	232	0,12	0,13	0,15	0,16	397	26,5

(*) Maximum current rate based on 90°C conductor temperature and 45°C ambient temperature IEC 60092-352 – see Generals section

3,6/6 kV

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	20°C	90°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
1 x	25	0,734	0,936	0,123	0,148	0,289	391	0,74	0,75	0,94	0,95	117	3,58
1 x	35	0,529	0,675	0,117	0,140	0,317	371	0,54	0,55	0,68	0,69	145	5,01
1 x	50	0,391	0,499	0,112	0,134	0,343	357	0,41	0,41	0,51	0,52	179	7,15
1 x	70	0,270	0,344	0,106	0,127	0,388	337	0,29	0,30	0,36	0,37	231	10,0
1 x	95	0,195	0,249	0,100	0,120	0,438	318	0,22	0,23	0,27	0,28	283	13,6
1 x	120	0,154	0,196	0,097	0,117	0,477	309	0,18	0,19	0,22	0,23	331	17,2
1 x	150	0,126	0,161	0,093	0,111	0,516	296	0,16	0,17	0,19	0,20	384	21,5
1 x	185	0,100	0,128	0,091	0,109	0,569	289	0,14	0,15	0,16	0,17	441	26,5
1 x	240	0,0762	0,0972	0,087	0,105	0,617	277	0,12	0,13	0,13	0,14	524	34,3
1 x	300	0,0607	0,0774	0,083	0,100	0,647	265	0,10	0,12	0,11	0,13	608	42,9
3 x	25	0,734	0,936	0,111	0,134	0,289	355	0,74	0,75	0,94	0,95	105	3,58
3 x	35	0,529	0,675	0,106	0,128	0,317	339	0,54	0,54	0,68	0,69	130	5,01
3 x	50	0,391	0,499	0,103	0,123	0,343	327	0,40	0,41	0,51	0,51	159	7,15
3 x	70	0,270	0,344	0,098	0,117	0,388	311	0,29	0,29	0,36	0,36	203	10,0
3 x	95	0,195	0,249	0,093	0,112	0,438	296	0,22	0,22	0,27	0,27	246	13,6
3 x	120	0,154	0,196	0,090	0,108	0,477	287	0,18	0,19	0,22	0,22	286	17,2
3 x	150	0,126	0,161	0,088	0,105	0,516	280	0,15	0,16	0,18	0,19	330	21,5
3 x	185	0,100	0,128	0,085	0,102	0,569	271	0,13	0,14	0,15	0,16	377	26,5
3 x	240	0,0762	0,0972	0,083	0,099	0,617	263	0,11	0,13	0,13	0,14	445	34,3
3 x	300	0,0607	0,0774	0,081	0,097	0,647	258	0,10	0,11	0,11	0,12	513	42,9

6/10 kV

1 x	25	0,734	0,936	0,126	0,151	0,228	400	0,74	0,75	0,94	0,95	117	3,58
1 x	35	0,529	0,675	0,124	0,149	0,249	395	0,54	0,55	0,69	0,69	145	5,01
1 x	50	0,391	0,499	0,117	0,140	0,268	372	0,41	0,42	0,51	0,52	179	7,15
1 x	70	0,270	0,344	0,110	0,133	0,301	352	0,29	0,30	0,36	0,37	231	10,0
1 x	95	0,195	0,249	0,104	0,125	0,338	332	0,22	0,23	0,27	0,28	283	13,6
1 x	120	0,154	0,196	0,101	0,121	0,367	322	0,18	0,20	0,22	0,23	331	17,2
1 x	150	0,126	0,161	0,097	0,116	0,396	308	0,16	0,17	0,19	0,20	384	21,5
1 x	185	0,100	0,128	0,094	0,113	0,435	300	0,14	0,15	0,16	0,17	441	26,5
1 x	240	0,0762	0,0972	0,090	0,108	0,487	288	0,12	0,13	0,13	0,15	524	34,3
1 x	300	0,0607	0,0774	0,086	0,103	0,544	274	0,11	0,12	0,12	0,13	608	42,9
3 x	25	0,734	0,936	0,119	0,142	0,228	377	0,74	0,75	0,94	0,95	105	3,58
3 x	35	0,529	0,675	0,113	0,136	0,249	360	0,54	0,55	0,68	0,69	130	5,01
3 x	50	0,391	0,499	0,109	0,131	0,268	348	0,41	0,41	0,51	0,52	159	7,15
3 x	70	0,270	0,344	0,103	0,124	0,301	329	0,29	0,30	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,098	0,118	0,338	313	0,22	0,23	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,095	0,114	0,367	303	0,18	0,19	0,22	0,23	286	17,2
3 x	150	0,126	0,161	0,093	0,111	0,396	295	0,16	0,17	0,19	0,20	330	21,5
3 x	185	0,100	0,128	0,090	0,107	0,435	285	0,13	0,15	0,16	0,17	377	26,5
3 x	240	0,0762	0,0972	0,086	0,104	0,487	275	0,12	0,13	0,13	0,14	445	34,3
3 x	300	0,0762	0,0972	0,083	0,100	0,544	265	0,10	0,12	0,11	0,13	513	42,9

