NGER PLATFORM TO ENHANCE CUSTOMER SERVICE
PRYSMIAN GROUP LEADING TECHNOLOGY
FIRE PRYSMIAN GROUP WORLDWIDE LEA
FIRE PERFORMANCE CABLES
NDED PROD
ADING TECHNOLOGY STRONGER PLATFORM
WORLDWIDE LEADER

Prysmian Group

PRYSMIAN
Draka

CONNECTING ENERGY AND INFORMATION TO GLOBAL GROWTH

Welcome to the Prysmian Group, the world's leading cable solutions provider.

Over 130 years of aggregated history, 22,000 people in 50 countries and almost 97 plants are the best possible platform for driving change and innovation. Operating through two of the industry's most respected global brands, Prysmian and Draka, we are ready to connect with our customers and help them respond to their present and future challenges. We enable them to bring their services to homes and businesses, cities and entire countries.

VISION

We believe in the effective, efficient and sustainable supply of Energy and Information as a primary driver in the development of communities.

MISSION

We provide our customers worldwide with superiors cable solutions based on state-of-the-art technology and consistent excellence in execution, ultimately delivery sustainable growth and profit.

VALUES

Excellence.
Integrity.
Understanding.

We are powered by a clear vision and an ambitious mission. We are guided by the belief in the efficient effective and sustainable supply of energy and information as a driver In the development of communities. We are linking the future.

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CONTENTS

Prysmian Group

Why Fire Performance Cables are so important?

Major accidents which have resulted in the deaths of many innocent people, have taught us that the safety of the occupants are users in public, commercial and industrial environments is of paramount importance. Every possible safety feature designed to prevent and protect against loss of life and damage to property should be specified and installed.

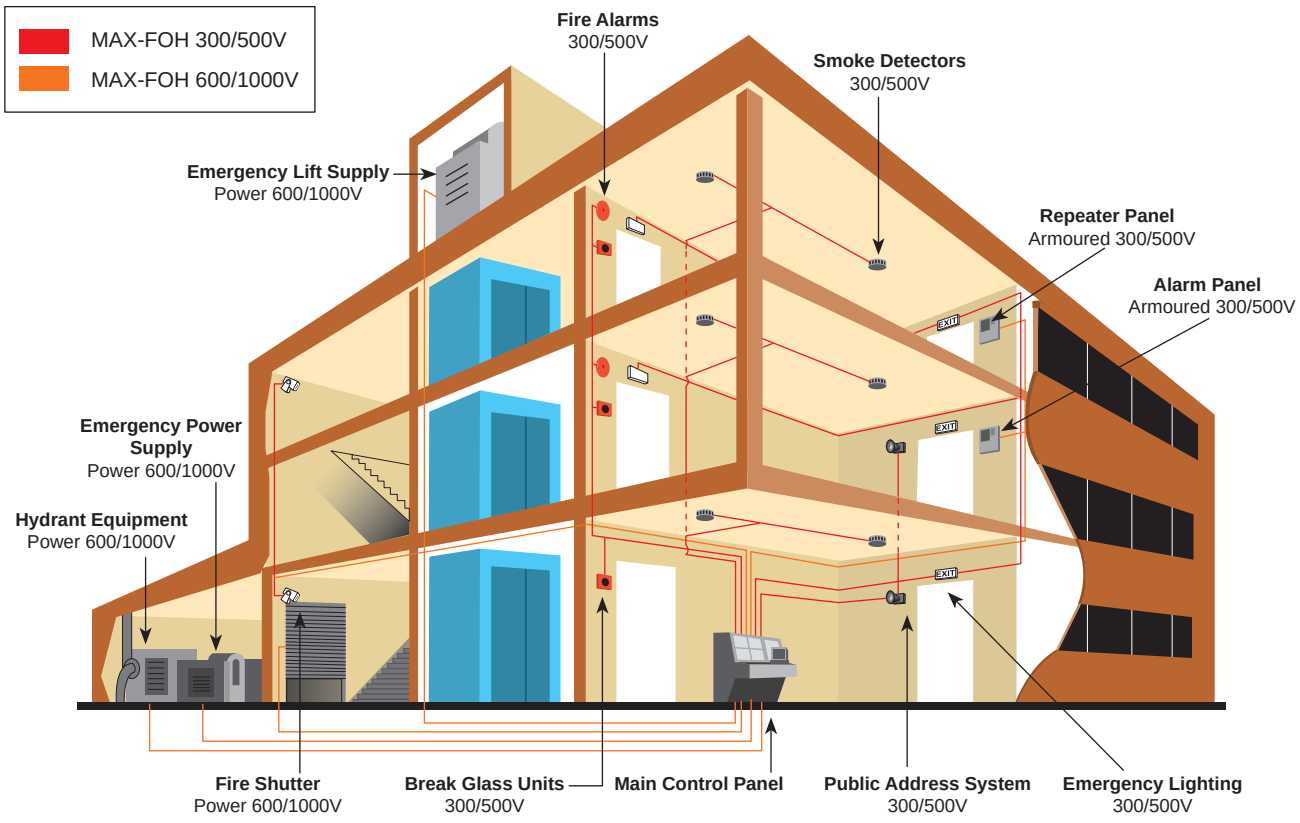
One such safety feature in the use of fire performance cables for critical safety system, including fire alarms, emergency lighting, PA systems, CCTV systems, emergency power supplies and smoke & fire shutters.

The correct selection and installation of these "life saving" cables helps ensure that in the event of an emergency, vital safety system will continue to operate to assist an orderly evacuation of the premises and to aid the emergency services in gaining quick and effective entry to deal with the hazard.

At Prysmain Group, we understand what is required from a fire performance cable and we appreciate the pressures faces by specifiers and consultants in selecting the correct cable from the range available. For nearly twenty years, our special cables have been servicing the needs of the market by designing and manufacturing the widest range of fire performance cables available today.

APPLICATION

Our fire performance cables are specifically designed to facilitate the quick and orderly evacuation of the building occupants in the events of an emergency. Purpose designed to maintain circuit integrity to a host of critical safety systems, including fire alarms, emergency lights, CCTV systems and emergency power supplied, MAX-FOH cables from a vital component of any safety system. The special characteristics of the MAX-FOH range make it suitable for an almost infinite number of application and environments. The diagram blow illustrated the main safety systems which should be fitted with either 300/500V or 600/1000V MAX-FOH cables.



Choosing The Right Cables, and The Right Manufacturer

Issues to take note when comparing with other cables,

1. Some brands are OEM cables and carry certifications from the original manufacturers.
2. Some conductors used may be undersized conductors, and hence cheaper.
3. Some brands use only one layer of mica tape for all conductors size with less than the recommended over-lapping.
4. Insulation used is cheaper PVC instead of LSHF material, hence the cable is actually not Low Smoke Halogen Free compliant.
5. Cheaper polymers are used to reduce cost, but are without sufficient flame and smoke suppressant.
6. Thickness of insulation and sheathing are thinner to reduce cost.
7. Other cables may only have in-house testing reports and not certifications from a recognised 3rd party verification agency.

Safety is NEVER a compromise when it comes to fire protection!

Any cable breakage or short circuited in any FIRE condition can lead to the loss of human "lives". Therefore, all cablings on critical systems must be of Fire Performance type.

WITH OUR MAX-FOH CABLE YOU CAN BE SURE YOUR SYSTEMS WILL WORK!

MAX-FOH

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SUPPORTING GLOBAL UTILITIES IN THE

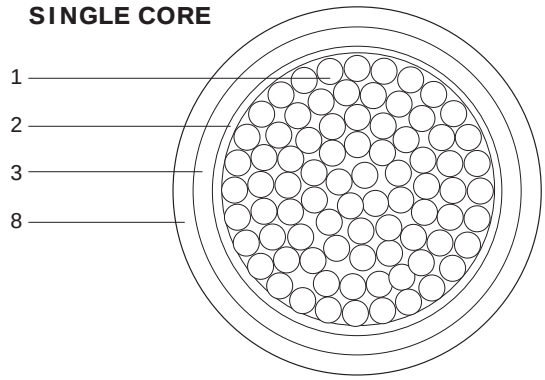
OF SMARTER AND GREENER POWER GR

STRONGER PLATFORM

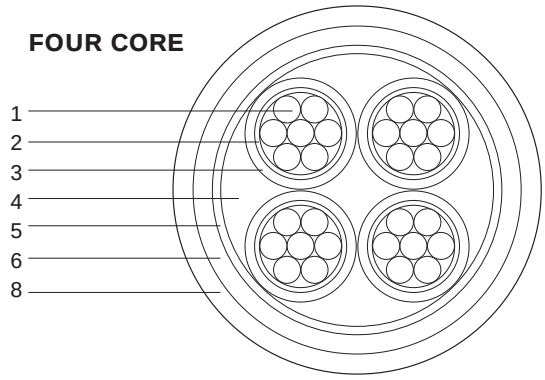
CONSTRUCTION OF CABLE

Construction	MAX-FOH
1 - Conductor	Stranded annealed copper
2 - Fire Barrier	Mica tape
3 - Insulation	Cross-linked polyethylene (XLPE)
4 - Filler*	LSHF filler or polypropylene split yarn
5 - Binder Tape*	Polyester tape
6 - Bedding*	Low smoke halogen free (LSHF) compound (Orange)
7 -Armour*/#	Galvanised steel wire (aluminium wire for single core)
8 - Sheath***	Low smoke halogen free (LSHF) compound

SINGLE CORE



FOUR CORE



* Optional: Depending on requirement
\# Braided armour also available on request
*** Standard colour of shealth is orange.
Other color is upon customer request.

No. of cores	Identification of cores	
	Option 1	Option 2
1	Natural	Other colour on request
2	Brown, Blue	Red, Black
3	Brown, Black, Grey	Red, Yellow Blue
4	Brown, Black, Grey, Blue	Red, Yellow, Blue, Black
5	Brown, Black, Grey, Blue, Green/Yellow	Red, Yellow, Blue, Black, Green/Yellow
6 and above	Black with white numbering	

Note: Special construction and design to customers' specification can be upon request.

Applicable Standards

IEC 60502-1 AS/NZS 3198	Extruded solid dielectric insulated power cable for rated voltage of 1 kV up to 30kV
IEC 60228 BS 6360 AS/NZS 1125	Conductors of insulated cables
IEC 60754-1 BS 6425-2 AS/NZS 1160.5	Test on gases evolved during combustion of electric cables – Detemination of the amount of halogen acid gases
IEC 60754-2 BS 6426-2 AS/NZS 1160.5.4	Test on gases evolved during combustion of electric cables – Detemination of degree of acidity of gases evolved by measuring pH and conductivity
IEC 60331 AS/NZS 1160.5.5	Fire resistant characteristics of electric cable (750°C for 90 minutes)
IEC 60332 Part 1 BS 4066 Part 1	Test on electric cables under fire conditions – Test on a single vertical insulated wire or cable
IEC 60332 Part 3 BS 4066 Part 3 Category A,B,C/ AS/NZS 1660.5.1	Test on electric cables under fire conditions – Test on bunched wires or cables
IEC 61034 BS 7622 AS/NZS 1660.5.2	Measurement of smoke density of electric cables burning under defined conditions
BS 6387 SS 299 Part 1	Performance requirements for cables required to maintain circuit integrity under fire condition – Category C : tested at 950°C for 3 hours Category W: fire with water Category Z : fire with mechanical shock
BS 6724	Armoured cables for electricity supply having thermosetting insulation with low emission of smoke and corrosive gases when affected by fire
BS 7211	Thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7846	600/1000V armoured fire-resistant electric cables having low emission of smoke and corrosive gases when affected by fire
AS/NZS 3013	Electrical installations – Classification of the fire and mechanical performance of wiring systems

* Standards applied will vary depending on cable construction.

Comparision between test standards IEC 60331 Part 21 & SS 299 Part 1

Ref	Description of tests	IEC 60331 Part 21	0.6/1kV cables	Data cables	Optical fibre cables	SS 299 Part 1	0.6/1kV cables	Data cables	Optical fibre cables
1	**Resistance to FIRE alone**								
	Flame temperature / Duration	750°C/90 min	✓	✓	✓	Cat A- 650 °C/3hr Cat B- 750 °C/3hr Cat C- 950 °C/3hr Cat S-650°C/20min	✓ ✓ ✓ ✓		
2	**Resistance to FIRE with mechanical shock**								
	Flame temperature / Duration	830°C/120 min	✓			Cat X- 650 °C/3hr Cat Y - 750°C/3hr Cat Z- 950 °C/3hr	✓ ✓ ✓		
	Mechanical shock	Every 5 min	✓			Every 30 sec	✓		
3	**Resistance to FIRE with water spray**								
	Flame temperature / Duration	Not available				Cat W-650°C/15min	✓		
4	**Other tests**								
	Electrical requirements for completed cables	Not available				Available	✓		
	Bending characteristics	Not available				Available	✓		
	Resistance of cable to impact	Not available				Available	✓		

BS 6387/SS 299 Part 1: 1994 - Fire, Fire with Water & Fire with Mechanical Shock Tests

The following test is the nationally recognised United Kingdom and Singapore test used to determine if a cable is capable of maintaining circuit integrity under fire conditions, fire with water and fire with mechanical shock. These tests use a number of alternative time and temperature parameters and depending on the level achieved by the cable, a corresponding letter is assigned to denote the category the cable passed.

