

Senarai Kategori EMAL

### #1 Pilih nama kategori

### Electrical Material Approved List EMAL

#### Pengumuman



Gear bagi bahan
LED Downlight
an housing yang
selaras dengan
esifikasi JKR L-
ation for Low
4 5 6 7

Pengenalan



EMAL adalah laman web yang memaparkan senarai bahan/barangan elektrik yang diluluskan oleh Jawatankuasa Kelulusan Bahan, Cawangan Kejuruteraan Elektrik JKR Malaysia. Senarai bahan/barangan elektrik tersebut adalah digunakan oleh Cawangan Kejuruteraan Elektrik JKR sahaja dan tidak boleh digunakan untuk apa jua pengiklanan atau apa jua tujuan lain.

#### SENARAI KATEGORI

No Nama Kategori Nama Sub kumpulan KABEL DAN AKSESORI EE01100 CABLES. P PENDAWAIAN G S CONDUITS & HIGH IMPACT PVC KABEL DAN AKSESORI 2 EE01110 2 CONDUITS PENDAWAIAN **BUSDUCT TRUNKING SYSTEM / CABLE** KABEL DAN AKSESORI EE01120 3 Q PENDAWAIAN MANAGEMENT SYSTEM KABEL DAN AKSESORI 4 EE01130 SWITCHES 0 PENDAWAIAN KABEL DAN AKSESORI EE01160 EARTHING SYSTEM & ACCESSORIES 5 P PENDAWAIAN KABEL DAN AKSESORI LIGHTNING PROTECTION SYSTEM 6 EE01170 2 PENDAWAIAN

Displaying 1-26 of 26 results.

Muka	Depan
Profil	

Denneland Denne

Menu Utama

Rujukan

Senarai Bahan/Barangan yang Diluluskan EMAL (Cable)

### #2 Pilih nama barang



Pengumuman

Mesyuarat JKB Bil.7/2021 telah menetapkan bahawa LED Control Gear bagi bahan / barangan LED Downlight perlu disediakan housing yang bersesuaian selaras dengan keperluan spesifikasi JKR L-S1: Specification for Low 1 a 2 a t 4 s 5 6 t 7 t 8 9 10 11 12 13 / 14 15 16 17 18 19 20 21 22 23 24 25 ketetabah mengan keperluan selaras 20 21 22 23 24 25 ketetabah mengan keperluan selaras 26 27 28 29 30 31

EA

#### SENARAI BAHAN/BARANGAN YANG DILULUSKAN

Displaying 1-7 of 7 results. Status Kod Barang Nama Barang No Barang EE01100012 PVC INSULATED CABLE (ARMOURED ) (ALUMINIUM) TAMBAHAN Q EE011001 MV CABLE TAMBAHAN Q XLPE INSULATED, PVC SHEATHED POWER CABLES EE0110010 TAMBAHAN Q (ARMOURED)(ALUMINIUM) EE0110011 PVC INSULATED CABLE (ARMOURED & NON ARMOURED) MANDATORI P XLPE INSULATED, PVC SHEATHED POWER CABLES EE011002 MANDATORI Q (ARMOURED AND NON ARMOURED) 6 EE011003 FIRE RESISTANT CABLE MANDATORI Q TAMBAHAN EE011009 MV CABLE (ALUMINIUM) Q

## Senarai Syarikat yang Diluluskan EMAL (PVC Insulated Cable)

### #3 Pilih nama syarikat

## Electrical Material Approved List EMAL

Pengumuman

JKR

Bermula pada 1 September 2021, semua permohonan bagi kategori baharu perlulah menggunakan Borang Permohonan Baharu 2021. Borang tersebut boleh dimuat turun dari laman sesawang EMAL.



Menu Utama

Muka Depan

#### DETAIL BAHAN/BARANGAN YANG DILULUSKAN

Displaying 1-30 of 33 results.

No	o Kod Barang Nama Bar		Nama Pengeluar	Jenama	Negara Pengeluar	
1	EE0110011.ME143.A149	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	TONN CABLE SDN. BHD.	TONN CABLE	MALAYSIA	Q
2	EE0110011.ME144.A150	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	MASTER TEC WIRE & CABLE SDN. BHD.	MASTER TEC	MALAYSIA	P
3	EE0110011.ME144.A150	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	MASTER TEC WIRE & CABLE SDN. BHD.	MASTER TEC	MALAYSIA	Q
4	EE0110011.ME224.A249	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	SOUTHERN CABLE	SOUTHERN CABLE	MALAYSIA	P
5	EE0110011.ME132.A139	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	UTAMA CABLES SDN. BHD.	UTAMA CABLES	MALAYSIA	Q