8,7/15 kV

1 x	25	0,734	0,936	0,135	0,162	0,186	431	0,75	0,75	0,95	0,95	117	3,58
1 x	35	0,529	0,675	0,129	0,154	0,202	409	0,54	0,55	0,69	0,69	145	5,01
1 x	50	0,391	0,499	0,124	0,148	0,216	393	0,41	0,42	0,51	0,52	179	7,15
1 x	70	0,270	0,344	0,115	0,138	0,242	365	0,29	0,30	0,36	0,37	231	10,0
1 x	95	0,195	0,249	0,110	0,132	0,270	350	0,22	0,24	0,27	0,28	283	13,6
1 x	120	0,154	0,196	0,105	0,126	0,292	334	0,19	0,20	0,22	0,23	331	17,2
1 x	150	0,126	0,161	0,102	0,122	0,314	325	0,16	0,18	0,19	0,20	384	21,5
1 x	185	0,100	0,128	0,098	0,117	0,344	311	0,14	0,15	0,16	0,17	441	26,5
1 x	240	0,0762	0,0972	0,093	0,112	0,383	297	0,12	0,14	0,13	0,15	524	34,3
1 x	300	0,0607	0,0774	0,090	0,109	0,427	288	0,11	0,12	0,12	0,13	608	42,9
3 x	25	0,734	0,936	0,126	0,152	0,186	402	0,74	0,75	0,94	0,95	105	3,58
3 x	35	0,529	0,675	0,121	0,145	0,202	384	0,54	0,55	0,69	0,69	130	5,01
3 x	50	0,391	0,499	0,116	0,139	0,216	370	0,41	0,42	0,51	0,52	159	7,15
3 x	70	0,270	0,344	0,110	0,132	0,242	350	0,29	0,30	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,104	0,125	0,270	332	0,22	0,23	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,101	0,121	0,292	321	0,18	0,20	0,22	0,23	286	17,2
3 x	150	0,126	0,161	0,098	0,117	0,314	312	0,16	0,17	0,19	0,20	330	21,5
3 x	185	0,100	0,128	0,094	0,113	0,344	301	0,14	0,15	0,16	0,17	377	26,5
3 x	240	0,0762	0,0972	0,091	0,109	0,383	289	0,12	0,13	0,13	0,15	445	34,3

12/20 kV

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT(*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	20°C	90°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
1 x	35	0,529	0,675	0,133	0,159	0,175	422	0,55	0,55	0,69	0,69	145	5,01
1 x	50	0,391	0,499	0,128	0,153	0,187	406	0,54	0,55	0,69	0,69	179	7,15
1 x	70	0,270	0,344	0,120	0,145	0,208	383	0,41	0,42	0,51	0,52	231	10,0
1 x	95	0,195	0,249	0,114	0,136	0,232	362	0,29	0,30	0,36	0,37	283	13,6
1 x	120	0,154	0,196	0,110	0,132	0,250	350	0,22	0,24	0,27	0,28	331	17,2
1 x	150	0,126	0,161	0,107	0,128	0,268	340	0,19	0,20	0,22	0,23	384	21,5
1 x	185	0,100	0,128	0,102	0,123	0,293	325	0,16	0,18	0,19	0,20	441	26,5
1 x	240	0,0762	0,0972	0,098	0,117	0,325	311	0,14	0,15	0,16	0,17	524	34,3
1 x	300	0,0607	0,0774	0,093	0,112	0,360	296	0,12	0,14	0,13	0,15	608	42,9
3 x	35	0,529	0,675	0,127	0,152	0,175	403	0,54	0,55	0,69	0,69	130	5,01
3 x	50	0,391	0,499	0,122	0,146	0,187	388	0,41	0,42	0,51	0,52	159	7,15
3 x	70	0,270	0,344	0,115	0,138	0,208	367	0,29	0,30	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,109	0,131	0,232	348	0,22	0,24	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,106	0,127	0,250	336	0,19	0,20	0,22	0,23	286	17,2
3 x	150	0,126	0,161	0,102	0,123	0,268	326	0,16	0,18	0,19	0,20	330	21,5
3 x	185	0,100	0,128	0,099	0,118	0,293	314	0,16	0,17	0,19	0,20	377	26,5

18/30 kV

1 x	50	0,391	0,499	0,138	0,166	0,145	441	0,41	0,42	0,52	0,53	179	7,15
1 x	70	0,270	0,344	0,131	0,157	0,160	416	0,30	0,31	0,37	0,38	231	10,0
1 x	95	0,195	0,249	0,123	0,148	0,177	393	0,23	0,24	0,28	0,29	283	13,6
1 x	120	0,154	0,196	0,118	0,141	0,190	375	0,19	0,21	0,23	0,24	331	17,2
1 x	150	0,126	0,161	0,114	0,137	0,202	364	0,17	0,19	0,20	0,21	384	21,5
1 x	185	0,100	0,128	0,111	0,133	0,219	352	0,15	0,17	0,17	0,18	441	26,5
1 x	240	0,0762	0,0972	0,104	0,125	0,242	332	0,13	0,15	0,14	0,16	524	34,3
1 x	300	0,0607	0,0774	0,099	0,119	0,267	316	0,12	0,13	0,13	0,14	608	42,9
3 x	50	0,391	0,499	0,134	0,161	0,145	428	0,41	0,42	0,52	0,52	159	7,15
3 x	70	0,270	0,344	0,127	0,152	0,160	404	0,30	0,31	0,37	0,38	203	10,0
3 x	95	0,195	0,249	0,120	0,144	0,177	383	0,23	0,24	0,28	0,29	246	13,6
3 x	120	0,154	0,196	0,116	0,139	0,190	369	0,19	0,21	0,23	0,24	286	17,2
3 x	150	0,126	0,161	0,112	0,135	0,202	358	0,17	0,18	0,20	0,21	330	21,5

(*) Maximum current rate based on 90°C conductor temperature and 45°C ambient temperature IEC 60092-352 – see Generals section