Resistance to fire:	Symbol
650°C for 3 hours	A
750°C for 3 hours	B
950°C for 3 hours	C
950°C for 20 minutes	S

Resistance to fire and water:	Symbol
650°C for 15 minutes, then for 15 minutes with fire and water	W

Resistance to fire with mechanical shock:	Symbol
650°C for 15 minutes, with 30 second hammer blows	X
750°C for 15 minutes, with 30 second hammer blows	Y
950°C for 15 minutes, with 30 second hammer blows	Z

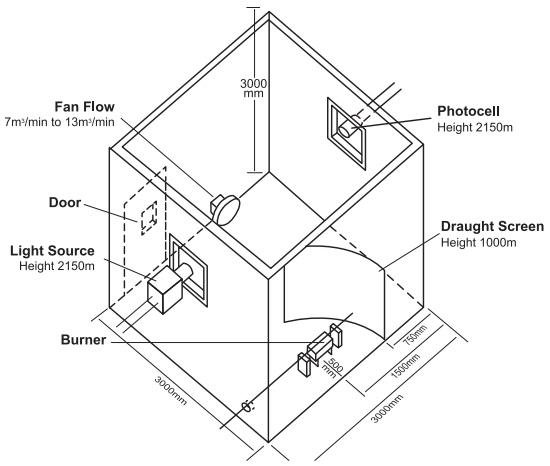
During the tests the cables are energised at their rated voltage.
MAX-FOH cables meet the highest categories of BS 6387 i.e. C, W & Z

IEC 61034 - Smoke Density Test

This test measures the smoke emission from electric cables during fire. The test is carried out in a 3m cubed chamber where a cable sample is subjected to fire.

The smoke emission and density are measured by transmitting a beam of light across the inside of the chambers to a photo electric cell which measures the amount of light received.

All MAX-FOH cables comply to IEC 61034 requirements.



IEC 60754 – Acid Gas Emission Test

Due to the concern regarding the amount of acid gas which could be produced when cables are burnt, this international test was developed to determine the amount of gas evolved by burning cables.

The recommended values of the test state that the weighted pH value should not be less than 4.3, when related to 1 litre of water. The weighted valued of conductivity should not exceed 10us/mm.

MAX-FOH cables meet the above requirements.

IEC 60331 – Fire Test

The international fire test is designed to establish whether a cable can maintain circuit integrity during and after exposure to fire.

A sample of cable is exposed to fire for 90 minutes at a temperature of between 750°C and 800°C, after 90 minutes the fire is extinguished and the current is turned off. After a further 12 hours, the sample of cable is re-energized and must maintain its circuit integrity.

MAX-FOH cables meet the requirements of IEC 60331

IEC 60332 Part 3 - Flame Propagation Test

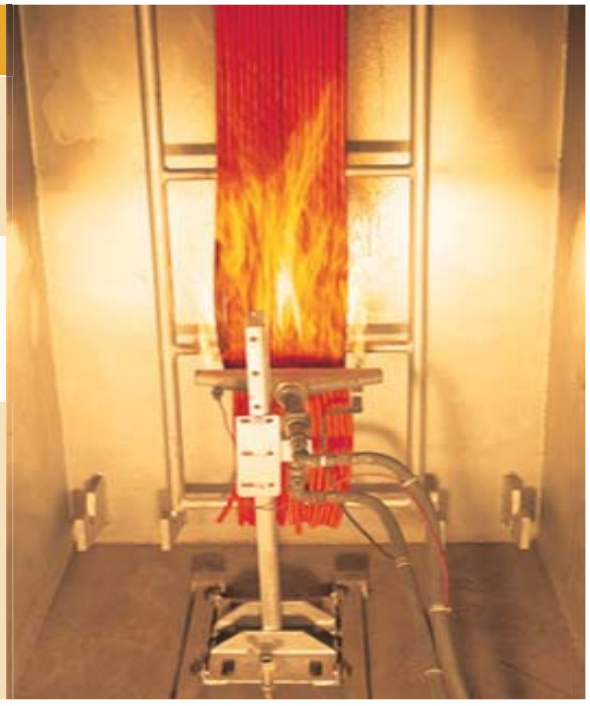
This test defines the ability of bunched cables to restrict vertical flame propagation when laid in trunking, cable trays or conduit. The test comprises of 3 categories each determined by the amount of combustible material in a 1 metre sample, as shown in the table below.

Category	A	B	C	D
No. of litres of combustible material in a 1 metre sample.	7	3.5	1.5	0.5
Exposure (mins)	40	40	20	20

The cable samples are placed vertically next to one another on a vertical ladder where they are exposed to fire from a ribbon gas burner for the pre-arranged times.

After burning, the samples are wiped clean to examine for char (the crumbling) of the cable surface. The charring should not have reached a height exceeding 2.5m above the bottom edge of the burner.

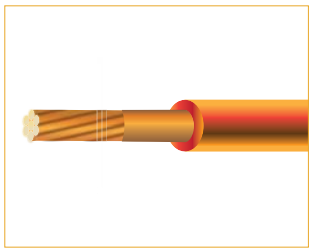
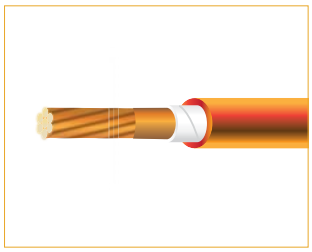
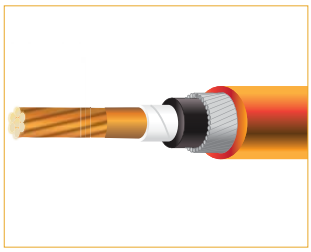
MAX-FOH cables meet the requirement of IEC 60332 part 3



Additional Considerations

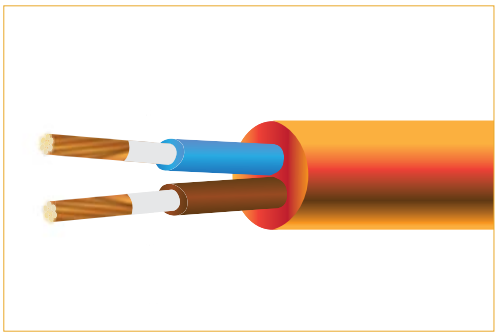
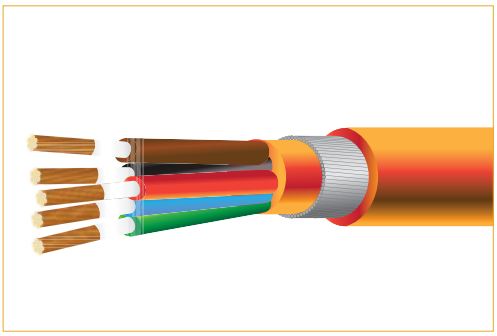
As well as requirements written into international and British cable standards, there are other essential criteria which designers and consultants need to consider – is the cable able to withstand voltage spikes, transmit date and prevent flame propagation?

All MAX-FOH cables do comply with these additional benefits, including the added advantage that MAX-FOH requires fewer joints in a cable run compare to mineral, reducing the risk of weak links in the chain. MAX-FOH does not require complicated terminations and is therefore quicker and easier to install.

	MAX-FOH-I Insulated, non-sheathed	MAX-FOH Insulated and sheathed	MAX-FOH Insulated, armoured and sheathed
			
Conductor:	Plain stranded annealed copper Class 2	Plain stranded annealed copper Class 2	Plain stranded annealed copper Class 2
	1.5mm^2 up to 630 mm^2	1.5mm^2 up to 1000 mm^2	50mm^2 up to 1000 mm^2
Fire Barrier :	Mica Glass Tape	Mica Glass Tape	Mica Glass Tape
Insulation :	LSHF compound	XLPE compound	XLPE compound
Bedding :			LSHF compound
Armouring :			Aluminium wire
Sheath :		LSHF compound	LSHF compound
UV Resistance :	Optional	Optional	Optional
Anti-Termite :	Optional	Optional	Optional
Anti-Rodent :	Optional	Optional	Optional
Insulation Colours :	Orange (Standard)	Natural	Natural
Bedding :			Black
Sheath Colours :		Orange (Standard)	Orange (Standard)
Reference Standard :	IEC 60502-1	IEC 60502-1	IEC 60502-1, BS 7846
Voltage : Uo/U	600/1000V	600/1000V	600/1000V
Circuit Integrity :	IEC 60331, SS 299-1 Cat C,W,Z	IEC 60331, SS 299-1 Cat C,W,Z	IEC 60331, SS 299-1 Cat C,W,Z
	(for 300/500V, 450/750V, 600/1000V)	(for 300/500V, 450/750V, 600/1000V)	(for 300/500V, 450/750V, 600/1000V)
	BS 6387 Cat C, W, Z	BS 6387 Cat C, W, Z	BS 6387 Cat C, W, Z
Test Standard :	(for 300/500V & 450-750V ONLY)	(for 300/500V & 450-750V ONLY)	(for 300/500V & 450-750V ONLY)
Flame Retardant :			
Single vertical cable	IEC 60332-1, BS 4066-1, BS EN 50266-1	IEC 60332-1, BS 4066-1, BS EN 50266-1	IEC 60332-1, BS 4066-1, BS EN 50266-1
Bunched cables	IEC 60332-3 BS 4066-3, BS EN 50266-2	IEC 60332-3 BS 4066-3, BS EN 50266-2	IEC 60332-3 BS 4066-3, BS EN 50266-2
Halogen gases :	IEC 60754-1, BS 6425-1, BS EN 50267-2-1	IEC 60754-1, BS 6425-1, BS EN 50267-2-1	IEC 60754-1, BS 6425-1, BS EN 50267-2-1
Corrosiveness & Conductivity :	IEC 60754-2, BS 6425-2, BS EN 50267-2-2	IEC 60754-2, BS 6425-2, BS EN 50267-2-2	IEC 60754-2, BS 6425-2, BS EN 50267-2-2
Smoke Emission :	IEC 61034-2, BS 7622-2, BS EN 61034-2	IEC 61034-2, BS 7622-2, BS EN 61034-2	IEC 61034-2, BS 7622-2, BS EN 61034-2

Cable Type			MAX-FOH-I			MAX-FOH			
Constructions			Insulated, non-sheathed			Insulated and sheathed			
Material Composition			Copper/MGT/LSHF			Copper/MGT/XLPE/LSHF			
Standard			IEC 60502-1			IEC 60502-1			
Voltage			600/1000V			600/1000V			
			Unarmoured						
	Conductor cross sectional area	No. & diameter Of Wire	Insulation thickness	Cable overall diameter	Cable weight	Insulation thickness	Sheath thickness	Cable overall diameter	Cable weight
	mm^2	No/ mm	mm	mm	kg/km	mm	mm	mm	kg/km
Single Core	1 x 1.5	7/0.53	0.7	4.0	30	0.7	1.4	6.6	60
	1 x 2.5	7/0.67	0.8	4.5	40	0.7	1.4	7.0	73
	1 x 4	7/0.85	1.0	5.4	60	0.7	1.4	7.6	93
	1 x 6	7/1.04	1.0	6.0	90	0.7	1.4	8.1	120
	1 x 10	7/1.35	1.0	7.0	130	0.7	1.4	9.0	160
	1 x 16	7/1.70	1.0	8.1	190	0.7	1.4	10.1	230
	1 x 25	7/2.14	1.2	9.8	300	0.9	1.4	12.0	330
	1 x 35	19/1.53	1.2	11.0	400	0.9	1.4	13.3	450
	1 x 50	19/1.78	1.4	12.8	540	1.0	1.4	14.8	600
	1 x 70	19/2.14	1.4	14.5	740	1.1	1.4	16.7	810
	1 x 95	19/2.52	1.6	16.9	1020	1.1	1.5	18.9	1100
	1 x 120	37/2.03	1.6	18.4	1250	1.2	1.5	20.9	1340
	1 x 150	37/2.25	1.8	20.7	1540	1.4	1.6	23.1	1650
	1 x 185	37/2.52	2.0	23.0	1930	1.6	1.7	25.6	2050
	1 x 240	61/2.25	2.2	26.0	2510	1.7	1.7	28.4	2630
	1 x 300	61/2.52	2.4	28.9	3130	1.8	1.8	31.3	3260
	1 x 400	61/2.85	2.6	32.1	3960	2.0	1.9	34.7	4100
	1 x 500	61/3.20	2.8	35.8	4990	2.2	2.1	38.8	5180
	1 x 630	127/2.52	2.8	39.7	6330	2.4	2.2	43.3	6590
	1 x 800	127/2.85				2.6	2.3	48.0	8300
	1 x 1000	127/3.20				2.8	2.5	53.5	10470