## Contoh I - Kelulusan PVC Insulated Cable (Armoured & Non Armoured)

#### MAKLUMAT BAHAN/BARANGAN YANG DILULUSKAN Keterangan Barangan PVC INSULATED CABLE (ARMOURED & NON ARMOURED) Kod Barangan EE0110011.ME224.A249 Nama Syarikat SOUTHERN CABLE SDN BHD Status Syarikat PENGILANG Alamat LOT 42, JALAN MERBAU PULAS, KAWASAN PERUSAHAAN KUALA KETIL. 09300 KUALA KETIL KEDAH No Telefon 044161600 No Fax 044161599 Email sc@southerncable.com.my Website www.southerncable.cc $\bigcirc$ Jenama SOUTHERN CABLE No Laporan PENSIJILAN SIRIM : PC001885 LAPORAN UJIAN SIRIM : 2014EEA0732 3 Tarikh Tamat 15-02-2021 Rujukan MS 2103 : 2007 JENIS PVC INSULATED CABLES FOR ELECTRICITY SUPPLY Catatan Negara MALAYSIA No. Rated Bil Model Voltage Size (sq.mm) of Gambar (v) Core Δ PVC/SWA/PVC - PVC INSULATED, PVC SHEATHED, 1.5, 2.5, 4, 6, 10, 2, 3 STEEL WIRE ARMOURED, STRANDED COPPER 600/1000 16, 25, 35, 50, 70, 8.4 CONDUCTOR CABLE 95 & 120



JENIS CABLE	SAIZ
PVC Insulated Cable (Armoured & Non Armoured)(copper)	1.5 mm sq dan ke atas
PVC Insulated Cable (Armoured)(Aluminium)	16 mm sq dan 25 mm sq
XLPE Insulated PVC Sheathed Power Cable (Armoured & Non Armoured)(Copper)	35 mm sq dan ke atas kecuali multicore auxiliary
XLPE Insulated PVC Sheathed Power Cable (Armoured)(Aluminium)	35 mm sq dan ke atas

Spesifikasi JKR

Multi strand conductor with a minimum 7 strands

Marking shall be durable and legible

Standard colour coded cable shall be used

The conductors shall be of stranded plain annealed copper

The conductors shall be of Class 2 (stranded conductors)

The insulation shall be suitable for continuous operation at a maximum cable temperature of 70°C (PVC Insulated Cable)

The insulation shall be suitable for continuous operation at a maximum cable temperature of 90°C (XLPE Insulated Cable)

Shall be comply with Malaysia Standard (MS) and International Electrotechnical Commission (IEC)



# Basic Elements of Electric cables

#### Conductor

• determines base current ratings

### Insulation

• determines voltage/stress levels

#### **Protective Layer**

• determines protection level and installation conditions



Class 1 – Solid Conductor

Fixed installations

- Class 2 Stranded Conductor
- Class 5 Flexible Conductor

### Types of stranded (MS IEC 60228)

- Stranded circular non-compacted conductors
- Stranded compacted circular conductors
- Stranded shaped conductors



stranded not compacted

![](_page_8_Picture_11.jpeg)

stranded compacted

![](_page_8_Picture_13.jpeg)

solid

![](_page_8_Picture_15.jpeg)

Stranded shaped

Minimum Number of strands

Class 2

Stranded conductors for single-core and multicore cables

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $											
$ \begin{array}{c c} Nominal cross-sectional area \\ \hline Nominal area \\ \hline 0.5 \\ 1 \\ 7 \\ - \\ 1 \\ 7 \\ - \\ 7 \\ 1 \\ 1$	1	2	3	4	5	6	7	8	9	10	
$ \begin{array}{c cross-sectional area} & \hline Circular conjucted (non-compacted) \\ \hline cross-sectional area} \\ \hline mm^2 & \hline Cu & A^1 & Cu & A^1 & Cu & A^1 & Cu & A^1 & \hline Metal-coated (non-compacted) \\ \hline mm^2 & \hline Cu & A^1 & Cu & A^1 & Cu & A^1 & \hline Cu & A^1 & \hline Metal-coated (non-compacted) \\ \hline mm^2 & \hline Cu & A^1 & Cu & A^1 & Cu & A^1 & \hline Cu & A^1 & \hline Metal-coated (non-compacted) \\ \hline 0.5 & 7 & & & & & & 24.5 & 24.8 & & & & & & 24.5 & 24.8 & & & & & & & & $		Minimum number Maximum resistance of wires in the conductor of conductor at 20 °C									
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Nominal	Circ	ular luctor	Circ	cular pacted	Shaped		Copper	conductor	Aluminium conductor, plain	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	cross-sectional area	(n comp	on- acted)	cond	luctor			Plain wires	Metal-coated wires	metal-coated or metal-clad wires	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $											
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	mm²	Cu	Al	Cu	AI	Cu	Al	Ω/km	Ω/km	Ω/km	
1600 43 0.0186	0.5 0.75 1 1.5 2.5 4 6 10 16 25 35 50 70 95 120 150 150 185 240 300 400 500 630 800 1000 1200 (1400) <sup>a</sup> ) 1600	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	7 <sup>2</sup> ) 7 7 7 7 7 7 7 7 19 19 19 37 37 61 61 61 61 91 91 91	66666666666666666666666666666666666666		6 6 12 15 18 30 34 53 53 53 53	6 6 6 12 15 15 30 30 30 53 53 53 	36.0 24.5 18.1 12.1 7.41 4.61 3.08 1.83 1.15 0.727 0.524 0.387 0.268 0.193 0.153 0.153 0.153 0.124 0.0601 0.0470 0.0366 0.0283 0.0221 0.0176 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.0	36.7 24.8 18.2 7.56 4.70 3.11 1.84 1.16 0.734 0.529 0.391 0.270 0.195 0.154 0.126 0.100 0.0762 0.0607 0.0475 0.0369 0.0286 0.0286 0.0224 0.0177 51		
				1		5					