CONSTRUCTION				MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE @ 50 & 60 Hz [Ω/km]		L/R ratio @ 1 kHz [µHenry/Ω]
	n		[mm²]	20°C	90°C	50 Hz	60 Hz	max.	nominal	20°C	90°C	max.
pair	2	x	0,75	26,3	33,5	0,100	0,120	0,080	318	26,3	33,5	12,1
	2	x	1	19,3	24,6	0,095	0,114	0085	303	19,3	24,6	15,7
	2	x	1,5	12,9	16,5	0,095	0,113	0,090	301	12,9	16,5	23,3
triple	3	x	0,75	26,3	33,5	0,100	0,120	0,080	318	26,3	33,5	12,1
	3	x	1	19,3	24,6	0,095	0,114	0,085	303	19,3	24,6	15,7
	3	x	1,5	12,9	16,5	0,094	0,113	0,090	301	12,9	16,5	23,3

1 core

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 95°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 95°C/350°C
n	[mm²]	20°C	95°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
1 x	10	1,84	2,38	0,136	0,164	0,161	434	1,85	1,85	2,39	2,39	72	171
1 x	16	1,16	1,50	0,126	0,151	0,180	401	1,17	1,17	1,51	1,51	97	2,74
1 x	25	0,734	0,951	0,120	0,144	0,186	381	0,74	0,75	0,96	0,96	128	4,28
1 x	35	0,529	0,685	0,114	0,137	0,201	364	0,54	0,55	0,69	0,70	160	5,99
1 x	50	0,391	0,506	0,112	0,134	0,219	355	0,41	0,41	0,52	0,52	197	8,55
1 x	70	0,270	0,350	0,106	0,127	0,227	337	0,29	0,30	0,37	0,37	254	12,0
1 x	95	0,195	0,253	0,104	0,125	0,240	331	0,22	0,23	0,27	0,28	311	16,2
1 x	120	0,154	0,199	0,102	0,122	0,247	324	0,18	0,20	0,22	0,23	364	20,5
1 x	150	0,126	0,163	0,100	0,120	0,253	319	0,16	0,17	0,19	0,20	422	25,7
1 x	185	0,100	0,130	0,097	0,116	0,262	308	0,14	0,15	0,16	0,17	485	31,6
1 x	240	0,0762	0,0987	0,096	0,115	0,268	305	0,12	0,14	0,14	0,15	577	41,0
1 x	300	0,0607	0,0786	0,094	0,113	0,280	300	0,11	0,13	0,12	0,14	670	51,3

2 cores

2 x	1,5	12,2	15,8	0,110	0,132	0,160	351	12,2	12,2	15,8	15,8	24	0,26
2 x	2,5	7,56	9,79	0,103	0,123	0,180	327	7,56	7,56	9,79	9,79	33	0,43
2 x	4	4,70	6,09	0,095	0,114	0,207	303	4,70	4,70	6,09	6,09	45	0,68
2 x	6	3,11	4,03	0,090	0,108	0,230	286	3,11	3,11	4,03	4,03	57	1,03
2 x	10	1,84	2,38	0,084	0,101	0,261	268	1,84	1,84	2,38	2,39	78	1,71
2 x	16	1,16	1,50	0,080	0,096	0,293	254	1,16	1,16	1,50	1,51	105	2,74

3 cores

3 x	1,5	12,2	15,8	0,110	0,132	0,160	351	12,2	12,2	15,8	15,8	21	0,26
3 x	2,5	7,56	9,79	0,103	0,123	0,180	327	7,56	7,56	9,79	9,79	29	0,43
3 x	4	4,70	6,09	0,095	0,114	0,207	303	4,70	4,70	6,09	6,09	38	0,68
3 x	6	3,11	4,03	0,090	0,108	0,230	286	3,11	3,11	4,03	4,03	49	1,03
3 x	10	1,84	2,38	0,084	0,101	0,261	268	1,84	1,84	2,38	2,39	68	1,71
3 x	16	1,16	1,50	0,080	0,096	0,293	254	1,16	1,16	1,50	1,51	91	2,74
3 x	25	0,734	0,951	0,079	0,095	0,299	251	0,74	0,74	0,95	0,96	116	4,28
3 x	35	0,529	0,685	0,077	0,092	0,319	244	0,53	0,54	0,69	0,69	144	5,99
3 x	50	0,391	0,506	0,077	0,092	0,318	244	0,40	0,40	0,51	0,51	175	8,55
3 x	70	0,270	0,350	0,075	0,090	0,338	238	0,28	0,28	0,36	0,36	224	12,0
3 x	95	0,195	0,253	0,074	0,089	0,343	237	0,21	0,21	0,26	0,27	271	16,2
3 x	120	0,154	0,199	0,073	0,087	0,359	232	0,17	0,18	0,21	0,22	315	20,5
3 x	150	0,126	0,163	0,073	0,088	0,357	233	0,15	0,15	0,18	0,19	363	25,7
3 x	185	0,100	0,130	0,073	0,087	0,359	232	0,12	0,13	0,15	0,16	415	31,6
3 x	240	0,0762	0,0987	0,072	0,087	0,366	230	0,11	0,12	0,12	0,13	490	41,0
3 x	300	0,0607	0,0786	0,072	0,086	0,373	228	0,09	0,11	0,11	0,12	565	51,3