Cable Type			MAX-FOH-AWA				
Constructions			Insulated, armoured and sheathed				
Material Composition			Copper/MGT/XLPE/LSHF/AWA/LSHF				
Standard			IEC 60502-1				
Voltage			600/1000V				
			Armourded				
	Conductor cross sectional area	No. & diameter Of Wire	Diameter under armour	Armour wire diameter	Sheath thickness	Cable overall diameter	Cable weight
	mm^2	No/ mm	mm	mm	mm	mm	kg/km
Single Core	1 x 1.5	7/0.53					
	1 x 2.5	7/0.67					
	1 x 4	7/0.85					
	1 x 6	7/1.04					
	1 x 10	7/1.35					
	1 x 16	7/1.70					
	1 x 25	7/2.14					
	1 x 35	19/1.53					
	1 x 50	19/1.78	13.8	1.25	1.5	19.5	800
	1 x 70	19/2.14	15.7	1.25	1.5	21.7	1130
	1 x 95	19/2.52	17.7	1.25	1.6	23.9	1450
	1 x 120	37/2.03	19.4	1.6	1.6	26.3	1770
	1 x 150	37/2.25	21.4	1.6	1.7	28.5	2130
	1 x 185	37/2.52	23.7	1.6	1.8	31.0	2580
	1 x 240	61/2.25	26.5	1.6	1.9	34.0	3220
	1 x 300	61/2.52	29.2	1.6	1.9	36.7	3890
	1 x 400	61/2.85	32.8	2.0	2.1	41.5	5000
	1 x 500	61/3.20	36.5	2.0	2.2	45.4	6150
	1 x 630	127/2.52	40.8	2.0	2.3	49.9	7670
	1 x 800	127/2.85	45.7	2.5	2.5	56.2	9780
	1 x 1000	127/3.20	50.8	2.5	2.6	61.5	12080

	MAX-FOH Insulated and sheathed	MAX-FOH-SWA Insulated, armoured and sheathed
		
Conductor:	Plain stranded annealed Class 2 Copper.	Plain stranded annealed Class 2 Copper.
	1.5mm^2 up to 400 mm^2	50mm^2 up to 1000 mm^2
Fire Barrier :	Mica Glass Tape	Mica Glass Tape
Insulation :	XLPE compound	XLPE compound
Bedding :		LSHF compound
Armouring :		Steel wire
Sheath :	LSHF compound	LSHF compound
UV Resistance :	Optional	Optional
Anti-Termite :	Optional	Optional
Anti-Rodent :	Optional	Optional
Insulation Colours :	Refer to identification of core colours (page 6)	Refer to identification of core colours (page 6)
Bedding :		Black
Sheath Colours :	Orange (Standard)	Orange (Standard)
Reference Standard :	IEC 60502-1	IEC 60502-1, BS 7846
Voltage : Uo/U	600/1000V	600/1000V
Circuit Integrity :	IEC 60331, SS 299-1 Cat C,W,Z,	IEC 60331, SS 299-1 Cat C,W,Z,
	(for 300/500V, 450/750V, 600/1000V)	(for 300/500V, 450/750V, 600/1000V)
	BS 6387 Cat C, W, Z	BS 6387 Cat C, W, Z
Test Standard :	(for 300/500V & 450-750V only)	(for 300/500V & 450-750V only)
Flame Retardant :		
Single vertical cable	IEC 60332-1, BS 4066-1, BS EN 50266-1	IEC 60332-1, BS 4066-1, BS EN 50266-1
Bunched cables	IEC 60332-3 BS 4066-3, BS EN 50266-2	IEC 60332-3 BS 4066-3, BS EN 50266-2
Halogen gases :	IEC 60754-1, BS 6425-1, BS EN 50267-2-1	IEC 60754-1, BS 6425-1, BS EN 50267-2-1
Corrosiveness & Conductivity :	IEC 60754-2, BS 6425-2, BS EN 50267-2-2	IEC 60754-2, BS 6425-2, BS EN 50267-2-2
Smoke Emission :	IEC 61034-2, BS 7622-2, BS EN 61034-2	IEC 61034-2, BS 7622-2, BS EN 61034-2

Cable Type			MAX-FOH				MAX-FOH-SWA				
Constructions			XLPE Insulated, LSHF sheathed				XLPE Insulated, LSHF bedding, Steel wire armoured and LSHF sheathed				
			Unarmoured				Armoured				
Material Composition			Copper/MGT/XLPE/LSHF				Copper/MGT/XLPE/LSHF/SWA/LSHF				
Standard			IEC 60502-1				IEC 60502-1, BS 7846				
Voltage			600/1000V				600/1000V				
			Unarmoured				Armoured				
	Conductor cross sectional area	No. & diameter Of wire	Insulation thickness	Sheath thickness	Cable overall diameter	Cable Weight	Diameter under armour	Armour wire diameter	Sheath thickness	Cable overall diameter	Cable weight
	mm^2	No/ mm	mm	mm	mm	kg/km	mm	mm	mm	mm	kg/km
Two Cores	2 x 1.5	7/0.53	0.7	1.8	11.3	180	9.7	0.9	1.8	15.1	435
	2 x 2.5	7/0.67	0.7	1.8	12.1	210	10.5	0.9	1.8	15.9	493
	2 x 4	7/0.85	0.7	1.8	13.2	270	11.6	0.9	1.8	17.0	576
	2 x 6	7/1.04	0.7	1.8	14.3	340	12.7	1.25	1.8	18.8	777
	2 x 10	7/1.35	0.7	1.8	16.3	380	14.7	1.25	1.8	20.8	901
	2 x 16	7/1.70	0.7	1.8	19.7	540	16.9	1.25	1.8	23.5	1230
	2 x 25	7/2.14	0.9	1.8	22.5	780	20.4	1.6	1.8	27.7	1780
	2 x 35	19/1.53	0.9	1.8	25.3	1030	23.2	1.6	1.8	30.4	2150
	2 x 50	19/1.78	1.0	1.8	28.4	1320	26.3	1.6	1.9	33.7	2600
	2 x 70	19/2.14	1.1	1.8	32.4	1800	30.3	1.6	2.0	37.9	3300
	2 x 95	19/2.52	1.1	2.0	37.0	2450	34.9	2.0	2.1	43.5	4570
	2 x 120	37/2.03	1.2	2.1	40.6	3000	38.3	2.0	2.2	47.1	5310
	2 x 150	37/2.25	1.4	2.2	44.9	3710	42.4	2.0	2.4	51.6	6280
	2 x 185	37/2.52	1.6	2.3	49.8	4570	47.5	2.5	2.5	57.9	8150
	2 x 240	61/2.25	1.7	2.5	56.0	5920	53.3	2.5	2.7	64.1	9920
	2 x 300	61/2.52	1.8	2.6	61.6	7280	59.1	2.5	2.9	70.3	11790
	2 x 400	61/2.85	2.0	2.9	68.9	9200	68.8	2.5	3.1	77.4	14160
Three Cores	3 x 1.5	7/0.53	0.7	1.8	12.0	200	10.3	0.9	1.8	15.7	477
	3 x 2.5	7/0.67	0.8	1.8	12.8	245	11.2	0.9	1.8	16.6	544
	3 x 4	7/0.85	1.0	1.8	14.0	315	12.3	0.9	1.8	17.7	641
	3 x 6	7/1.04	1.0	1.8	15.2	400	13.6	1.25	1.8	19.7	867
	3 x 10	7/1.35	1.0	1.8	17.3	500	15.7	1.25	1.8	21.8	1033
	3 x 16	7/1.70	1.0	1.8	19.9	720	18.1	1.25	1.8	24.7	1460
	3 x 25	7/2.14	1.2	1.8	24.1	1060	22.0	1.6	1.8	29.2	2130
	3 x 35	19/1.53	1.2	1.8	27.0	1390	24.9	1.6	1.8	32.1	2600
	3 x 50	19/1.78	1.4	1.8	30.3	1810	28.2	1.6	1.9	35.7	3180
	3 x 70	19/2.14	1.4	1.9	35.0	2540	33.1	2.0	2.1	41.7	4570
	3 x 95	19/2.52	0.6	2.0	39.5	3390	37.4	2.0	2.2	46.2	5690
	3 x 120	37/2.03	1.6	2.1	43.5	4190	41.2	2.0	2.3	50.2	6680
	3 x 150	37/2.25	1.8	2.3	48.3	5140	46.0	2.5	2.5	56.4	8610
	3 x 185	37/2.52	2.0	2.4	53.5	6390	51.0	2.5	2.6	61.6	10220
	3 x 240	61/2.25	2.2	2.6	60.2	8310	57.7	2.5	2.8	68.7	12670
	3 x 300	61/2.52	2.4	2.8	66.4	10290	63.5	2.5	3.0	74.9	15070
	3 x 400	61/2.85	2.6	3.0	74.0	12990	70.7	2.5	3.3	82.7	18360

Cable Type			MAX-FOH				MAX-FOH-SWA				
Constructions			XLPE Insulated, LSHF sheathed				XLPE Insulated, LSHF bedding, Steel wire armoured and LSHF sheathed				
			Unarmoured				Armoured				
Material Composition			Copper/MGT/XLPE/LSHF				Copper/MGT/XLPE/LSHF/SWA/LSHF				
Standard			IEC 60502-1				IEC 60502-1, BS 7846				
Voltage			600/1000V				600/1000V				
			Unarmoured				Armoured				
	Conductor cross sectional area	No & diameter Of wire	Insulation thickness	Sheath thickness	Cable overall diameter	Cable weight	Diameter under armour	Armour wire diameter	Sheath thickness	Cable overall diameter	Cable weight
Four Cores	4 x 1.5	7/0.53	0.7	1.8	13.0	230	11.3	0.9	1.8	16.7	532
	4 x 2.5	7/0.67	0.7	1.8	14.0	290	12.3	0.9	1.8	17.7	616
	4 x 4	7/0.85	0.7	1.8	15.2	380	13.6	1.25	1.8	19.7	842
	4 x 6	7/1.04	0.7	1.8	16.6	480	15	1.25	1.8	21.1	990
	4 x 10	7/1.35	0.7	1.8	19.0	640	17.3	1.25	1.8	23.4	1212
	4 x 16	7/1.70	0.7	1.8	22.1	920	20	1.6	1.8	27.3	1890
	4 x 25	7/2.14	0.9	1.8	26.5	1390	24.4	1.6	1.8	31.6	2580
	4 x 35	19/1.53	0.9	1.8	29.7	1770	27.6	1.6	1.9	35.0	3110
	4 x 50	19/1.78	1.0	1.9	33.9	2350	32	2.00	2.1	40.6	4340
	4 x 70	19/2.14	1.1	2.0	38.9	3260	36.8	2.00	2.2	45.6	5520
	4 x 95	19/2.52	1.1	2.2	44.1	4490	41.6	2.00	2.3	50.6	7000
	4 x 120	37/2.03	1.2	2.3	48.5	5470	46.2	2.5	2.5	56.6	8940
	4 x 150	37/2.25	1.4	2.4	53.6	6790	51.1	2.5	2.7	61.9	10650
	4 x 185	37/2.52	1.6	2.6	59.7	8400	57.2	2.5	2.8	68.2	12700
	4 x 240	61/2.25	1.7	2.8	67.1	10870	64.2	2.5	3.0	75.6	15710
	4 x 300	61.2.52	1.8	3.0	74.0	13500	70.7	2.5	3.2	82.5	18820
	4 x 400	61/2.85	2.0	3.3	82.7	17060	79.2	3.2	3.5	92.9	24420
Five Cores	5 x 1.5	7/0.53	0.7	1.8	14.0	240	12.4	0.9	1.8	17.8	568
	5 x 2.5	7/0.67	0.7	1.8	15.2	310	13.6	1.25	1.8	19.7	773
	5 x 4	7/0.85	0.7	1.8	16.6	400	15.0	1.25	1.8	21.1	906
	5 x 6	7/1.04	0.7	1.8	18.2	520	16.6	1.25	1.8	22.7	1076
	5 x 10	7/1.35	0.7	1.8	20.7	750	19.1	1.6	1.8	25.9	1526
	5 x 16	7/1.70	0.7	1.8	24.3	1180	22.2	1.6	1.8	29.4	2250
	5 x 25	7/2.14	0.9	1.8	29.0	1800	26.9	1.6	1.9	34.3	3100
	5 x 35	19/1.53	0.9	1.8	32.7	2310	30.6	1.6	2.0	38.2	3810
	5 x 50	19/1.78	1.0	2.0	37.5	3130	35.4	2.0	2.1	44.0	5290
	5 x 70	19/2.14	1.1	2.1	43.0	4310	40.7	2.0	2.3	49.7	6800
	5 x 95	19/2.52	1.1	2.3	48.8	5810	46.5	2.5	2.5	56.9	9280
	5 x 120	37/2.03	1.2	2.4	53.6	7140	51.1	2.5	2.6	61.7	10970
	5 x 150	37/2.25	1.4	2.6	59.6	8790	57.1	2.5	2.8	68.1	13090
	5 x 185	37/2.52	1.6	2.8	66.3	10990	63.4	2.5	3.0	74.8	15770