![](_page_9_Picture_4.jpeg)

7 Strand

![](_page_9_Picture_6.jpeg)

19 Strand

<sup>1)</sup> Minimum number of wires not specified.

2) See Sub-clause 4.2.1.

Voltage Vesignations

- Rated Voltages
- Uo / U (Um)

\*

- $U_{\circ}$  = Rated power frequency voltage between conductor and earth or metallic screen for which the cable is designed
- U = Rated power frequency voltage between conductor for which the cable is designed
- Um = Max. value of the highest system voltage for which the equipment may be used

600 / 1000 V – For Electric Power Supply 450 / 750 V – For Electric Power & Lighting 300 / 500 V – For Electric Power & Lighting

![](_page_11_Picture_0.jpeg)

Insulating Compounds	Abbreviated Designation
a) Thermoplastic	
- Polyvinyl Chloride (PVC) intended for cable with rated voltages U_ / U $\leq$ 1.8 / 3 kV	PVC/A
b) Cross-linked	
- Ethylene propylene rubber or similar (EPM or EPDM)	EPR
- High modulus or hard grade ethylene propylene rubber	HEPR
- Cross-linked polyethylene	XLPE

# Max, Conductor Temperature for Different Types of Insulating Compounds

Insulating Compounds	Max. Conductor Temperature (° C)					
insulating Compounds	Normal operation	Short-circuit (5 sec max. duration)				
a)Polyvinyl Chloride (PVC/A)						
- Conductor cross-section ≤ 300 mm <sup>2</sup>	70	160				
- Conductor cross-section > 300 mm <sup>2</sup>	70	140				
b) Cross-linked polyethylene (XLPE)	90	250				
c) Ethylene propylene rubber	90	250				

The operating temperature of an electrical cable normally refers to the minimum and maximum temperature that the cable can safely operate at for a sustained period of time. This operating temperature is determined by the insulation and/or sheathing material around the cable.

Sheathing Compounds

Sheathing Compounds	Abbreviated Designation	Max. Conductor Temperature in Normal Condition (° C)
a) Thermoplastic		
- Polyvinyl Chloride (PVC)	ST1	80
	ST <sub>2</sub>	90
- Polyethylene	ST3	80
	ST7	90
- Halogen free	ST8	90
b) Elastomeric		
- polychlorophene, chlorosulfonated polyethylene or similar polymers	SEı	

## Insulating and sheathing Thickness (XLPE Non-Armoured-MS 2107)

The nominal and minimum thickness of insulation shall be as specified in Table 3. Each piece of core, the smallest value measured shall not fall below 90% of the nominal value by more than 0.1mm

The nominal and minimum thickness of sheath shall be as specified in Table 1. The average of the measured value rounded to 0.1mm, shall not be less than the nominal thickness.

Note: Refer relevant standard for others type of cables Table 3. Four core cables 600/1 000 (1 200) V