4 cores

4 x	1,5	12,2	15,8	0,117	0,141	0,145	373	12,2	12,2	15,8	15,8	21	0,26
4 x	2,5	7,56	9,79	0,110	0,132	0,161	350	7,56	7,56	9,79	9,79	29	0,43
4 x	4	4,70	6,09	0,102	0,123	0,182	325	4,70	4,70	6,09	6,09	38	0,68
4 x	6	3,11	4,03	0,097	0,116	0,200	308	3,11	3,11	4,03	4,03	49	1,03
4 x	10	1,84	2,38	0,091	0,110	0,223	291	1,84	1,84	2,39	2,39	68	1,71
4 x	16	1,16	1,50	0,087	0,104	0,246	276	1,16	1,16	1,51	1,51	91	2,74
4 x	25	0,734	0,951	0,086	0,103	0,250	274	0,74	0,74	0,95	0,96	116	4,28
4 x	35	0,529	0,685	0,084	0,101	0,264	267	0,54	0,54	0,69	0,69	144	5,99
4 x	50	0,391	0,506	0,084	0,101	0,263	267	0,40	0,40	0,51	0,52	175	8,55
4 x	70	0,270	0,350	0,082	0,098	0,277	261	0,28	0,29	0,36	0,36	224	12,0
4 x	95	0,195	0,253	0,081	0,098	0,280	259	0,21	0,22	0,27	0,27	271	16,2
4 x	120	0,154	0,199	0,080	0,096	0,291	255	0,17	0,18	0,21	0,22	315	20,5
4 x	150	0,126	0,163	0,080	0,096	0,289	255	0,15	0,16	0,18	0,19	363	25,7
4 x	185	0,100	0,130	0,080	0,096	0,291	255	0,13	0,14	0,15	0,16	415	31,6
4 x	240	0,0762	0,0987	0,079	0,095	0,295	253	0,11	0,12	0,13	0,14	490	41,0
4 x	300	0,0607	0,0786	0,079	0,095	0,300	251	0,10	0,11	0,11	0,12	565	51,3

multicore

CONSTRUCTION			MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 95°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 95°C/350°C
n		[mm²]	20°C	95°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
5	**x**	**1,5**	12,2	15,8	0,120	0,144	0,140	382	12,2	12,2	15,8	15,8	13	0,26
7	**x**	**1,5**	12,2	15,8	0,154	0,184	0,097	489	12,2	12,2	15,8	15,8	12	0,26
12	**x**	**1,5**	12,2	15,8	0,182	0,219	0,077	581	12,2	12,2	15,8	15,8	10	0,26
19	**x**	**1,5**	12,2	15,8	0,197	0,237	0,070	628	12,2	12,2	15,8	15,8	10	0,26
27	**x**	**1,5**	12,2	15,8	0,213	0,256	0,063	679	12,2	12,2	15,8	15,8	9	0,26
37	**x**	**1,5**	12,2	15,8	0,223	0,267	0,060	709	12,2	12,2	15,8	15,8	7	0,26
5	**x**	**2,5**	7,56	9,79	0,113	0,135	0,155	359	7,56	7,56	9,79	9,79	18	0,43
7	**x**	**2,5**	7,56	9,79	0,146	0,176	0,104	466	7,56	7,56	9,79	9,79	16	0,43
12	**x**	**2,5**	7,56	9,79	0,175	0,210	0,082	557	7,56	7,56	9,79	9,79	13	0,43
19	**x**	**2,5**	7,56	9,79	0,204	0,245	0,074	649	7,56	7,56	9,79	9,80	12	0,43
27	**x**	**2,5**	7,56	9,79	0,206	0,247	0,066	655	7,56	7,56	9,79	9,80	11	0,43
37	**x**	**2,5**	7,56	9,79	0,215	0,258	0,063	686	7,56	7,56	9,80	9,80	9	0,43

(*) Maximum current rate based on 95°C conductor temperature and 45°C ambient temperature IEC 60092-352 – see Generals section

3,6/6 kV

CONSTRUCTION		MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE 20°C [Ω/km]		IMPEDANCE 90°C [Ω/km]		MAXIMUM CURRENT (*) in free air	SHORT CIRCUIT 1 sec @ 90°C/250°C
n	[mm²]	20°C	90°C	50 Hz	60 Hz	nominal	nominal	50 Hz	60 Hz	50 Hz	60 Hz	[A]	[kA]
1 x	50	0,391	0,499	0,160	0,192	0,243	508	0,42	0,44	0,52	0,53	179	7,15
1 x	70	0,270	0,344	0,151	0,181	0,273	480	0,31	0,33	0,38	0,39	231	10,0
1 x	95	0,195	0,249	0,142	0,170	0,304	452	0,24	0,26	0,29	0,30	283	13,6
1 x	120	0,154	0,196	0,138	0,165	0,329	438	0,21	0,23	0,24	0,26	331	17,2
1 x	150	0,126	0,161	0,133	0,159	0,353	422	0,18	0,20	0,21	0,23	384	21,5
1 x	185	0,100	0,128	0,129	0,155	0,386	410	0,16	0,18	0,18	0,20	441	26,5
1 x	240	0,0762	0,0972	0,123	0,147	0,429	390	0,14	0,17	0,16	0,18	524	34,3
1 x	300	0,0607	0,0774	0,119	0,142	0,477	377	0,13	0,15	0,14	0,16	608	42,9
3 x	50	0,391	0,499	0,117	0,140	0,243	371	0,41	0,42	0,51	0,52	159	7,15
3 x	70	0,270	0,344	0,110	0,132	0,273	350	0,29	0,30	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,104	0,125	0,304	332	0,22	0,23	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,101	0,121	0,329	321	0,18	0,20	0,22	0,23	286	17,2
3 x	150	0,126	0,161	0,098	0,117	0,353	312	0,16	0,17	0,19	0,20	330	21,5
3 x	185	0,100	0,128	0,094	0,113	0,386	301	0,14	0,15	0,16	0,17	377	26,5
3 x	240	0,0762	0,0972	0,091	0,109	0,429	289	0,12	0,13	0,13	0,15	445	34,3