Cable Type			MAX-FOH				MAX-FOH-SWA				
Constructions			XLPE Insulated, LSHF sheathed				XLPE Insulated, LSHF bedding, Steel wire armoured and LSHF sheathed				
			Unarmoured				Armoured				
Material Composition			Copper/MGT/XLPE/LSHF				Copper/MGT/XLPE/LSHF/SWA/LSHF				
Standard			IEC 60502-1				IEC 60502-1, BS 7846				
Voltage			600/1000V				600/1000V				
			Unarmoured				Armoured				
	Conductor cross sectional area	No. & diameter Of wire	Insulation thickness	Sheath thickness	Cable overall diameter	Cable weight	Diameter under armour	Armour wire diameter	Sheath thickness	Cable overall diameter	Cable weight
Multicore – 1.5 mm²	6 x 1.5	7/0.53	0.7	1.8	15.2	280	13.6	1.25	1.8	19.7	750
	7 x 1.5	7/0.53	0.7	1.8	15.2	295	13.6	1.25	1.8	19.7	765
	10 x 1.5	7/0.53	0.7	1.8	19.0	410	17.4	1.25	1.8	23.5	990
	12 x 1.5	7/0.53	0.7	1.8	19.6	460	18.0	1.25	1.8	24.1	1070
	14 x 1.5	7/0.53	0.7	1.8	20.6	520	19.0	1.6	1.8	25.8	1290
	16 x 1.5	7/0.53	0.7	1.8	21.7	580	20.1	1.6	1.8	26.9	1390
	19 x 1.5	7/0.53	0.7	1.8	22.9	660	21.3	1.6	1.8	28.1	1510
	24 x 1.5	7/0.53	0.7	1.8	26.7	830	25.1	1.6	1.9	32.1	1830
	27 x 1.5	7/0.53	0.7	1.8	27.3	900	25.7	1.6	1.9	32.7	1930
	37 x 1.5	7/0.53	0.7	1.8	30.5	1180	29.3	2.0	2.0	37.3	2640
Multicore – 2.5 mm²	6 x 2.5	7/0.67	0.7	1.8	16.5	355	14.9	1.25	1.8	21.0	860
	7 x 2.5	7/0.67	0.7	1.8	16.5	380	14.9	1.25	1.8	21.0	890
	10 x 2.5	7/0.67	0.7	1.8	20.7	530	19.1	1.6	1.8	25.9	1300
	12 x 2.5	7/0.67	0.7	1.8	21.4	610	19.8	1.6	1.8	26.6	1400
	14 x 2.5	7/0.67	0.7	1.8	22.4	686	20.8	1.6	1.8	27.6	1510
	16 x 2.5	7/0.67	0.7	1.8	23.7	770	21.1	1.6	1.8	28.9	1650
	19 x 2.5	7/0.67	0.7	1.8	25.0	880	23.4	1.6	1.8	30.2	1800
	24 x 2.5	7/0.67	0.7	1.8	29.2	1100	27.6	1.6	1.9	34.6	2200
	27 x 2.5	7/0.67	0.7	1.8	29.8	1210	28.2	1.6	1.9	35.2	2330
	37 x 2.5	7/0.67	0.7	1.9	33.7	1610	32.3	2.0	2.1	40.5	3220

SELECTION OF CROSS-SECTIONAL AREA OF CONDUCTOR

In order to choose the right power cable, one has to consider:
- the current
- the voltage drop
- the short circuit rating
- the installation methods
- the ambient temperature
- the frequency and harmonic current
- maximum safe length at short circuit

Current Rating

When electric current flows through the conductor of a cable, the electrical resistance of the conductor generates heat. When a temperature greater than that allowed is reached by the cable due to heat generation, a larger conductor size (with lower electrical resistance) has to be selected. Other important considerations are methods of installation of the cable and ambient temperature. Calculation which takes into account all criteria are described in IEC 60287 and are rather complex. In general, preferences is given to standard current rating tables which are issued by national standardization bureaus.

The current rating given in Table 4 to 14 are based on the following standard conditions of the installation.

1. Maximum operating temperature f conductor	=90°C
2. Ambient air temperature	=30°C
3. Ground temperature	=15°C
4. Soil thermal resistivity	=1.2°C m/w
5. Depth of laying (For cable laid direct in the ground)	=0.5m

Voltage Drop

Another important factor for the determination of the conductor size is the voltage drop. The voltage drop of the cable at a given current is caused by losses in the cable. In case of a too high voltage drop, it is necessary to choose a bigger conductor size. The voltage drop in a cable demotes the different in voltage at the beginning and at the end of the cable. It depends on:
- the current carried
- the power factor
- the length of the cable
- the resistance of the cable
- reactance of the cable

The permissible voltage drop is usually stated as a percentage of the circuit voltage.

According to CP5:1998 regulation 525-01-01, it is stipulated that the total voltage drop for any particular cable run most be such that the voltage drop in the circuit of which the cable forms a part does not exceed 4% of the nominal voltage of the supply.

Selection of Cable based On Voltage Drop and Current using tables

Since the actual power factor of the load is usually not known, the most practical approach to the question of the voltage drop is to assume the worst conditions, i.e. power factor equal to one and the conductor is at maximum operating temperature. The voltage drop values given in the tables are based on these assumptions.

The values of the voltage drop (Vd) are tabulated for a current of one Ampere for a 1 metre run, the value of voltage drop needs to be multiplied by the length of the run, in metre, and by the current, in Ampere that the cables are to carry.

V=Vd x I x L

Where V = Voltage
Vd = Approximate Voltage drop/Ampere/metre
I = Current in Ampere per phase
L = Route length in metres

Examples:
Given that the supply voltage is 415V, 3 phase 50Hz and that the cable used is a 4C Cu/mica/XLPE/SWA/LSHF fire resistant cable. Required cable is to be installed in aground and to carry a 250 Amp load per phase over a route length of 100 m. Cable installation is to be in compliance with to CP5:1998 Regulation 522.08 regulation.

V=Vd x I x L

Maximum permissible voltage drop
Vmax = 4% of 415V
Vmax = 16.6V

Voltage drop/ampere/metre

$$Vd = \frac{Vmax}{I \times L} = \frac{16.6}{250 \times 100} = \mathbf{0.66mV}$$

Selected from Table 10 (page 40) such that the Vd value is equal to, or less than calculated 0.66mV, at the same time ensuring that it will carry the current. It will be seen that this value is 0.61 giving a cable size of 70 mm^2.

Minimum bending radius

Type of cable	Unarmoured		Armoured
Number of cores	Single core	Multicore	
600/1000V	8D	6D	10D

Where D: diameter of cable

Side wall pressure to cable
Permissible maximum side wall pressure to the cable at bending during installation is 500 kgf/m.

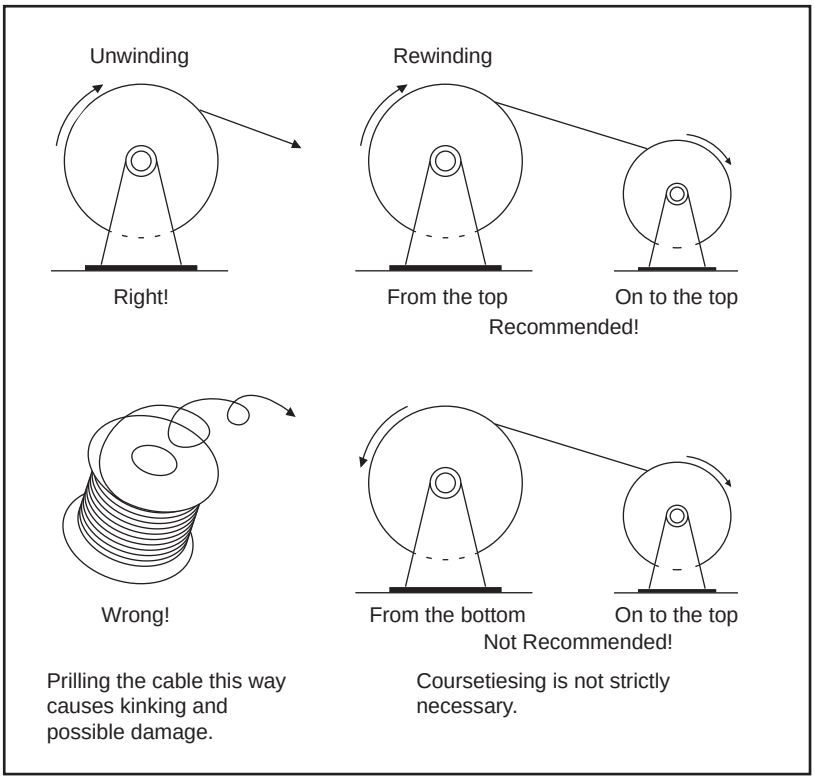
$$\text{Side wall pressure to cable} = \frac{\text{Pulling tension (kgf)}}{\text{Bending radius (m)}}$$

$$= \frac{T}{R}$$

Permissable maximum pulling tension (T)

Conductor	Tension (kgf)
copper	7 x (No. of cores) x (cross-sectional area of conductor)

Drum handling
Handle the drums with care! It is always recommended and a must with heavy drums – to lift drums with a fork-lift truck or a crane when removing them from the vehicle. Always take care to lower the drums into an upright position on their flanges



LSF : LOW SMOKE HALOGEN-FREE CABLES

CE EXTENDED PRODUCT OFFE

WORLDWIDE LE

SUPPORTING GLOBAL UTILITIES IN THE

OF SMARTER AND GREENER POWER GR

STRONGER PLATFORM

LOW SMOKE HALOGEN FREE CABLES

In certain applications, cables under fire conditions have become a major concern. When conventional cables burn, they may emit smoke, halogen and toxic gases that may obscure vision and may be harmful to both equipment and human beings.

After years of research and development, Prsymian Group is manufacturing and supplying Low Smoke Halogen Free Cables which meets the severe requirements of cables under fire condition.

Unlike conventional cables, Low Smoke Halogen Free Cables have the following characteristics:-

1. **Low Smoke** : When the cable is on fire, it does not liberate large volume of dense black smoke. These cables when ignited will only produce a limited amount of smoke. This property helps to improve safety in areas where there are limited means to escape in the event of an emergency, or where large crowds are regularly in attendance.

2. **Halogen Free** : When the cable is on fire, it does not emit any halogen gases. These are acidic and will attack equipment and human beings. The property helps to protect computer, electronic/ communication equipment and reduces thee toxicity of thee gases emitted from the fire. This reduces the risk of personnel engaged in vital operations being incapacitated and the safe escape of people in an emergency.

With the superior fi re performance, these range of cables are recommended for use in the following areas:

1. Underground tunnels, lifts, power stations
2. Mass Rapid Transit System
3. Airports
4. Large buildings/Multi Story Buildings
5. Critical areas of an installations e.g. escape route of an installation
6. Oil Platforms/Ships
7. Areas where masses of people gather and areas with limited means of escape in the event of a fire
8. Military installations/equipment/machines
9. Critical circuits that must continue to operate in case of a fire. e.g. Fire alarms, emergency lifts, pumps circuits etc.

CHARACTERISTICS OF LOW SMOKE HALOGEN FREE CABLES

Applicable test methods / standards for Low Smoke Halogen Free Property

Performance in Fire Tests

Fire Propagation

IEC 60332 PART 3	(International)
BS 4066 PART 3	(UK)
CEI 20-22	(Italy)
VDE 804C	(Germany)
NF C 32-070 CAT. C1	(France)
IEEE 383	(USA)
UL 1581	(USA)
UL 1666	(USA)
FT4	(Canada)
AS 1660.5.1	(Australia)

Cables jacketed with polyethylene or certain types of PVC compounds have the potential to spread or propagate a fire along a cable run. Many international bodies have devised tests designed to assess this property. LSF Cables are flame retardant and hence both hard to ignite and only burn with difficulty. Cables jacketed with LSF compounds have consistently been found to comply with most of these needs.

Acid Gas

IEC 60754 PART 1	(International)
IEC 60754 PART 2	(International)
CEI 20-37 PART 1	(Italy)
VDE 0472 PART 813	(Germany)
NF C 20-453	(France)
AS 1660.5.4	(Australia)

Many flame retardant compounds are based on halogen containing chemicals. Halogen can be present as part of the polymer e.g. PVC or may be a component of a flame retardant additive. When burnt, these materials liberate acidic gases such as hydrochloric gas which, when in contact with electrical or electronic components, can cause very expensive corrosion damage. The cost of thee secondary damage can far exceed those attributed to flame damage, particularly when associated with computer and communication equipment. LSF Cables are designed not to release acidic gases.

Smoke

IEC 61034	(International)
UITP E4	(International)
BS 7622	(UK)
UTE C 20-452	(France)
CEI 20-37 PART 3 - METHOD	(Italy)
ASTM E662	(USA)
AS 1660.5.2	(Australia)

Several materials used in the manufacture of electric wires and cables can liberate large volumes of dense black smoke when ignited. LSF Cables however, are designed to produce only limited amounts of smoke when they are exposed to fire. This property helps to improve safety in areas where there are limited means of escape in the event of an emergency, or where large crowds are regularly in attendance.