Nominal area of conductor	Thic	kness of lation	Thickness of bedding		Armour wire diameter	Thic	kness of sheath
(mm²)	Nominal (mm)	Minimum at any point (mm)	Nominal (mm)	Minimum at any point (mm)	Nominal (mm)	Nominal (mm)	Minimum at any point (mm)
1.5	0.7	0.53	1.0	0.60	0.9	1.8	1.24
2.5	0.7	0.53	1.0	0.60	0.9	1.8	1.24 .
1.5	0.7	0.53	1.0	0.60	0.9	1.8	1.24
2.5	0.7	0.53	1.0	0.60	0.9	1.8	1.24
4	0.7	0.53	1.0	0.60	0.9	1.8	1.24
6	0.7	0.53	1.0	0.60	1.25	1.8	1.24
10	0.7	0.53	1.0	0.60	1.25	1.8	1.24
16	0.7	0.53	1.0	0.60	1.6	1.8	1.24
25	0.9	0.71	1.0	0.60	1.6	1.8	1.24
35	0.9	0.71	1.0	0.60	1.6	1.9	1.32
16	0.7	0.53	1.0	0.60	1.6	1.8	1.24
25	0.9	0.71	1.0	0.60	1.6	1.8	1.24
35	0.9	0.71	1.0	0.60	1.6	1.9	1.32
50	1.0	0.80	1.0	0.60	1.6	2.0	1.40
70	1.1	0.89	1.2	0.76	2.0	2.2	1.56
95	1.1	0.89	1.2	0.76	2.0	2.3	1.64
120	1.2	0.98	1.4	0.92	2.5	2.5	1.80
150	1.4	1.16	1.4	0.92	2.5	2.6	1.88
185	1.6	1.34	1.4	0.92	2.5	2.8	2.04
240	1.7	1.43	1.6	1.08	2.5	3.0	2.20
300	1.8	1.52	1.6	1.08	2.5	3.2	2.36
400	2.0	1.70	1.8	1.24	3.15	3.5	2.60
500	2.2	1.88	1.8	1.24	3.15	3.8	2.84

ROCESS : EXTRUDING			Iskan	dat		20					
DATE: 13-09-20 (8	1		SHIFT :	SHIFT: (1) 2			/ -1 -1				
Sample No. :		(A)1	$(IA)_2$	(1A)3	4	б	6	7	8	9	10
Cable Size :		Κ.	-240	MM X40	x/s/p		>	i i	-	_	
Colour :		BLACK	BLACK	RED	YELLOW	BUE	BLACK				
lob Order No. :		K		180905	1080-		>				
Type ( Pvc or Xipe ) : Insulation / Bedding / Si	heath	s-x/s/p	RED	<	-XLDE	-INS-	>		1		
Specification refer Meg   X & Y axis in MM ) MS138/SS358 M   MS2112-3 Table1 Table 1 Pg 15 Table 3   MS2100 Table 1 Table 2 Pg 17 Table 5   MS2100 Table 1 Table 3 Pg 18 & 19 Table 7   MS2000 Table 9 Table 4 Pg 20 Table 9	a Kabel table 3(a)~3(k) or S274 IEC60502 Pg 16 Annex A Pg77 Pg 18 To Pg 87 Pg 20 X - Pg 22 y -	64.938 63. <del>7</del> 85	53.04/ 51.14/	27.966	27.617	28.003	28.336				
(2) Thickness (M/M) Measure No.		3.996	1.626	1.924	1.789	1.776	1.914				
Specification refer to	Measure No. 2	3.681	1.878	1.769	1.887	2.008	1.939				13
	Measure No. 3	4.474	1.678	1-869	1.778	1.946	1-965				
	Measure No. 4	3.732	1.674	1.812	1.866	1.891	1.952				
	Measure No. 5	4.264	- 1	1.680	1.635	1.753	1.834				
	Measure No. 6	3.966	-	1.682	1.564	1.683	1-750		>		
	Average value	4.019	1.714	1.789	1-753	1.826	1.892	/			
Refer to IPQC work instruction clause 5.b) i, i	, iii Minimum value	3.68)	1.626	1.680	1.564	1.683	1.750				
(3) Embossing i) Volt	age Designation	*		600/	1000V		>				
ii) Siz Refer	e of Characters (M/M) to IPQC work instruction										
iii) Ga of C Refer	p between adjacent set Characters (M/M) to IPQC work instruction	ELECTR 4CX 24 MS 210	DSQ-MM	CH XISIP TEC 60	SIRIM 9	00/1000 95 (EFT 04 -	TO	1	1	1	

Insulating Colour Coding (XLPE Multicore - MS 2107)

The core shall be identified either by colours for cables up to 5 cores and by numbers for cable of 6 cores and above.

The colours shall remain identifiable throughout the length of the cable.