6/10 kV

1 x	50	0,391	0,499	0,163	0,195	0,210	518	0,42	0,44	0,52	0,54	179	7,15
1 x	70	0,270	0,344	0,154	0,185	0,234	489	0,31	0,33	0,38	0,39	231	10,0
1 x	95	0,195	0,249	0,146	0,175	0,260	465	0,24	0,26	0,29	0,30	283	13,6
1 x	120	0,154	0,196	0,140	0,168	0,281	447	0,21	0,23	0,24	0,26	331	17,2
1 x	150	0,126	0,161	0,137	0,164	0,301	435	0,19	0,21	0,21	0,23	384	21,5
1 x	185	0,100	0,128	0,131	0,158	0,328	418	0,17	0,19	0,18	0,20	441	26,5
1 x	240	0,0762	0,0972	0,126	0,151	0,363	401	0,15	0,17	0,16	0,18	524	34,3
1 x	300	0,0607	0,0774	0,121	0,145	0,403	384	0,14	0,16	0,14	0,16	608	42,9
3 x	50	0,391	0,499	0,122	0,146	0,210	388	0,41	0,42	0,51	0,52	159	7,15
3 x	70	0,270	0,344	0,115	0,138	0,234	365	0,29	0,30	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,109	0,131	0,260	347	0,22	0,23	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,105	0,126	0,281	335	0,19	0,20	0,22	0,23	286	17,2
3 x	150	0,126	0,161	0,102	0,122	0,301	325	0,16	0,18	0,19	0,20	330	21,5
3 x	185	0,100	0,128	0,098	0,118	0,328	313	0,14	0,15	0,16	0,17	377	26,5

8,7/15 kV

1 x	50	0,391	0,499	0,165	0,199	0,182	527	0,42	0,44	0,53	0,54	179	7,15
1 x	70	0,270	0,344	0,156	0,188	0,202	498	0,31	0,33	0,38	0,39	231	10,0
1 x	95	0,195	0,249	0,149	0,178	0,224	473	0,25	0,26	0,29	0,31	283	13,6
1 x	120	0,154	0,196	0,144	0,173	0,241	459	0,21	0,23	0,24	0,26	331	17,2
1 x	150	0,126	0,161	0,139	0,167	0,257	443	0,19	0,21	0,21	0,23	384	21,5
1 x	185	0,100	0,128	0,134	0,161	0,280	426	0,17	0,19	0,19	0,21	441	26,5
1 x	240	0,0762	0,0972	0,128	0,154	0,309	408	0,15	0,17	0,16	0,18	524	34,3
1 x	300	0,0607	0,0774	0,123	0,147	0,342	391	0,14	0,16	0,15	0,17	608	42,9
3 x	50	0,391	0,499	0,128	0,153	0,182	407	0,41	0,42	0,52	0,52	159	7,15
3 x	70	0,270	0,344	0,120	0,144	0,202	383	0,30	0,31	0,36	0,37	203	10,0
3 x	95	0,195	0,249	0,114	0,137	0,224	363	0,23	0,24	0,27	0,28	246	13,6
3 x	120	0,154	0,196	0,110	0,132	0,241	350	0,19	0,20	0,22	0,24	286	17,2
3 x	150	0,126	0,161	0,107	0,128	0,257	339	0,17	0,18	0,19	0,21	330	21,5
3 x	185	0,100	0,128	0,103	0,123	0,277	327	0,14	0,16	0,16	0,18	377	26,5

12/20 kV

1 x	50	0,391	0,499	0,170	0,203	0,164	540	0,43	0,44	0,53	0,54	179	7,15
1 x	70	0,270	0,344	0,159	0,191	0,182	506	0,31	0,33	0,38	0,39	231	10,0
1 x	95	0,195	0,249	0,151	0,181	0,200	481	0,25	0,27	0,29	0,31	283	13,6
1 x	120	0,154	0,196	0,147	0,176	0,215	467	0,21	0,23	0,24	0,26	331	17,2
1 x	150	0,126	0,161	0,141	0,170	0,229	450	0,19	0,21	0,21	0,23	384	21,5
1 x	185	0,100	0,128	0,136	0,163	0,248	433	0,17	0,19	0,19	0,21	441	26,5
1 x	240	0,0762	0,0972	0,130	0,157	0,274	415	0,15	0,17	0,16	0,18	524	34,3
1 x	300	0,0607	0,0774	0,125	0,150	0,302	398	0,14	0,16	0,15	0,17	608	42,9
3 x	50	0,391	0,499	0,133	0,159	0,164	422	0,41	0,42	0,52	0,52	159	7,30
3 x	70	0,270	0,344	0,125	0,150	0,182	397	0,30	0,31	0,37	0,38	203	10,2
3 x	95	0,195	0,249	0,118	0,142	0,200	377	0,23	0,24	0,28	0,29	246	13,9
3 x	120	0,154	0,196	0,114	0,137	0,215	363	0,19	0,21	0,23	0,24	286	17,5
3 x	150	0,126	0,161	0,110	0,133	0,229	352	0,17	0,18	0,20	0,21	330	21,9

(*) Maximum current rate based on 90°C conductor temperature and 45°C ambient temperature IEC 60092-352 – see Generals section