Toxicity

Naval Engineering Standard 713	(UK)
CEI 20-37 PART 2	(Italy)
NF C 20-454	(France)

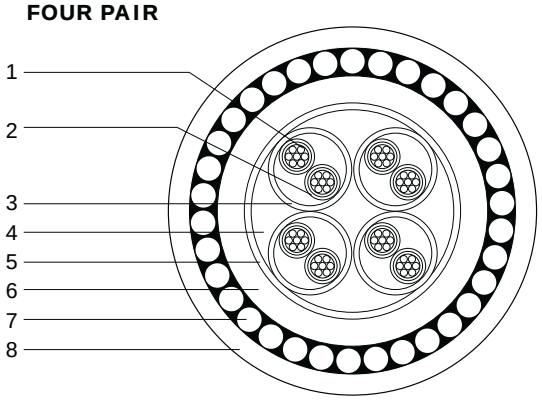
The evolution of toxic fumes from burning materials has been of concern to a variety of industries. In the case of electric wires and cables, toxic gases are of particular importance where they may hamper the safe escape of people in an emergency, or incapacitate personnel engaged in vital operations. LSF Cables do not liberate the highly toxic species generated by some other cable materials as in the case of LSF Cables the main products of combustion are water and carbon dioxide. LSF Cables comply with most military toxic gas evolution specifications.

CONSTRUCTION OF CABLE

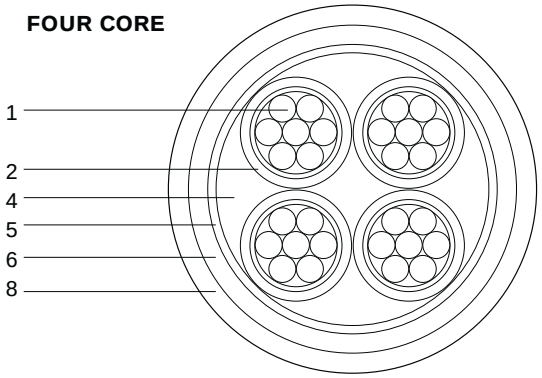
Construction	
1 - Conductor	Stranded annealed copper
2 - Insulation	XLPE or Low smoke halogen free (LSF) compound
3 - Shield*	Aluminium foil with tinned copper drain wire
4 - Filler*	LSF filler or polypropylene split yarn
5 - Binder Tape*	Polyester tape
6 - Bedding*	Low smoke halogen free (LSF) compound
7 - Armour*/#	Galvanised steel wire (aluminium or copper wire for single core)
8 - Sheath	Low smoke halogen free (LSF) compound

* Optional: Depending on requirement
\# Braided armour also available on request

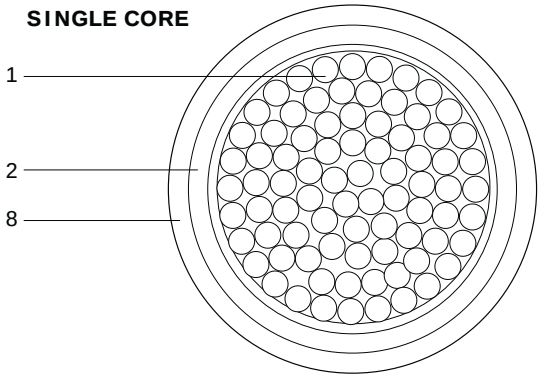
FOUR PAIR



FOUR CORE



SINGLE CORE



Identification of cores:

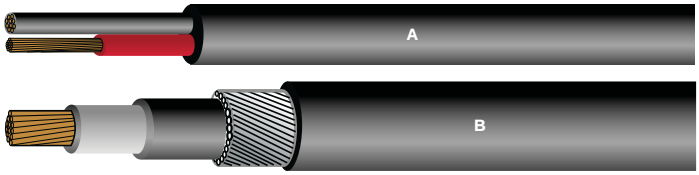
No. of cores	Identification of cores	
	Option 1	Option 2
1	Natural	Other colour on request
2	Brown, Blue	Red, Black
3	Brown, Black, Grey	Red, Yellow Blue
4	Brown, Black, Grey, Blue	Red, Yellow, Blue, Black
5	Brown, Black, Grey, Blue, Green/Yellow	Red, Yellow, Blue, Black, Green/Yellow
6 and above	Black with white numbering (Others on request)	
Pairs	Black with white numbering	

Note: Special construction and design to customers' specification can be provided upon request.

Applicable Standards

IEC 60502-1	Extruded solid dielectric insulated power cables for rated voltage of 1 kV up to 30 kV
IEC 60228/BS 6360	Conductors of insulated cables
IEC 60754-1/BS 6425-1	Test on gases evolved during combustion of electric cables - Determination of the amount of halogen acid gases
IEC 60754-2/BS 6425-2	Test on gases evolved during combustion of electric cables - Determination of degree of acidity of gases evolved by measuring PH and conductivity
IEC 61034/BS 7622	Measurement of smoke density of electric cables burning under defined conditions
BS 6724	Armoured cables for electricity supply having thermosetting insulation with low emission of smoke and corrosive gases when affected by fire
BS 7211	Thermosetting insulated cables (non-armoured) for electric power and lighting with low emission of smoke and corrosive gases when affected by fire
BS 7846	600/1000V armoured fire-resistant electric cables having low emission of smoke and corrosive gases when affected by fire

TABLE OF CONSTRUCTION

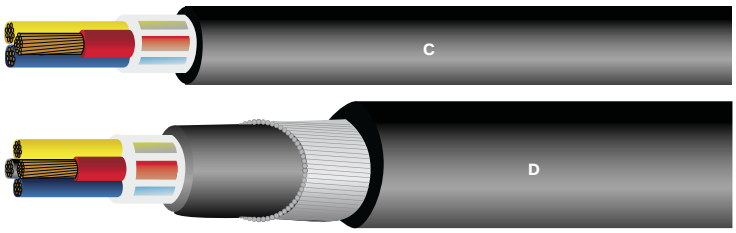


600/1000V, Unarmoured and Armoured LSF Cables

Table 1

		(A) Unarmoured Cables							(B) Armoured Cables				
		Insulated, non-sheathed			Insulated and Sheathed				Insulated and Sheathed				
	Nominal area of conductor	Insulation Thickness	Approx. diameter overall	Approx. weight	Insulation Thickness	Sheath Thickness	Approx. diameter overall	Approx. weight	Bedding Thickness	Armour wire diameter	Sheath Thickness	Approx. diameter overall	Approx. weight
	mm^2	mm	mm	kg/km	mm	mm	mm	kg/km	mm	mm	mm	mm	kg/km
Single Core	1.5	0.7	3.9	32	0.7	1.4	6.4	55	-	-	-	-	-
	2.5	0.8	4.6	43	0.7	1.4	6.8	70	-	-	-	-	-
	4	0.8	5.1	55	0.7	1.4	7.4	90	-	-	-	-	-
	6	0.8	5.6	85	0.7	1.4	7.9	110	-	-	-	-	-
	10	1.0	7.1	146	0.7	1.4	8.9	160	-	-	-	-	-
	16	1.0	8.1	198	0.7	1.4	9.9	220	-	-	-	-	-
	25	1.2	9.8	320	0.9	1.4	12.2	330	-	-	-	-	-
	35	1.2	10.9	410	0.9	1.4	13.5	430	-	-	-	-	-
	50	1.4	13.4	549	1.0	1.4	15.0	560	1.0	1.25	1.8	19.6	800
	70	1.4	15.2	770	1.1	1.4	17.0	770	1.0	1.25	1.8	22.5	1000
	95	1.6	17.6	1140	1.1	1.5	19.0	1040	1.0	1.25	1.8	24.0	1400
	120	1.6	19.3	1425	1.2	1.5	20.8	1290	1.0	1.60	1.8	27.0	1700
	150	1.8	21.3	1720	1.4	1.6	23.0	1580	1.0	1.60	1.8	29.0	2000
	185	2.0	23.7	2155	1.6	1.6	25.3	1950	1.0	1.60	1.9	31.3	2400
	240	2.2	26.8	2900	1.7	1.7	28.3	2530	1.0	1.60	2.0	35.0	3300
	300	2.4	29.7	3540	1.8	1.8	31.0	3140	1.0	1.60	2.1	37.0	3800
	400	2.6	33.3	4410	2.0	1.9	34.7	3970	1.2	2.00	2.3	42.0	4800
	500	2.8	37.2	5660	2.2	2.0	38.5	4970	1.2	2.00	2.4	46.0	5900
	630	2.8	41.3	7140	2.4	2.2	43.5	6400	1.2	2.00	2.5	51.0	7400
	800	2.8	-	-	2.6	2.3	48.0	8000	1.4	2.00	2.8	57.0	9400
	1000	3.0	-	-	2.8	2.4	53.2	10200	1.4	2.00	2.9	62.0	11000
Two Cores	1.5	-	-	-	0.7	1.8	10.4	150	1.0	0.90	1.8	15.0	400
	2.5	-	-	-	0.7	1.8	11.2	180	1.0	0.90	1.8	16.0	450
	4	-	-	-	0.7	1.8	12.3	240	1.0	0.90	1.8	17.0	530
	6	-	-	-	0.7	1.8	13.5	300	1.0	0.90	1.8	18.0	620
	10	-	-	-	0.7	1.8	15.7	420	1.0	1.25	1.8	20.0	900
	16	-	-	-	0.7	1.8	17.8	590	1.0	1.25	1.8	22.0	1050
	25	-	-	-	0.9	1.8	21.2	860	1.0	1.60	1.8	26.5	1600
	35	-	-	-	0.9	1.8	23.7	1120	1.0	1.60	1.9	29.0	1964

A Unarmoured cables
B Armoured cables

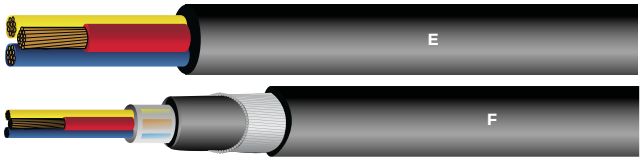


600/1000V, Unarmoured and Armoured LSF Cables

Table 2

	(C) Unarmoured Cables					(D) Armoured Cables				
	Nominal area of conductor	Insulation Thickness	Sheath Thickness	Approx. diameter overall	Approx. weight	Bedding Thickness	Armour wire diameter	Sheath Thickness	Approx. diameter overall	Approx. weight
	mm^2	mm	mm	mm	kg/km	mm	mm	mm	mm	kg/km
Three Cores	1.5	0.7	1.8	10.0	170	1.0	0.90	1.8	14.5	400
	2.5	0.7	1.8	11.0	215	1.0	0.90	1.8	15.4	470
	4	0.7	1.8	12.1	280	1.0	0.90	1.8	16.5	560
	6	0.7	1.8	13.3	360	1.0	1.25	1.8	16.5	770
	10	0.7	1.8	15.3	510	1.0	1.25	1.8	20.5	1000
	16	0.7	1.8	17.6	740	1.0	1.60	1.8	23.4	1400
	25	0.9	1.8	21.3	1100	1.0	1.60	1.8	28.0	1900
	35	0.9	1.8	24.0	1400	1.0	1.60	1.9	30.3	2400
	50	1.0	1.8	27.1	1900	1.0	1.60	2.1	34.5	3140
	70	1.1	2.0	32.0	2600	1.2	2.00	2.2	39.5	4150
	95	1.1	2.1	37.0	3500	1.2	2.00	2.4	43.9	5400
	120	1.2	2.3	42.0	4400	1.4	2.50	2.6	49.6	6830
	150	1.4	2.4	45.0	5500	1.4	2.50	2.7	54.1	8080
	185	1.6	2.6	50.3	6800	1.4	2.50	2.9	59.4	9720
	240	1.7	2.8	56.8	8800	1.6	2.50	3.1	66.3	12000
	300	1.8	3.0	62.8	10900	1.6	3.15	3.3	74.0	15500
Four Cores	1.5	0.7	1.8	10.8	180	1.0	0.90	1.8	15.3	450
	2.5	0.7	1.8	11.8	240	1.0	0.90	1.8	16.3	530
	4	0.7	1.8	13.1	320	1.0	1.25	1.8	18.3	740
	6	0.7	1.8	14.7	430	1.0	1.25	1.8	19.6	900
	10	0.7	1.8	16.7	629	1.0	1.25	1.8	21.9	1150
	16	0.7	1.8	19.3	870	1.0	1.60	1.8	25.3	1620
	25	0.9	1.8	23.4	1330	1.0	1.60	1.9	30.0	2260
	35	0.9	1.8	26.4	1770	1.0	1.60	2.0	33.9	3060
	50	1.0	1.8	30.0	2330	1.2	2.00	2.2	37.9	3860
	70	1.1	2.1	35.5	3350	1.2	2.00	2.3	43.1	5080
	95	1.1	2.3	40.4	4530	1.4	2.50	2.6	49.5	6980
	120	1.2	2.4	45.1	5710	1.4	2.50	2.7	54.2	8420
	150	1.4	2.6	50.1	7000	1.6	2.50	2.9	59.7	10080
	185	1.6	2.8	56.0	8770	1.6	2.50	3.1	65.6	12190
	240	1.7	3.0	63.3	11360	1.6	3.15	3.4	74.3	16050
	300	1.8	3.2	70.1	14200	1.6	3.15	3.6	81.5	19420