Number of Core	Identification
Two-core	Red, Black
Three-core	Red, Yellow, Blue
Four-core	Red, Yellow, Blue, Black
Five-core	Red, Yellow, Blue, Black, Green/Yellow

Note:

Refer relevant standard for others type of cables

Markings

#### • L-S1 Clause 9.0.3

- All cable shall be legibly, and durable marked on the external surface of the cable with at least the following elements;

- a) Manufacturer's identification
- b) Voltage designation
- c) Standard number
- d) Number of cores, Nominal cross-sectional area and type of conductor

#### MS Standard

- The oversheath shall be marked with complete set of elements in the order specified below
- a) Electric cable
- b) Voltage designation
- c) Standard number
- d) Manufacturer's identification
- e) Number of cores, Nominal cross-sectional area and type of conductor
- f) Year of manufacturer

Marking

a) Electrical Cable – ELECTRIC CABLE

b) Voltage Designation – 600/1000 V

c) Malaysian Standard Number – MS2101:2007

d) Manufacturer's Identification – SOUTHERN CABLE

e) Number of Core & Nominal Area of Conductors – 1 X 630 SQMM

![](_page_18_Picture_6.jpeg)

![](_page_19_Picture_0.jpeg)

Standards

NO.	STANDARD	DESCRIPTION
1	MS 2112-1	Electric Cable and Wire – Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltages Up To and Including 450/750 V – Part 1: General Requirements
2	MS 2112-2	Electric Cable and Wire – Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltages Up To and Including 450/750 V – Part 2: Test Methods
3	MS 2112-3	Electric Cable and Wire – Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltages Up To and Including 450/750 V – Part 3: Non-Sheathed Cables For Fixed Wiring
4	MS 2112-4	Electric Cable and Wire – Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltages Up To and Including 450/750 V – Part 4: Sheathed Cables For Fixed Wiring
5	MS 2100	Electric Cable and Wire : $600/1000 (U_m = 1 200) \vee$ Single Core PVC Insulated Cable - Non-Armoured
6	MS 2101	Electric Cable and Wire : 600/1000 ( $U_m$ =1 200) V Single Core PVC Insulated Cable – Armoured
7	MS 2102	Electric Cable and Wire : 600/1000 (U <sub>m</sub> =1 200) V Multi Core PVC Insulated Cable - Non-Armoured
8	MS 2103	Electric Cable and Wire : $600/1000 (U_m = 1 200) V$ Multi Core PVC Insulated Cable – Armoured

Jadual 1 : Malaysia Standard bagi PVC Insulated Cable

Standards

NO.	STANDARD	DESCRIPTION
1	IEC 60502-1	Power Cable with extruded insulation and their accessories for rated voltages from 1 kV (Um=1.2 kV) up to 30 kV (Um=36 kV) – Part 1: Cable for rated voltages of 1 kV (Um=1.2 kV) and 3 kV (Um=3.6 kV)
2	MS 2104	Electric Cable and Wire – 600/1000 (Um=1200) V Single Core XLPE Insulated Cable – Non Armoured
3	MS 2105	Electric Cable and Wire – 600/1000 (Um=1200) V Single Core XLPE Insulated Cable – Armoured
4	MS 2106	Electric Cable and Wire – 600/1000 (Um=1200) V Multi Core XLPE Insulated Cable – Non Armoured
5	MS 2107	Electric Cable and Wire – 600/1000 (Um=1200) V Multi Core XLPE Insulated Cable – Armoured
		Jadual 2 : Standard bagi XLPE Insulated Cable

Type of Cables

- CU / PVC PVC Insulated, Non-Sheathed Cable
- CU / PVC / PVC PVC Insulated, PVC Sheathed Cable
- CU / PVC / PVC / SWA / PVC PVC Insulated, PVC Bedded, Galvanised Steel Wire Armoured, PVC Sheathed Cable
- CU / XLPE / PVC XLPE Insulated, PVC Sheathed Cable
- CU / XLPE / PVC / SWA / PVC XLPE Insulated, PVC Bedded, Galvanised Steel Wire Armoured, PVC Sheathed Cable

![](_page_23_Picture_0.jpeg)

PVC Insulated, Non-Sheathed Cable, 450/750V

#### CONSTRUCTION

#### a) Conductor

Plain Annealed Copper, Class 2 Stranded Circular or Compacted

#### b) Insulation

Polyvinyl Chloride (PVC) Compound Type PVC/A

![](_page_23_Picture_8.jpeg)

![](_page_23_Picture_9.jpeg)

Component 1. Plain Annealed Copper Wire 2. PVC Compound

CU / PVC / PVC Cable

PVC Insulated, PVC Sheathed Cable, 450/750V

#### CONSTRUCTION

#### a) Conductor

Plain Annealed Copper, Class 2 Stranded Circular or Compacted

#### b) Insulation

Polyvinyl Chloride (PVC) Compound Type PVC/A

#### c) Sheath

Polyvinyl Chloride (PVC) Compound Type PVC/ST1

![](_page_24_Picture_10.jpeg)

![](_page_24_Picture_11.jpeg)

CU / PVC / PVC / SWA / PVC Cable

PVC Insulated, PVC Bedded, Galvanised Steel Wire Armoured, PVC Sheathed, 600/1000V Cable