CONSTRUCTION				MAX. CONDUCTOR RESISTANCE [Ω/km]		REACTANCE [Ω/km]		CAPACITANCE [µFarad/km]	INDUCTANCE [µHenry/km]	IMPEDANCE @ 50 & 60 Hz [Ω/km]		L/R ratio @ 1 kHz [µHenry/Ω]
	n		[mm²]	20°C	95°C	50 Hz	60 Hz	max.	nominal	20°C	95°C	max.
pair	2	x	0,75	26,3	34,1	0,120	0,144	0,120	383	26,3	34,1	14,6
	2	x	1	19,3	25,0	0,111	0,133	0,125	354	19,3	25,0	18,3
	2	x	1,5	12,9	16,7	0,110	0,132	0,135	351	12,9	16,7	27,2
triple	3	x	0,75	26,3	34,1	0,120	0,144	0,120	383	26,3	34,0	14,6
	3	x	1	19,3	25,0	0,111	0,133	0,125	354	19,3	25,0	18,3
	3	x	1,5	12,9	16,7	0,110	0,132	0,135	351	12,9	16,7	27,2

Generals

PRELIMINARY

SHF2 H-M outer sheath (on request)

This code recognizes the highest level of Oils and MUDs (drilling fluids) resistance of elastomeric outer sheath referred to NEK 606:2016. The compound is based on SHF2 according to IEC 60092-360 and shall satisfies the requests in Table 1 Category d of the a.m. NEK, reported below:

FLUID & TEST PARAMETERS	UNIT	REQUESTED
• IRM 902 mineral oil **• IRM 903 mineral oil** **• Hydraulic/gear oil**		
Temperature	°C	100 ±2
Duration	days	7
Tensile strength	%	± 30 max
Elongation	%	
Volume	%	
Weight	%	
• CALCIUM BROMIDE drilling fluid		
Temperature	°C	70 ±2
Duration	days	56
Tensile strength	%	± 25 max
Elongation	%	
Volume	%	± 20 max
Weight	%	± 15 max
• EDC 95-11 drilling fluid		
Temperature	°C	70 ±2
Duration	days	56
Tensile strngth	%	± 30 max
Elongation	%	
Volume	%	± 25 max
Weight	%	

NOTE : **%** = parameter variation from natural (before immersion)

ELECTRICALS

CONDUCTOR ELECTRICAL RESISTANCE

It's the most important parameter of the conductor sizing, related to:

ρ	conductor resistivity	[Ω m m²/m]
l	conductor length	[km]
A	cross sectional area	[mm²]

For low frequencies, conductor resistance is equal to DC condition.

$$R = \rho \times l / A \qquad [\Omega]$$

For copper conductors:

$\rho = 17{,}241 \times 10^{-6}$ Ω x mm²/m @ 20°C plain copper

$\rho = 17{,}931 \times 10^{-6}$ Ω x mm²/m @ 20°C tinned copper

Temperature influence is calculated as:

$$R_t = R_{20} \times (234{,}5 + t) / 254{,}5 \qquad [\Omega]$$

R_t	conductor resistance	[**Ω**]
R_{20}	conductor resistance @ 20°C	[**Ω**]
t	conductor temperature	[**°C**]

Conductor resistance increases with frequency.

INSULATION RESISTANCE

It's the resistance to the flow of direct current between a conductor and the earthed core screen, armour and adjacent conductors.
A higher value of insulation resistance means better insulating capacity.
The measurement values, shall be corrected to the reference temperature of 20°C by mean a correction factor

$$R_t = K_i \times (\log_{10} D/d) \times L/1000 \times C_t \qquad [M\Omega \times km]$$

Rt = measured insulation resistance referred to 1 km @ 20°C
K_i = insulation constant of insulation compound
for XLPE - EPR and HEPR = 3670 [MΩ x km]
d = diameter over conductor [mm].
D = diameter over insulation [mm]
L = cable length [m]
C_t = temperature correction factor

Correction factor C_t

10°C	11°C	12°C	13°C	14°C	15°C	16°C	17°C	18°C	19°C	**20°C**
0.50	**0.54**	**0.57**	**0.2**	**0.66**	**0.71**	**0.76**	**0.81**	**0.87**	**0.93**	**1.00**

20°C	21°C	22°C	23°C	24°C	25°C	26°C	27°C	28°C	29°C	30°C
1.00	**1.07**	**1.15**	**1.23**	**1.32**	**1.42**	**1.52**	**1.62**	**1.74**	**1.87**	**2.00**

VOLTAGE RATING

The voltage designation of cables has three characteristic parameters:

- **Uo** the rated power voltage between conductor and any earth or metallic screen.
- **U** the rated power frequency voltage between conductors
- **Um** the maximum value of the highest system voltage which may be sustained under normal operating conditions at any time and at any point.

CURRENT RATING

Current carrying capacity, whatever is the type of covering (e.g. both unarmoured and armoured cables), depends from the cable installation method.

IEC 60092-352 standard reports the reference methods for which the current carrying capacity has been determined by test or calculation

The ELECTRICAL DATA reported in this catalogue are in accordance with:

- Table A.4 insulation rated temperature of 90°C
- Table A.5 insulation rated temperature of 95°C

They refer to:

- installation in free air @ 45°C
- continuous service @ max rated temperature
- single core cables with 3 of them in touch (method F)
- 2, 3 & 4 cores (method E)
- multicore cables (5 cores and over) subjected to correction factors
- current ratings, based on Class 2 conductors, refer to nominal dimensions of 0,6/1 kV cables.
- current rating for higher voltages 5 % lower than the tabulated values for LV cables

■ Continuous service

It's considered a duration longer than three times the Time Constant [T] of the cable (with constant load)

$$T = 0{,}245\ d^{1{,}35}$$

d = cable overall diameter [mm]

■ Correction factor for half-hour and one-hour service

When cables operate for intermittent periods of half an hour or one hour, the maximum current rating allowed can be increased multiplying the tabulated current rating by the following correction factor:

$$\sqrt{\frac{1{,}12}{1 - \exp(-t_s/T)}}$$

where:

t_s = 30 or 60 [min]

T = Time Constant of cable (see above Continuous Service)

■ Correction factor for intermittent service

For cables supplying a single motor or other equipment, operating in an intermittent service, the maximum current rating may be increased multiplying by a correction factor.