C Unarmoured cables
D Armoured cables
* Multicore unarmoured and armoured fire resistant cables are available upon request

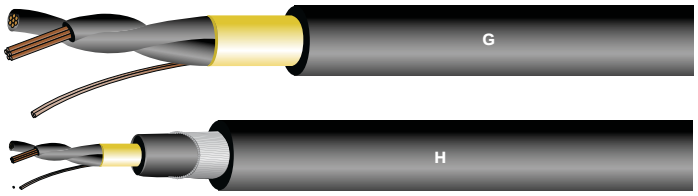


300/500V, Unarmoured and Armoured LSF Cables

Table 3

	(E) Unarmoured Cables						(F) Armoured Cables				
	Nominal area of conductor	No. & Diameter of wires	Insulation Thickness	Sheath Thickness	Approx. diameter overall	Approx. weight	Bedding Thickness	Armour wire diameter	Sheath Thickness	Approx. diameter overall	Approx. weight
	mm^2	No./mm	mm	mm	mm	kg/km	mm	mm	mm	mm	kg/km
Single Core	0.75	7/0.37	0.55	0.5	4.1	22	0.5	0.9	1.4	8.9	155
	1	7/0.44	0.55	0.5	4.3	26	0.5	0.9	1.4	9.1	165
	1.5	7/0.53	0.55	0.5	4.6	32	0.5	0.9	1.4	9.4	180
	2.5	7/0.67	0.55	0.5	5.0	43	0.5	0.9	1.4	9.8	200
	4	7/0.85	0.55	0.5	5.6	60	0.5	0.9	1.4	10.4	240
Two Cores	0.75	7/0.37	0.55	0.5	7.0	64	0.5	0.9	1.4	11.8	285
	1	7/0.44	0.55	0.5	7.4	74	0.5	0.9	1.4	12.2	310
	1.5	7/0.53	0.55	0.5	8.0	92	0.5	0.9	1.4	12.8	345
	2.5	7/0.67	0.55	0.5	8.8	120	0.5	0.9	1.4	13.6	400
	4	7/0.85	0.55	0.5	9.9	165	0.5	0.9	1.4	14.7	475
Three Cores	0.75	7/0.37	0.55	0.5	7.5	75	0.5	0.9	1.4	12.3	310
	1	7/0.44	0.55	0.5	7.9	88	0.5	0.9	1.4	12.7	355
	1.5	7/0.53	0.55	0.5	8.5	110	0.5	0.9	1.4	13.3	375
	2.5	7/0.67	0.55	0.5	9.4	150	0.5	0.9	1.4	14.2	445
	4	7/0.85	0.55	0.5	10.6	205	0.5	0.9	1.4	15.4	535
Four Cores	0.75	7/0.37	0.55	0.5	8.3	90	0.5	0.9	1.4	13.1	360
	1	7/0.44	0.55	0.5	8.7	105	0.5	0.9	1.4	13.5	380
	1.5	7/0.53	0.55	0.5	9.4	135	0.5	0.9	1.4	14.2	430
	2.5	7/0.67	0.55	0.5	10.4	180	0.5	0.9	1.4	15.2	500
	4	7/0.85	0.55	0.5	11.7	255	0.5	0.9	1.4	16.7	620

E Unarmoured fire resistant cable
F Armoured fire resistant cable
* Multicore unarmoured and armoured fire resistant cables are available upon request



300/500V, Unarmoured and LSF Cables

Table 4

	(E) Unarmoured Cables						(F) Armoured Cables				
	Nominal area of conductor	No. & Diameter of wires	Insulation Thickness	Sheath Thickness	Approx. diameter overall	Approx. weight	Bedding Thickness	Armour wire diameter	Sheath Thickness	Approx. diameter overall	Approx. weight
	mm^2	No./mm	mm	mm	mm	kg/km	mm	mm	mm	mm	kg/km
One pair	0.75	7/0.37	0.5	0.8	7.9	65	0.8	0.9	1.4	12.7	300
	1	7/0.43	0.6	0.8	8.5	75	0.8	0.9	1.4	13.3	340
	1.5	7/0.53	0.5	0.8	9.1	90	0.8	0.9	1.4	13.9	370
	2.5	7/0.67	0.6	0.8	9.9	110	0.8	0.9	1.4	14.7	420
Two pair	0.75	7/0.37	0.5	0.8	10.0	100	0.8	0.9	1.4	14.8	410
	1	7/0.43	0.6	0.9	11.0	125	0.9	0.9	1.4	15.8	460
	1.5	7/0.53	0.6	0.9	11.8	150	0.9	0.9	1.5	16.8	520
	2.5	7/0.67	0.6	1.0	13.1	205	1.0	0.9	1.5	18.1	605
Three pair	0.75	7/0.37	0.5	1.0	12.2	145	1.0	0.9	1.5	17.2	565
	1	7/0.43	0.6	1.0	13.1	170	1.0	0.9	1.5	18.1	600
	1.5	7/0.53	0.6	1.0	14.1	215	1.0	0.9	1.6	19.3	655
	2.5	7/0.67	0.6	1.1	15.7	290	1.1	1.25	1.6	21.6	920
Four pair	0.75	7/0.37	0.5	1.0	13.7	180	1.0	0.9	1.5	18.7	600
	1	7/0.43	0.6	1.0	14.7	215	1.0	1.25	1.6	20.6	820
	1.5	7/0.53	0.6	1.1	16.1	280	1.1	1.25	1.6	22.0	920
	2.5	7/0.67	0.6	1.1	17.7	370	1.1	1.25	1.6	23.8	1090

G Unarmoured fire resistant cable
H Armoured fire resistant cable
* Multi-pairs unarmoured and armoured shielded fire resistant cables are available upon request

TECHNICAL INFORMATION

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OF SMARTER AND GREENER POWER GR

STRONGER PLATFORM

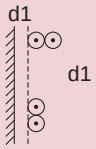
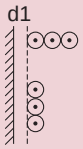
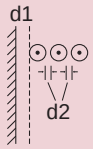
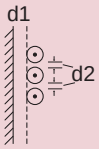
Cables installed in free air

Plain annealed stranded conductor, mica tape lapping, XLPE insulated, LSHF cables, 600/1000V

Conditions of installation:

Ambient temperature : 30°C
Maximum Conductor temperature : 90°C

Table 1

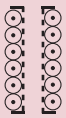
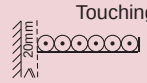
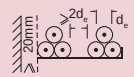
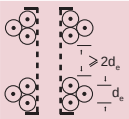
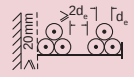
Nominal area of conductor mm²	INSTALLATION METHODS						
	Single Core Cable					Multicore Cable	
	2-Single Cores Touching	2-Single Cores Touching	3-Single Cores Trefoil	3-Single Cores Spaced Horizontal	3-Single Cores Spaced Vertical	2 Loaded Conductor	3 Loaded Conductor
	A 	B 	C 	D 	E 	F 	G 
1.5	27	23	22	27	23	26	23
2.5	35	31	30	37	31	36	32
4	49	42	40	52	44	49	42
6	63	54	52	67	55	63	54
10	88	76	73	95	76	86	75
16	137	100	96	150	112	115	100
25	161	141	135	182	161	149	127
35	200	176	169	226	201	185	157
50	242	215	207	275	246	225	192
70	310	279	268	353	318	289	246
95	377	341	328	430	389	352	298
120	437	399	382	500	454	410	346
150	504	462	443	577	527	473	399
185	575	531	509	661	605	542	456
240	679	631	604	781	719	641	538
300	783	731	699	902	833	741	620
400	940	880	839	1085	1008	-	-
500	1083	1006	958	1253	1169	-	-
630	1254	1117	1077	1454	1362	-	-
800	1460	1262	1152	1696	1595	-	-
1000	1683	1432	1240	1958	1847	-	-

Group installation correction factor for methods A to E, please refer to Table 2
Group installation correction factor for methods F to G, please refer to Table 3
Correction factors for ambient air temperature other than 30°C, please refer to Table 6
d1: Clearance to wall not less than one cable diameter
d2: Minimum 0.3 times the diameter of cable

Correction factors for groups of more than one circuit of single core cables

To be used in conjunction with current rating in Table 4 for single core cables in free air for installation methods A to G.

Table 2

Installation method (See Note 1)			Number of three-phase circuits (Note 4)				Use as a multiplier to rating for
			Numbers of trays	1	2	3	
Unperforated trays (Note 2)	H		1 2 3	0.95 0.92 0.90	0.90 0.85 0.80	0.85 0.80 0.75	Three cables in horizontal formation
Perforated trays (Note 2)	J		1 2 3	0.95 0.95 0.90	0.90 0.85 0.85	0.85 0.80 0.80	
Vertical perforated trays (Note 3)	K		1 2	0.95 0.90	0.85 0.85	- -	Three cables in vertical formation
Ladder supports, cleats, etc (Note 2)	L		1 2 3	1.00 0.95 0.95	0.95 0.90 0.90	0.95 0.90 0.85	Three cables in horizontal formation
Unperforated trays (Note 2)	H		1 2 3	1.00 0.95 0.95	0.95 0.90 0.90	0.95 0.85 0.85	Three cables in trefoil formation
Perforated trays (Note 2)	J		1 2 3	1.00 0.95 0.95	1.00 0.95 0.90	0.95 0.90 0.85	
Vertical perforated trays (Note 3)	K		1 2	1.00 1.00	0.90 0.90	0.90 0.85	
Ladder supports, cleats, etc (Note 2)	L		1 2 3	1.00 0.95 0.95	1.00 0.95 0.95	1.00 0.95 0.90	

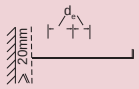
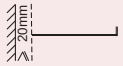
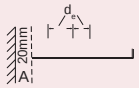
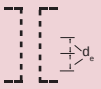
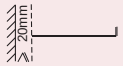
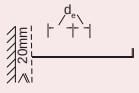
Notes:

1. Factors are given for single layers of cables (for trefoil groups) as shown in the tables and DO NOT apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.
2. Values are given for a vertical spacing between trays of 300mm. For closer spacing the factors should be reduced.
3. Values are given for a horizontal spacing between trays of 225mm. with tray mounted back to back. For closer spacing the factors should be reduced.
4. For circuits having more than one cable in parallel per phase, each set of three conductors should be considered as a circuit for the purposes of this tables.

Correction factors for groups of more than one multicore cable

To be used in conjunction with current ratings in Table 1 for multicore cables in free air for installation methods F to G.

Table 3

Installation method			Number of trays	Number of cables					
				1	2	3	4	6	9
Unperforated trays (Note 2)	M	Touching 	1 2 3	0.95 0.95 0.95	0.85 0.85 0.85	0.80 0.75 0.75	0.75 0.75 0.70	0.70 0.70 0.65	0.70 0.65 0.60
		Spaced 	1 2 3	1.00 0.95 0.95	0.95 0.95 0.95	0.95 0.90 0.90	0.95 0.90 0.90	0.90 0.85 0.85	- - -
Perforated trays (Note 2)	N	Touching 	1 2 3	1.00 1.00 1.00	0.90 0.85 0.85	0.80 0.80 0.80	0.80 0.75 0.75	0.75 0.75 0.70	0.75 0.70 0.65
		Spaced 	1 2 3	1.00 1.00 1.00	1.00 1.00 1.00	100 0.95 0.95	0.95 0.90 0.90	0.90 0.85 0.85	- - -
Vertical perforated trays (Note 3)	O	Touching 	1 2	1.00 1.00	0.90 0.90	0.80 0.80	0.75 0.75	0.75 0.70	0.70 0.70
		Spaced 	1 2	1.00 1.00	0.90 0.90	0.90 0.90	0.90 0.85	0.85 0.85	- -
Ladder supports cleats, etc. (Note 2)	P	Touching 	1 2 3	1.00 1.00 1.00	0.85 0.85 0.85	0.80 0.80 0.80	0.80 0.80 0.75	0.80 0.75 0.75	0.80 0.75 0.70
		Spaced 	1 2 3	1.00 1.00 1.00	1.00 1.00 1.00	1.00 1.00 0.95	1.00 0.95 0.95	1.00 0.95 0.95	- - -

Notes:

1. Factors apply to single layer groups of cables as shown above and do NOT apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.
2. Values are given for a vertical spacing between trays of 300mm. for closer vertical spacing the factors should be reduced.
3. Values are given for a horizontal spacing between trays of 225mm with trays mounted back to back. For closer spacing the factors should be reduced.