#### CONSTRUCTION

#### a) Conductor

Plain Annealed Copper, Class 2 Stranded circular, compacted or sectored

#### b) Insulation:

Polyvinyl Chloride (PVC) Compound Type PVC

#### c) Bedding:

Polyvinyl Chloride (PVC) Compound Type PVC

#### d) Armour:

Galvanized Steel Wire Armoured (SWA)

#### e) **sheath:**

Polyvinyl Chloride (PVC) Compound Type PVC/ST2

![](_page_25_Picture_14.jpeg)

CU / XLPE / PVC Cable

XLPE insulated and PVC sheathed. Cables are rated at 600 / 1000 V

#### CONSTRUCTION

#### a) Conductor

Plain circular, compacted, or shaped stranded Annealed copper conductor, conform to IEC 60228 class 2.

#### b) Insulation

XLPE (cross-linked polyethylene) rated at 90°C.

c) **Sheath** Polyvinyl Chloride (PVC) Compound Type PVC/ST2

![](_page_26_Picture_9.jpeg)

![](_page_26_Figure_10.jpeg)

![](_page_26_Picture_11.jpeg)

![](_page_26_Figure_12.jpeg)

CU/XLPE/PVC/SWA/PVC Cable

XLPE insulated, armoured and PVC sheathed. Cables are rated at 600 / 1000 V

#### CONSTRUCTION

#### a) Conductor

Plain circular, compacted or shaped stranded copper conductor, conform to IEC 60228 class 2.

#### b) Insulation

XLPE (cross-linked polyethylene) rated at 90 °C.

#### c) Armour

Single Core - Aluminium wire shall be applied over the PVC bedding. Multicore - Galvanized steel wire shall be applied over the PVC bedding.

#### d) Sheath

PVC type ST2

![](_page_27_Picture_12.jpeg)

Testing (MS 2104)

Tests	Requirement Category Reference for of test* test method			Tests	Requirement	Category of test*	Reference for test method				
Conductors:					Heat shock test (only for PVC)	Shall comply with IEC 60502-1	т	MS IEC 60811-3-1			
Conductor construction	Shall comply with MS IEC 60228	S.	MS IEC 60228		Tests on Complete Cables:						
Insulation:					Measurement of electrical resistance	Shall comply with IEC 60502-1	R	MS IEC 60228			
Thickness	Shall comply with Table 1	S/T	MS IEC 60811-1-1		High voltage a.c test for 5 min	Shall comply with IEC 60502-1	R	IEC 60502-1			
Shrinkage test	Shall comply with IEC 60502-1	т	MS IEC 60811-1-3		High voltage a.c test for 4 h	Shall comply with IEC 60502-1	т	IEC 60502-1			
Mechanical test without ageing	Shall comply with IEC 60502-1	т	MS IEC 60811-1-1		Insulation resistance at	Shall comply with IEC 60502-1	Т	IEC 60502-1			
Mechanical test after ageing in air oven	Shall comply with IEC 60502-1	т	MS IEC 60811-1-1 MS IEC 60811-1-2		temperature		-				
Hot set test	Shall comply with IEC 60502-1	s/r	MS IEC 60811-2-1		the copper conductors	Shall comply with IEC 60502-1	1	1 MS IEC 60811-1-2			
Water absorption test	Shall comply with IEC 60502-1	т	MS IEC 60811-1-3		Bending test after ageing with the conner conductors (only if	Shall comply with IEC 60502-1	т	MS IEC 60811-1-2			
Spark test (online)	Shall comply with BS 5099	R	BS 5099		the tensile test is not practicable)						
Oversheath:					Flame spread test on single	Shall comply with IEC 60502-1	т	IEC 60502-1			
Thickness	Shall comply with Table 1	s/т	MS IEC 60811-1-1		required)						
Shrinkage test (only for PE)	Shail comply with IEC 60502-1	т	MS IEC 60811-1-3		Additional ageing test of completed cables	Shall comply with IEC 60502-1	т	IEC 60502-1			
Mechanical test without ageing	Shall comply with IEC 60502-1	S	MS IEC 60811-1-1		Cable markings	Shall comply with this standard	R	Visual			
Mechanical test after ageing in air oven	Shall comply with IEC 60502-1	s	MS IEC 60811-1-1 MS IEC 60811-1-2								
Pressure test at elevated temperature	Shall comply with IEC 60502-1	т	MS IEC 60811-3-1								
Carbon black content (only for PE)	Shall comply with IEC 60502-1	т	MS IEC 60811-4-1		* The category of test is defined or R = Routine test	The category of test is defined on IEC 60502-1 are as follows:					
Loss of mass test (only for PVC)	Shall comply with IEC 60502-1	т	MS IEC 60811-3-2								

Current Carrying Capacity (CCC)