IEC 60092-352 standard reports a calculation example of such correction factor over a period of 10 min. with 4 min. at maximum current rating and 6 min unloaded

$$Fi = \sqrt{\frac{1\text{-}\exp(-4/T)}{1\text{-}\exp(-4/T)}}$$

Intermittence period = 10 [min]

Intermittence ratio (duty cycle) = 40 [%]

T = Time Constant of cable (see above Continuous Service)

■ Temperature correction factor

For different operating ambient temperature than 45°C and conductor at a max. rated temperature, the maximum permissible cable current rating has to be mutiplied by the following correction factor:

Max. rated conductor temp **[°C]**	Correction factors for ambient air temperature **[°C]** of										
	35	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**
90	1.10	1,05	1,00	0,94	0,88	0,82	0,74	0,67	0,58	0,47	-
95	1.10	1,05	1,00	0,95	0,89	0,84	0,77	0,71	0,63	0,55	0,45

SHORT CIRCUIT RATING

Short Circuit current is calculated as:

$$Isc = k \times \frac{A}{\sqrt{t}} \quad [kA]$$

where:

k factor	**Insulation compound**	**Max. rated conductor temperature**	
		Normal operation °C	**Short-circuit °C**
1,43	XLPE- EPR - HEPR	90	250
1,71	Silicone S95	95	350

A = conductor cross section [mm²]

t = short circuit duration [sec]

CURRENT to power and voltage

In case of three-phase systems, the determination of the current relationship between power and voltage is:

$I = 722\ kW/V$ $I = 578\ kVA/V$ $I = 531\ HP/V$

I = current intensity	[A]
V = rated voltage	[V]
kW = power(cos φ = 0.8)	[kW]
kVA = power	[kVA]
HP = horse power	[HP]

REACTANCE

When the cable operates in A.C., reactance is related mainly to axial distance between conductors.
For 2 - 3 - 4 conductors the Reactance per phase can be calculated as:

$$X = 2 \times \pi \times f \times L \times l \qquad [\Omega]$$

f	frequency	[Hz]
L	Inductance	[H/m]
l	core length	[m]

INDUCTANCE

$$L = 0{,}2 \times (\ln 2a/d + 0.25) \times 10^{-6} \qquad [H/m]$$

a	distance between cores	[mm]
d	core diameter	[mm]

IMPEDANCE

$$Z = \sqrt{(R^2 + X^2)} \qquad [\Omega]$$

Z	Impedance per phase	[Ω]
R	Electrical resistance @ 20°C	[Ω]
X	Reactance per phase	[Ω]

CAPACITANCE

- Single core cable

$$C = \varepsilon r / 18 \log_e (D/d) \qquad [\mu F/km]$$

εr	relative permittivity of insulation	
D	diameter over insulation	[m]
d	diameter over conductor	[m]

- Multicore belted cable

In the above equation:
D = diameter of one conductor + insulation between conductors + thickness of belt between any core and the metal screen or armour

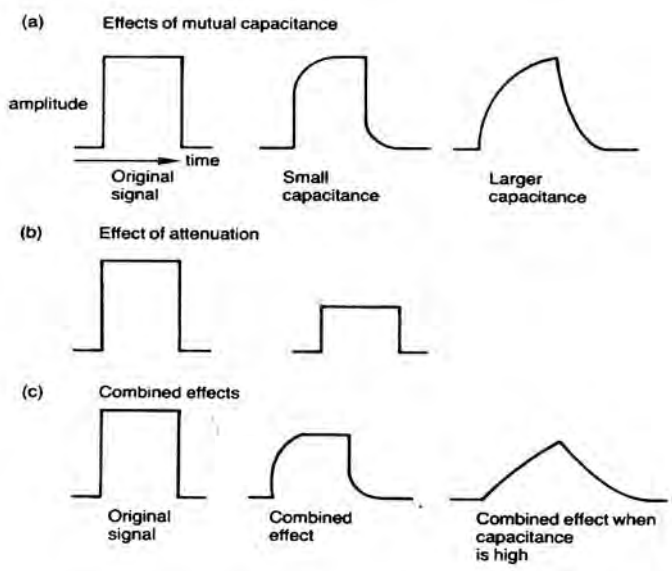
■ Digital signals

Small and larger capacitance causes distortion of digital signals

It depends by:

- conductor construction (increasing of conductor size means larger capacitance)
- insulation thickness (inversely proportional)
- insulation permittivity

In high frequency transmission capacitance rounds or distorts the pulse shape as shown hereafter:



VOLTAGE DROP (up to 1 kV)

$$\Delta V = K \times I \times L/1000 \quad [V]$$

I	rated current	[A]
L	cable length	[km]
K	correction factor (see table)	

conductor section [mm²]	K (correction factor)					
	2 cores		3 cores		3 cores (three foil)	
	cosφ = 1	cosφ = 0,8	cosφ = 1	cosφ = 0,8	cosφ = 1	cosφ = 0,8
1	45,0	36,1	39,0	31,3	38,3	30,8
1,5	30,2	24,3	26,1	21,0	25,7	20,7
2,5	18,2	14,7	15,7	12,7	15,4	12,5
4	11,4	9,21	9,85	7,98	9,65	7,87
6	7.56	6.16	6.54	5.34	6.42	5.28
10	4.55	3.73	3.94	3.24	3.87	3.22
16	2.87	2.39	2.48	2.07	2.44	2.07
25	1.81	1.55	1.57	1.34	1.54	1.34
35	1.31	1.14	1.13	0.988	1.11	0.993
50	0.967	0.866	0.838	0.750	0.820	0.760
70	0.669	0.624	0.579	0.541	0.568	0.555
95	0.484	0.476	0.419	0.412	0.410	0.428
120	0.383	0.394	0.332	0.342	0.325	0.358
150	0.314	0.341	0.272	0.295	0.265	0.308
185	0.251	0.289	0.217	0.250	0.213	0.265
240	0.193	0.245	0.167	0.212	0.163	0.224
300	0,156	0,215	0,135	0,186	0,132	0,198