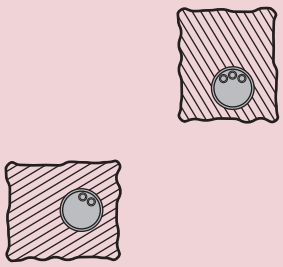
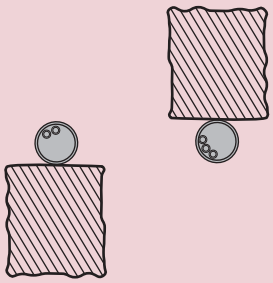
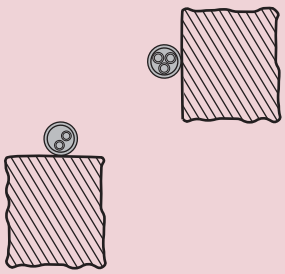
Cables in conduit and trunking, and bunched cables on a surface

Plain annealed stranded conductor, mica tape tapping, XLPE insulated, LSHF cables, 600/1000V

Conditions of installation:

Ambient temperature : 30°C
Maximum Conductor temperature : 90°C

Table 4

Nominal area of conductor	Insulated conductors in R		Insulated conductors in S		Multicore cable on a wall T	
	2 loaded Conductor	3 loaded Conductor	2 loaded Conductor	3 loaded Conductor	2 loaded Conductor	3 loaded Conductor
						
mm²	Amp		Amp		Amp	
1.5	19	17	23	20	24	22
2.5	26	23	31	27	33	30
4	35	31	42	37	45	40
6	45	40	54	48	58	52
10	61	54	74	66	80	71
16	81	73	100	89	107	96
25	106	95	133	117	138	119
35	131	117	164	144	171	147
50	158	141	198	175	210	179
70	200	179	254	222	269	229
95	241	216	306	269	328	278
120	278	249	354	312	382	322
150	318	285	-	-	441	371
185	362	324	-	-	506	424
240	424	380	-	-	599	500
300	486	435	-	-	693	576
400	579	519	-	-	860	692
500	664	595	-	-	994	797
630	765	685	-	-	1155	923
800	885	792	-	-	1349	1074
1000	1014	908	-	-	1560	1237

For group correction factors, please refer to Table 5
Correction factors for ambient temperature other than 30°C, refer to Table 6

Correction factors for cables in conduit and trunking, and bunched cables on a surface

Correction factors for groups of more than one circuit or more than one multicore cable.
To be used in conjunction with ratings for cables in Table 4.

Table 5

Item	Arrangement of Cables		Correction factors													
			Number of circuits or multicore cables													
			1	2	3	4	5	6	7	8	9	10	12	14	16	18	20
1	Bunched on a surface or enclosed in conduit or trunking		1.00	0.80	0.70	0.65	0.60	0.55	0.55	0.50	0.50	0.50	0.45	0.45	0.40	0.40	0.40
2	Single-layer wall or floor	Touching	1.00	0.85	0.80	0.75	0.75	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.65	0.65	0.65
3		Spaced	1.00	0.95	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
4	Single-layer under ceiling	Touching	0.95	0.80	0.70	0.70	0.65	0.65	0.65	0.60	0.60	0.60	0.60	0.60	0.55	0.55	0.55
5		Spaced	0.95	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

Notes:

1. These factors are applicable to uniform groups of cables, equally loaded.
2. Where horizontal clearance between adjacent cables exceeds twice their overall diameter, no reduction factor need be applied.
3. "Spaced" cables means a clearance between adjacent surfaces of one cable diameter.
4. The same correction factors are applied to:
   -groups of two or three single-core cables;
   -multicore cables.
5. If a system consists of both two and three core cables, the total number of cables is taken as the number of circuits, and the corresponding correction factor is applied to the tables for two loaded conductors for the two-core cables, and to the tables for three loaded conductors for the three-core cables.
6. If a group consists of n loaded single-core cables it may either be considered as n/2 circuits of two loaded conductors or n/3 circuits of three loaded conductors.

Correction factors for ambient air temperature other than 30°C

Table 6

Ambient temperature ^{0}C	10	15	20	25	35	40	45	50	55	60	65	70	75	80
Correction factors	1.15	1.12	1.08	1.04	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41

Voltage drop table (Unarmoured Cable)

Voltage drop for single core cables per amp per metre

Table 7

Nominal area of conductor (mm^2)	For		For (mV)	For (mV)	For (mV)
	AC (mV)	DC (mV)			
1.5	30.86	30.86	26.73	26.73	26.73
2.5	18.90	18.90	16.37	16.37	16.37
4	11.76	11.76	10.19	10.19	10.19
6	7.86	7.86	6.81	6.81	6.81
10	4.67	4.66	4.04	4.04	4.05
16	2.95	2.94	2.55	2.55	2.56
25	1.87	1.85	1.62	1.62	1.63
35	1.35	1.34	1.17	1.17	1.19
50	1.01	0.99	0.87	0.88	0.90
70	0.71	0.68	0.61	0.62	0.65
95	0.52	0.49	0.45	0.45	0.50
120	0.43	0.39	0.37	0.38	0.42
150	0.36	0.32	0.32	0.33	0.37
185	0.30	0.25	0.26	0.28	0.33
240	0.25	0.19	0.22	0.24	0.29
300	0.22	0.15	0.20	0.21	0.28
400	0.20	0.12	0.17	0.20	0.26
500	0.19	0.093	0.16	0.18	0.25
630	0.18	0.072	0.15	0.17	0.25
800	0.17	0.056	0.15	0.17	0.24
1000	0.16	0.045	0.14	0.16	0.24

Voltage drop for multi-core cables per amp per metre

Table 8

Nominal area of conductor (mm^2)	For twin-core		For 3 and 4 cores (mV)
	AC (mV)	DC (mV)	
16	2.90	2.90	2.60
25	1.90	1.90	1.60
35	1.30	1.30	1.20
50	1.00	0.99	0.87
70	0.70	0.68	0.61
95	0.52	0.49	0.45
120	0.42	0.39	0.36
150	0.35	0.32	0.30
185	0.29	0.25	0.25
240	0.24	0.19	0.21
300	0.21	0.15	0.19

Cable laid direct in ground

Single Core

Plain annealed stranded copper conductor, mica tape tapping, XLPE insulated, Aluminium or copper wire armoured, LSHF cables, 600/1000V

Table 9

Nominal Area of Conductor	Single Core (Aluminium wire armoured)					
	Two cables touching				Three cables trefoil (touching) 3-phase	
	Single-phase (ac)		dc			
mm²	Current rating Amp	Approx volt drop per Amp per metre mV	Current rating Amp	Approx voltdrop per Amp per metre mV	Current rating Amp	Approx volt drop per Amp per metre mV
50	275	0.99	275	0.99	235	0.86
70	340	0.70	340	0.68	290	0.61
95	405	0.53	410	0.49	345	0.46
120	460	0.43	470	0.39	390	0.37
150	510	0.37	530	0.32	435	0.32
185	580	0.31	600	0.25	490	0.27
240	670	0.26	690	0.19	560	0.23
300	750	0.24	790	0.15	630	0.21
400	830	0.21	910	0.12	700	0.19
500	910	0.20	1030	0.093	770	0.18
630	1000	0.19	1200	0.072	840	0.17
800	1117	0.18	1422	0.056	931	0.16
1000	1254	0.17	1683	0.045	1038	0.15

Twin and Multi Core

Plain annealed stranded copper conductor, mica tape tapping, XLPE insulated, LSHF bedded, Galvanised steel wire armoured, LSHF sheathed cables, 600/1000V

Table 10

Nominal Area of Conductor	Direct in ground					
	Two-Core cable				Three or Four Core Cable	
	Single-phase (ac)		dc			
mm²	Current rating Amp	Approx volt drop per Amp per metre mV	Current rating Amp	Approx volt drop per Amp per metre mV	Current rating Amp	Approx volt drop per Amp per metre mV
16	140	2.90	140	2.90	115	2.60
25	180	1.90	180	1.90	150	1.60
35	215	1.30	215	1.30	180	1.20
50	255	1.00	255	0.99	215	0.87
70	315	0.70	315	0.68	265	0.61
95	380	0.52	380	0.49	315	0.45
120	430	0.42	435	0.39	360	0.36
150	480	0.35	490	0.32	405	0.30
185	540	0.29	560	0.25	460	0.25
240	630	0.24	650	0.19	530	0.21
300	700	0.21	740	0.15	590	0.19

For group correction factors, please refer to Table 12. Correction factors for ground temperatures other than 15°C, refer to Table 14

Conditions of installation (for Table 9 & 10):

Ground temperature : 15°C
Depth of laying : 0.5m
Soil thermal resistivity : 1.2°C m/w
Maximum conductor operating temperature at rated current : 90°C

Note:
Ratings given are for single circuits installed thermally independent of any other heat source.

Cables run in single way ducts

Plain annealed stranded copper conductor, mica tape tapping, XLPE insulated, armoured, LSHF cables, 600/1000V

Table 11

Nominal area of conductor	Single Core				Two-Core		Three or Four Core	
	Two cables ducts touching		Three cables ducts touching,trefoil					
	Current rating	Approx volt drop per Amp per metre	Current rating	Approx volt drop per Amp per metre	Current rating	Approx volt drop per Amp per metre	Current rating	Approx volt drop per Amp per metre
mm^2	Amp	mV	Amp	mV	Amp	mV	Amp	mV
16	-	-	-	-	115	2.90	94	2.6
25	-	-	-	-	145	1.90	125	1.6
35	-	-	-	-	175	1.30	150	1.2
50	255	1.10	235	0.93	210	1.00	175	0.87
70	310	0.80	280	0.70	260	0.70	215	0.61
95	365	0.65	330	0.56	310	0.52	260	0.45
120	410	0.55	370	0.48	355	0.42	300	0.36
150	445	0.50	405	0.43	400	0.35	335	0.30
185	485	0.45	440	0.39	455	0.29	380	0.25
240	550	0.40	500	0.35	520	0.24	440	0.21
300	610	0.37	550	0.32	590	0.21	495	0.19
400	640	0.35	580	0.30	-	-	-	-
500	690	0.33	620	0.28	-	-	-	-
630	750	0.30	670	0.26	-	-	-	-
800	828	0.28	735	0.24	-	-	-	-
1000	919	0.26	811	0.22	-	-	-	-

For group correction factors, please refer to Table 13
Correction factors for ground temperatures other than 15°C, refer to Table 14

Conditions of installation:

Ground temperature : 15°C
Depth of laying : 0.5m
Soil thermal resistivity : 1.2°C m/w
Maximum conductor operating temperature at rated current : 90°C
Ambient air temperature : 25°C

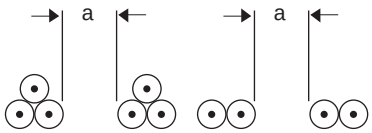
Note:
*Single core cables are aluminium wire armoured for a.c. system.
Ratings given are for single circuits installed thermally independent of any other heat source.

Correction factors for more than one circuit, cables laid directly in the ground

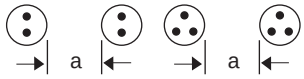
Table 12

Number of circuits	Cable to cables clearance (a)				
	Nil (cables touching)	One cable diameter	0.215m	0.25m	0.5m
2	0.75	0.80	0.85	0.90	0.90
3	0.65	0.70	0.15	0.80	0.85
4	0.60	0.60	0.70	0.75	0.80
5	0.55	0.55	0.65	0.70	0.80
6	0.50	0.55	0.60	0.70	0.80

Single-core cables



Multicore cables



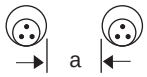
Correction factors for more than one circuit, cables laid directly in ducts in the ground

A – Multicore cables in single-way ducts

Table 13

Number of cables	Duct to duct clearance (a)			
	Nil (ducts touching)	0.25m	0.5m	1.0m
2	0.85	0.90	0.95	0.95
3	0.75	0.85	0.90	0.95
4	0.70	0.80	0.85	0.90
5	0.65	0.80	0.85	0.90
6	0.60	0.80	0.80	0.90

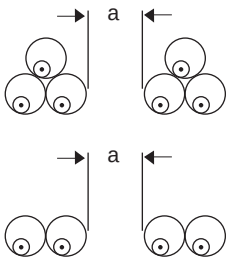
Multicore cables



B – Single-core cables in single-way ducts

Number of single-core circuits of two or three cables	Duct to duct clearance (a)			
	Nil (ducts touching)	0.25m	0.5m	1.0m
2	0.80	0.90	0.90	0.95
3	0.70	0.80	0.85	0.90
4	0.65	0.75	0.80	0.90
5	0.60	0.70	0.80	0.90
6	0.60	0.70	0.80	0.90

Single-core cables



Correction factors for ground temperatures other than 15°C

Table 14

Ground temperature °C	10	15	20	25	30	35	40	45	50
Correction factor	1.03	1.00	0.97	0.93	0.89	0.86	0.82	0.76	0.72

Another important factor for the determination of the conductor size is maximum allowable current during a short circuit when the maximum allowable conductor temperature is higher than during normal operation.