TABLE (1) Single-core PVC insulated cables, non-armoured, with or without sheath (COPPER CONDUCTORS) BS6004 / BS6346 / GB5023 / GB/T12706.1 / IEC60227 / IEC60502

#### CURRENT CARRYING CAPACITY (Amperes):

Ambient temperature: 30°C Conductor operating temperature:70°C

	Reference Met in conduit i insulating	hod 4(enclosed in thermally wall etc.)	Reference Met in conduit or trunkin	hod 3(enclosed n a wall or in ig etc.)	Reference Me dire	thod 1(clipped ect)	Reference Me perforated horizontal	ethod 11(on a cable tray or vertical)	Reference Method 12(free air)			
Conductor cross- sectional area	2 cables,	3 or 4 cables,	2 cables,	3 or 4 cables,	2 cables,	3 or 4 cables, three-phase	2 cables,	3 or 4 cables, three-phase	Horizontal flat spaced	Vertical flat spaced	Trefoil	
	single-phase a.c. or d.c.	three-phase a.c.	single-phase a.c. or d.c.	three-phase a.c.	a.c. or d.c. flat and touching.	a.c. flat and touching or trefoil	a.c. or d.c flat and touching	a.c. flat and touching or trefoil	phase a.c or d.c. or 3 cables three-phase a.c.	phase a.c or d.c. or 3 cables three-phase a.c.	trefoil three phase a.c.	
mm <sup>2</sup>	Α	Α	Α	Α	Α	Α	Α	Α	Α	Α	A	
1	11	10.5	13.5	12	15.5	14	-	-	-	-	-	
1.5	14.5	13.5	17.5	15.5	20	18	-	-	-	-	-	
2.5	20	18	24	21	27	25	-	-	-	-	-	
4	26	24	32	28	37	33	-	-	-	-	-	
6	34	31	41	36	47	43	-	-	-	-	-	
10	46	42	57	50	65	59	-	-	-	-	-	
16	61	56	76	68	87	79	-	-	-	-	-	
25	80	73	101	89	114	104	131	114	146	130	110	
35	99	89	125	110	141	129	162	143	181	162	137	
50	119	108	151	134	182	167	196	174	219	197	167	
70	151	136	192	171	234	214	251	225	281	254	216	
95	182	164	232	207	284	261	304	275	341	311	264	
120	210	188	269	239	330	303	352	321	396	362	308	
150	240	216	300	262	381	349	406	372	456	419	356	
185	273	245	341	296	436	400	463	427	521	480	409	
240	321	286	400	346	515	472	546	507	615	569	485	
300	367	328	458	394	594	545	629	587	709	659	561	
400	-	-	546	467	694	634	754	689	852	795	656	
500	-	-	626	533	792	723	868	789	982	920	749	
630	-	-	720	611	904	826	1005	905	1138	1070	885	
800	-	-	-	-	1030	943	1086	1020	1265	1188	971	
1000	-	-	-	-	1154	1058	1216	1149	1420	1337	1079	