VFD - EMC characteristics

Variable Frequency Drive (VFD) devices control AC motors speed and torque by varying their input frequency and voltage.

EMC (Electro Magnetic Compatibility) is the ability of the equipment components to minimize the electrical interferences (radio frequency disturbance and electrical surges) produced by such a device.

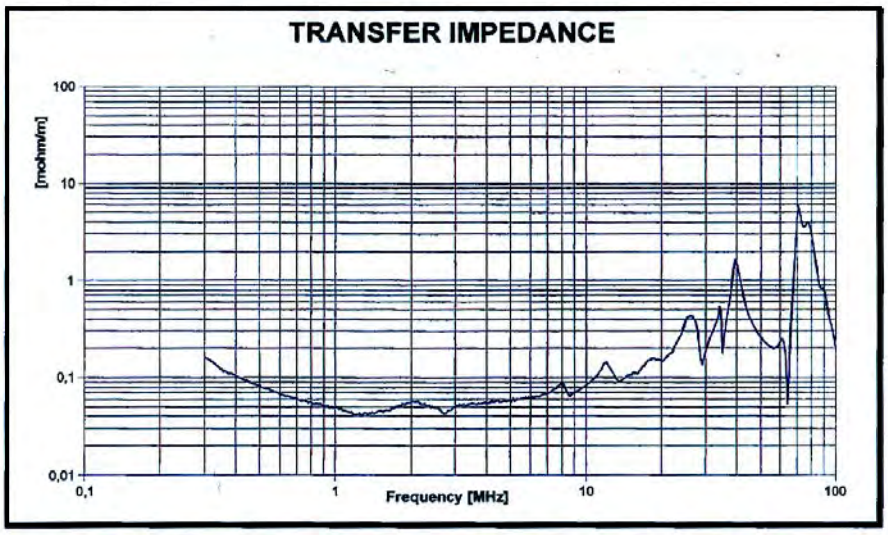
To face electrical surges safely, a working voltage rate of 0,6/1 kV implies to adopt 1,8/3 kV (3,6 kV peak) cable construction.

Furthermore, to minimize EM interferences, cables shall be copper tape shielded as protective hearting.

The parameter of surface Transfer Impedance describes the shielding effectiveness.

Its value shall be lower than 100 mΩ/m in the frequency range up to 100 MHz.

The diagram shows the typical Transfer Impedance (< 6 mΩ/m) measured on CCI VFD EMC cables.



Fixed installations in hazardous area

The cables mentioned in this catalogue are appropriate to operate in hazardous area. Their construction includes:

- conductors circular and compacted
- bedding and sheaths extruded
- non-hygroscopic fillers, when adopted

and prevents gas or vapour migration in accordance to the requirements of IEC 60079-14 Annex E

MECHANICALS

PULLING TENSION DURING INSTALLATION

- unarmoured cables

  $P = 25 \times Sc$ [N]

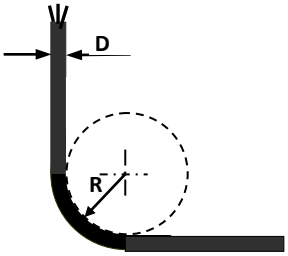
- armoured cables

  $P = 50 \times Sc$ [N]

Sc = total cross section of pulled conductors [mm^2]

BENDING RADIUS

The recommended minimum internal Bending Radius of cables in this catalogue is related to the their outer diameter (D).



D = cable outer diameter [mm]
R = Bending Radius [mm]

Good practice is to reach progressively the minimum bending radius, with suitable round tools to help the correct bending, in particular when cable installation is performed at low temperature.

- Minimum installation temperature - 20°C
- Minimum operating temperature - 40°C

CONVERSION TABLE U.S. to METRIC cross sections

AWG (U.S.)	Metric cross-section [mm²]	Standard metric cross-section [mm²]
20	0.519	0.75
18	0.823	1,0
16	1.31	1.5
14	2.08	2.5
12	3.31	4,0
10	5.26	6,0
8	8.37	10
6	13.30	16
4	21.15	25
2	33.62	35
1	42.41	50
1/0	53.49	70
2/0	67.23	70
3/0	85.01	95
4/0	107.2	120
--	--	--

MCM (U.S.)	Metric cross-section [mm²]	Standard metric cross-section [mm²]
250	126.7	150
300	152.0	150
350	177.3	185
400	202.7	185
450	228.0	240
500	253.4	300
550	278.7	300
600	304.0	300
650	329.4	300
700	354.7	400
750	380,0	400
800	405.4	400
850	430.7	400
900	456.0	500
950	481.4	500
1000	506.7	500

Head office
Strada Provinciale 117
20010 BERNATE TICINO (Milano) - Italy
Ph +39 02 97255817
Email: cci@cableservice.com
www.cableservice.com

OFFSHORE/FPSO CABLES CATALOGUE 2021

All data mentioned in this catalog may be subject to continuous revision and improved at any time