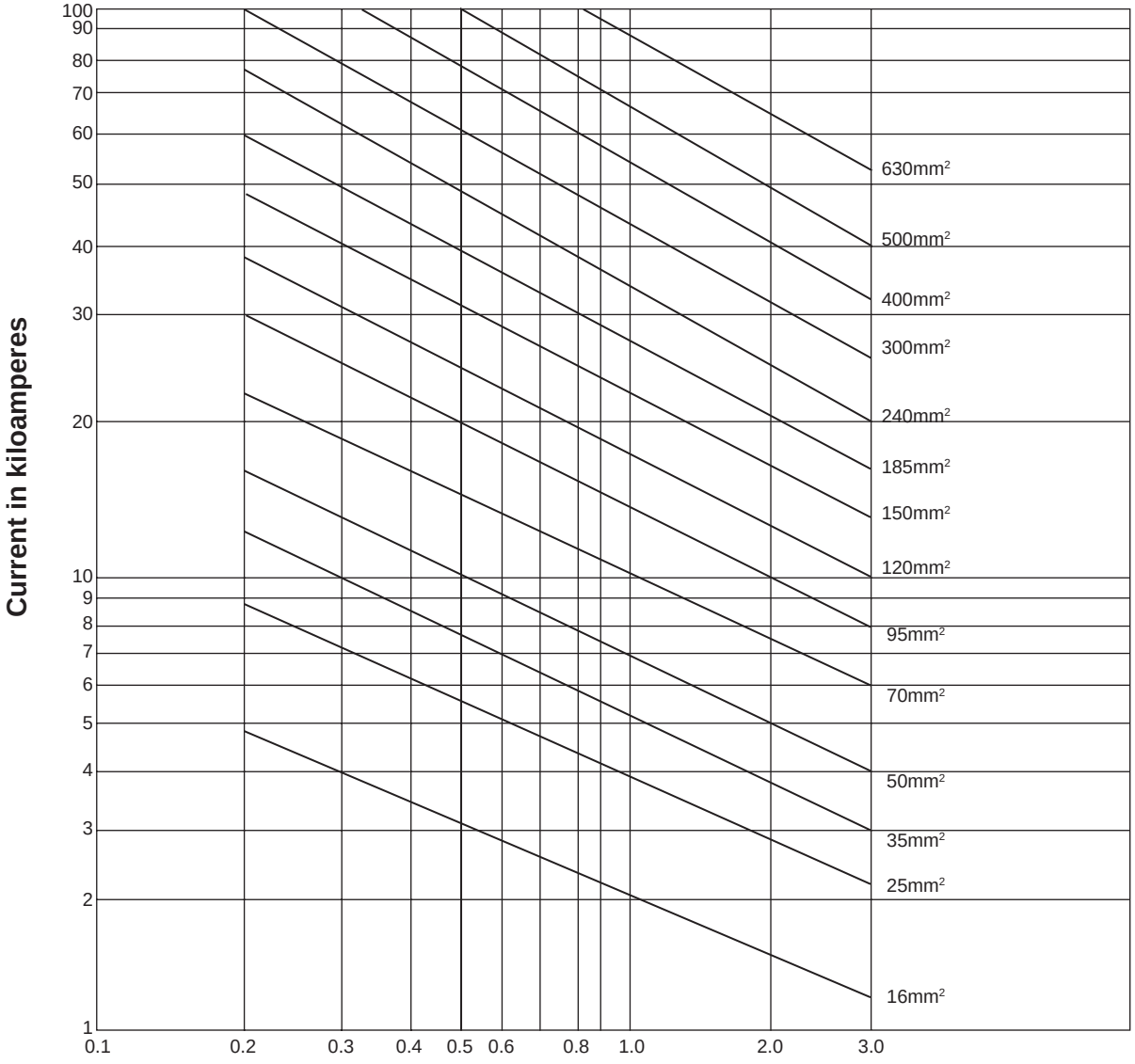
The maximum permissible short circuit of XLPE cables up to 1kV with copper conductors can be calculated with following formula:

$$1k = \frac{S}{\sqrt{t}} * K$$

Where 1k = Maximum permissible short circuit current in Ampere
S = Conductor area in mm2
t = Duration of short circuit process in seconds. Maximum value for t = 5 second
K = Constant of 143 for copper conductors and temperature rising 90 degree C to 250 degree C

Copper Conductors

The values of fault current given in the graph are based on the cable being fully loaded at the state of the short circuit (conductor temperature 90^{O}C) and a final conductor temperature of 250^{O}C, and it should be ensured that the accessories associated with the cable are also capable of operation at these values of fault current.



Maximum conductor resistance

Table 15

Cross Section Area (S) mm²	Conductor for fixed wiring Class 1 (solid) Class 2 (stranded) ohm/km at 20°C
0.50	36.0
0.75	24.5
1.00	18.1
1.50	12.1
2.50	7.41
4	4.61
6	3.08
10	1.83
16	1.15
25	0.727
35	0.524
50	0.387
70	0.268
95	0.193
120	0.153
150	0.124
185	0.0991
240	0.0754
300	0.0601
400	0.0470
500	0.0366
630	0.0283
800	0.0221
1000	0.0176

Electrical Characteristics

Table 16

Conductor Resistance Temperature Correction Factors			
Temp°C	Factor	Temp°C	Factor
10	0.961	25	1.020
11	0.965	30	1.039
12	0.969	35	1.059
13	0.972	40	1.079
14	0.976	45	1.098
15	0.980	50	1.118
16	0.984	55	1.138
17	0.988	60	1.157
18	0.992	65	1.177
19	0.996	70	1.196
20	1.000	75	1.216
21	1.004	80	1.236
22	1.008	80	1.255
23	1.012	90	1.275
24	1.016		

A Glimpse of Our Project Reference ASEAN

Australia
Cross City Tunnel
Eastern Distribution Tunnel
Lane Cove Tunnel
M5 Motorway
Parramatta Rails
Proggo Road Busway

Brunei
700 Units Housing Development
Balai Bomba at Perumahan Kg Bt Beruang, Tutong
Balai Bomba Dan Perumahan Kampong Mentiri
BLNG / Refinery CCTV
LBNG Cooling Tower
BLNG Power Plant
Brunei Methanol Plant
BSP CER (Containerised Equipment Room)
BSP DATA Centre
BSP Magpie Platform
BSP Mampak Platform
BSP Seria North Flank
BSP Supplies
BSP Tank Major Repair
Centre Point Hotel updraging
DES Supplies
DES Supply
Empire Hotel upgrading
Kg Kilanas Mosque
Kiulap Mall
Light Industry Show at Kg Katimahar, Sengkurong
Magistrate Court
Maraburong Prison
Naval Base
New Building For Brunei Muara District
Radio TV Brunei
RTB (Radio TV Brunei)
SCOT Rejuvenisation
Shell Brunei Refinery
Tutong Street Lighting
Various Schools

Hong Kong
Caribbean Coast
Disneyland
Elements Shopping Center
Enterprise Square Five Mega Box Mall
Four Season Hotel
Grand Promenade
Harbor Front Horizon
Hong Kong International Airport
Hong Kong Science Park
Hong Kong-Shenzhen Western Corridor Bridge
ICAC Headquarter
Kowloon, Tsingyi, Iai King, Olympic, Tsuen Wan West MRT Station
Movie City
One Beacon Hill
Pok Oi Hospital
Taiwan, Kam Sheung, Fotan MRT stations

Indonesia
Australia Embassy
British Embassy
Ciputra World
DATA Centre at Surabaya
Kemmang Village Apt
Life Style Kuta Bali
LOTTE Mart Bintaro
Mall Summarecon
Mayapada Hospital
SILOAM Hospital
ST Moritz
TANG City Mall
TEMPO Scan
TRANS Studio Bandung

Macau
Macao Sands Casino
Macua Airport Extension
Ponte 16 Casino
Venetian Expo, Theater & Arena
Venetian Parcel 1 Casino

Malaysia
ALAM DAMAI
BANK NEGARA
Bank Negara Malaysia, Cyberjaya
BASF Gebeng, Petronas
CAPITAL SQAURE KL
Customs Kelantan
CX5
CYBERJAYA PRIMA 9 & 10
CYGAL PROPERTIES
Good Wood Hotel, JB
GOOGLE DATA CENTER
Jatya Jusco, Bukit Indah, JB
JB Project
KINRARA MAS PUCHONG
KLIA 2 MOV CPMMUNICATION
KLIA SPUR LINE
Kuantan & Segament Compressor Expansion Project
LHDNM – CYBERJAYA
Light Rail Transit Station
LOT C, KLCC
LYNAS
MCOT Petronas
Megasteel
MELODY HOME PROJECT
MEMC
Midvalley Magamall
MLNG – Fire & Gas System, Metering Station 1
MyDin Hypermarket
PACIFIC FOOD
PAHLAWAN
PAJAM SOLAR FARM
PEMBINAAN PEJABAT TANAH & GALIAN PAHANG
Petronas Refinery Melaka
Petronas Twin Towers
RAUB AUSTRALIAN GOLD MINE PROJECT
S-COGENNERATION Project
SGL CARBON BANTING
Shell offshore Platform B11, F6, F26
SMART Tunnel Project
SPMY – HK SL SUNPOWER
SUBANG AVENUE
SUNPOWER PROJECT SITE (SPMY-HK 8L)
Tawakai Hospital
Teluk Salut, Tanhill Power
Tenaga National Berhad SCADA System
TNB
TNB SCADA System
UOA Holding Berhad – 2 Block Condominium at Bangsar South
UTUSAN MALAYSIA
Wisma Lee Rubber
WISMA PERSEKUTUAN AT MITC MELAKA
WTP

Singapore
A posh Bizhub
Alstom Metropolis C830
Anchor Handling Tug/Supply AHTS – Ice Class
Breadtalk Building
CAAS Terminal 3 CCTV
Changi Airport T3
Changi International Airport
Changi PMS Electrical Works
Changi Prison CCTV
Changi Water Reclamation Plant
Circle Line Stage 3 – Mechanical
Circle Line Stage 3,4,5 – Electrical
Common Service Tunnel – Marina
Credit Suisse Datacenter
Deutsche Bank @ Mapletree Business City
Downtown line singal package, C955, C956, C960, C961
Downtown Ling State 1 (M&E)
Downtown Ling State 2 (M&E)
Exxon Mobile Singapore Parallel Train, Jurong Island
Exxon Mobile Singapore Parallel Train 2, Jurong Island
Formula One Grand Prix – Pitstop
Formula One Night Race
Garden by the Bay
HDB Commercial, Industrial & Residential Buildings
Ion Orchard
Islamic Hub
Kallang Paya Lebar Expressway
LTA Circle Line C830, C414
LTA KPE Expressway C415
Management Development Institute of Singapore (MDIS)
Marina Coastal Expressway C461
Marina Coastal Expressway C466
Marina Sands Integrated Resort
MSD Pharmaceutical Facility
North South Line Extension (Electrical), C1565
North South Line Extension (Mechanical), C1563
Orchard Gateway
Orchard Turn Shopping Center
OTS10 (Oil Tanking) Project
Oxley Bizhub 1 & 2
Presidential ISTANA CCTV
PSA Corporation Harbor projects
Regal Theatre
Renewable Energy Consortium
Savvis Datacenter
Schering Plough Expansion
SG2 Equinox Datacenter
SGH Heart Center
SGH Pathology Center
Shell Bukom C2 Jetty
Shell Houdini, Bukom Refinery
Shell MEG Air Liquide Project
Singapore Sports Hub
St James Power Station
The Baywater Condo
The Pier@ Robertson Quay
The Pinnacle Collection, Sentosa Cove
The SAIL Condo
Tuas Incineration Plant
Tuas undersea Tunnel
UE Bizhub East @ Changi Business Park
Vopak Horizon Project PII & PIII
Yen San Building, Orchard
Yong Loo Lin School of Medicine
Zion Bishan Bible – Presbyterian Church

Thailand
Airport Rail Link
Ban Rachaprasong Rachadomri
Bangchart Combine Heat & Power Plant
Bangkok Bank Building
Bangkok Metropolitan Administration
Bangkok Transit Systems (BTS)
Bangsui Watereastment
Baromchonranee Tunnel Road
BNC
Chulalongkorn University
Expressway Thailand Authority
Glow Power 115 MW CFB#3
Honda New Factory – 3
Jasmine Telecom
KLT – 8
Love Beach Hotel
LP Hospitality
Mahidol University (Dentistry Department)
Maneeya
Mass Rapid Transit System (MTRA – Blue Line)
MEA 230 KV Transmission Tunnel
MEA 230kV Underground Transmission Line Between Bangkapi and Chidlom
MEA PM2-0030-WBA Modification of 69 Kv Circuit Breaker 9 Substations
Novotel Airport Hotel
Pre Clinic Siriraj Hospital
Prin Natathiwas, Prin Ratchaprerob
PTT RSP & GSP#6 Plant
Ramkamkhang University
Ricoh (RMT) New Factory
Samart Ministry of Defense Southern Province CCTV
SCB Data center
Siam Cement Group Chemicals THPP#3
Suvanabhumi International Airport (SBIA)
Thammasat University Rangsit
Thappline – Ethanol & Gasohol
The RoomRadchada
Triple T Broadband Project
True Multimedia
United International Highway

Vietnam
Ca Mau Pipeline
Can Tho Airport
Dung Quat Oil Refinery
Fideco Building, HCMC
Gemadept Tower
Hanoi Museum
Hyatt Hotel
IndoChina Plaza Hanoi
Park Hyatt HCM
RMIT University HCM
Saigon Pearl Condominuim
Thi VI LPG Storage Tanks Development
Vietcombank Tower HCM

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