Voltage Drop

Table (1)(Cont.)																						
VOLTAGE DROP (per ampere per metre):											Conductor operating temperature:70°C											
Conductor cross- sectional area	2 cables d.c.	Reference 3 & 4 (Ei conduit e a wall)	rerence Methods 4 (Enclosed in nduit etc. in or on wall) 2 cable-single-phase a Reference Method 1 & 11 (Clipped direct or on trays, touching)					a.c. Referen (spaced)	ce Metho ')	3 or 4 cables Reference Methods 3 & 4 (Enclosed in conduit etc. in or on a wall)			S-three-phase a.c. Reference Methods 1, 11 &12 (In trefoil)			Reference Methods 1 & 11 (Flat and touching)			Reference Methos 12 (Flat spaced*)			
mm <sup>2</sup>	mV		mV	mV				mV			mV			mV				mV		mV		
1	44		44			44		44			38			38			38			38		
1.5	29		29			29		29			25			25			25			25		
2.5	18		18		18			18			15			15			15			15		
4	11		11			11		11			9.5			9.5			9.5			9.5		
6	7.3		7.3			7.3		7.3			6.4			6.4			6.4			6.4		
10	4.4		4.4	4.4				4.4			3.8			3.8			3.8			3.8		
16	2.8		2.8		2.8			2.8			2.4			2.4			2.4			2.4		
		r	X	z	r	X	Z	r	X	Z	r	X	Z	r	X	Z	r	X	Z	r	X	Z
25	1.75	1.8	0.33	1.8	1.75	0.2	1.75	1.75	0.29	1.8	1.5	0.29	1.55	1.5	0.175	1.5	1.5	0.25	1.55	1.5	0.32	1.55
35	1.25	1.3	0.31	1.3	1.25	0.195	1.25	1.25	0.28	1.3	1.1	0.27	1.1	1.1	0.17	1.1	1.1	0.24	1.1	1.1	0.32	1.15
50	0.93	0.95	0.3	1.0	0.93	0.19	0.95	0.93	0.28	0.97	0.81	0.26	0.85	0.8	0.165	0.82	0.8	0.24	0.84	0.8	0.32	0.86
70	0.63	0.65	0.29	0.72	0.63	0.185	0.66	0.63	0.27	0.69	0.56	0.25	0.61	0.55	0.160	0.57	0.55	0.24	0.6	0.55	0.31	0.63
95	0.46	0.49	0.28	0.56	0.47	0.180	0.5	0.47	0.27	0.54	0.42	0.24	0.48	0.41	0.155	0.43	0.41	0.23	0.47	0.4	0.31	0.51
120	0.36	0.39	0.27	0.47	0.37	0.175	0.41	0.37	0.26	0.45	0.33	0.23	0.41	0.32	0.150	.0.36	0.32	0.23	0.4	0.32	0.3	0.44
150	0.29	0.31	0.27	0.41	0.3	0.175	0.34	0.29	0.26	0.39	0.27	0.23	0.36	0.26	0.150	0.3	0.26	0.23	0.34	0.26	0.3	0.40
185	0.23	0.25	0.27	0.37	0.24	0.17	0.29	0.24	0.26	0.35	0.22	0.23	0.32	0.21	0.145	0.26	0.21	0.22	0.31	0.21	0.3	0.36
240	0.18	0.195	0.26	0.33	0.185	0.165	0.25	0.185	0.25	0.31	0.17	0.23	0.29	0.160	0.145	0.22	0.16	0.22	0.27	0.16	0.29	0.34
300	0.145	0.160	0.26	0.31	0.15	0.165	0.22	.015	0.25	0.29	0.14	0.23	0.27	0.13	0.14	0.19	0.13	0.22	0.25	0.13	0.29	0.32
400	0.105	0.13	0.26	0.29	0.12	0.16	0.2	0.115	0.25	0.27	0.12	0.22	0.25	0.105	0.14	0.175	0.105	0.21	0.24	0.10	0.29	0.31
500	0.086	0.11	0.26	0.28	0.098	0.155	0.185	0.093	0.24	0.26	0.1	0.22	0.25	0.086	0.135	0.160	0.086	0.21	0.24	0.081	0.29	0.3
630	0.68	0.094	0.25	0.27	0.081	0.155	0.175	0.076	0.24	0.25	0.08	0.22	0.24	0.072	0.135	0.150	0.072	0.21	0.22	0.066	0.28	0.29
800	0.053	-	-	-	0.068	0.15	0.165	0.061	0.24	0.25	-	-	-	0.06	0.13	0.145	0.06	0.21	0.22	0.053	0.28	0.29
1000	0.042	-	-	-	0.059	).059 0.15 0.16 0.05 0.24 0						-	-	0.052	0.13	0.14	0.052	0.2	0.21	0.044	0.28	0.28

References

Below are the applicable standards that are used as reference in the construction of low voltage cables.

- MS 2112 3 : Electrical Cable and Wire Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltage up to and Including 450/740 V Part 3: Non – sheathed Cables for Fixed Wiring
- MS 2112 4 : Electric Cable and Wire Polyvinyl Chloride (PVC) Insulated Cables of Rated Voltages Up To and Including 450/750 V - Part 4: Sheathed Cables For Fixed Wiring
- IEC 60227-3 : Polyvinyl Chloride insulated cables of rated voltages up to and including 450/750V Part 3: Non-sheathed cables for fixed wiring.
- IEC 60227-4 : Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V Part 4: Sheathed cables for fixed wiring
- MS 2100 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Single Core PVC Insulated Cable Non-Armoured
- MS 2101 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Single Core PVC Insulated Cable Armoured
- MS 2102 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Multi Core PVC Insulated Cable Non-Armoured
- MS 2103 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Multi Core PVC Insulated Cable Armoured
- MS 2104 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Single Core XLPE Insulated Cable Non-Armoured

References

- MS 2105 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Single Core XLPE Insulated Cable Armoured
- MS 2106 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Multi Core XLPE Insulated Cable Non-Armoured.
- MS 2107 : Electric Cable and Wire : 600/1 000 (Um=1 200) V Multi Core XLPE Insulated Cable Armoured
- IEC 60228 : Conductors of insulated cables.
- IEC 60502-1: Power cables with extruded insulation and their accessories for rated voltages from 1 kV (Um = 1,2 kV) up to 30 kV (Um = 36 kV) - Part 1: Cables for rated voltages of 1 kV (Um = 1,2 kV) and 3 kV (Um = 3,6 kV)