ELECTRICAL MATERIAL APRROVED LIST (EMAL)

CABLE

SENARAI KATEGORI EMAL

#1 Pilih nama kategori

SENARAI BAHAN/BARANGAN YANG DILULUSKAN EMAL (CABLE)

#2 Pilih nama barang

No	Kod Barang	Nama Barang	Status Barang
1	EE01100012	PVC INSULATED CABLE (ARMOURED) (ALUMINIUM)	TAMBAHAN
2	EE011001	MV CABLE	TAMBAHAN
3	EE0110010	XLPE INSULATED, PVC SHEATHED POWER CABLES (ARMOURED)(ALUMINIUM)	TAMBAHAN
4	EE0110011	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)	MANDATORI
5	EE011002	XLPE INSULATED, PVC SHEATHED POWER CABLES (ARMOURED AND NON ARMOURED)	MANDATORI
6	EE011003	FIRE RESISTANT CABLE	MANDATORI
7	EE011009	MV CABLE (ALUMINIUM)	TAMBAHAN

- Mandatori : Hanya senarai yang terdapat pada kelulusan EMAL sahaja yang boleh diguna pakai dalam projek JKR
- Tambahan : Senarai yang tiada dalam kelulusan EMAL boleh diguna pakai berdasarkan kriteria yang telah ditetapkan dalam spesifikasi JKR

SENARAI SYARIKAT YANG DILULUSKAN EMAL (PVC INSULATED CABLE)

#3 Pilih nama syarikat

Contoh 1
- Kelulusan PVC *Insulated Cable (Armoured & Non Armoured)*

MAKLUMAT BAHAN/BARANGAN YANG DILULUSKAN

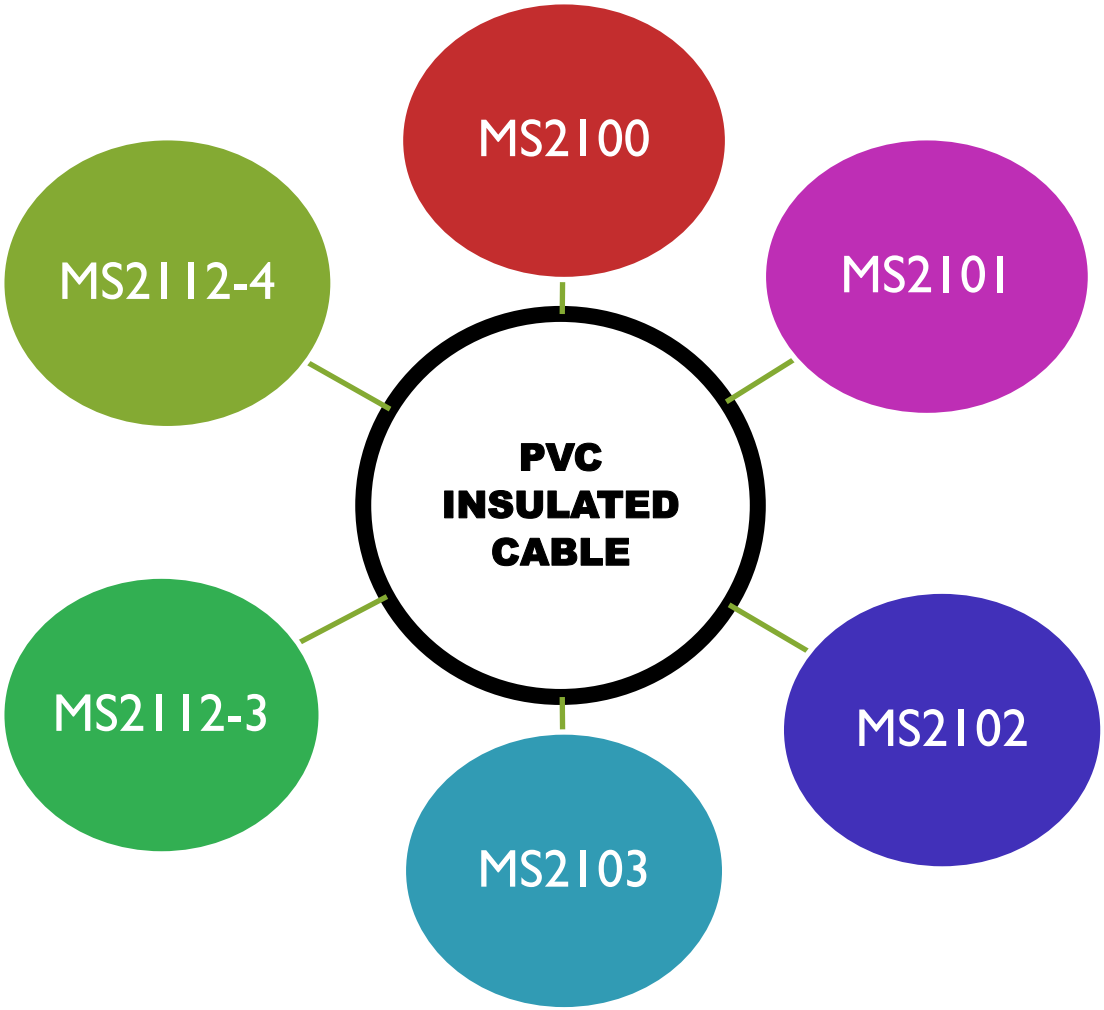
Keterangan Barangan	PVC INSULATED CABLE (ARMOURED & NON ARMOURED)
Kod Barangan	EE0110011.ME224.A249
Nama Syarikat	SOUTHERN CABLE SDN BHD
Status Syarikat	PENGILANG
Alamat	LOT 42, JALAN MERBAU PULAS, KAWASAN PERUSAHAAN KUALA KETIL,
	09300 KUALA KETIL KEDAH
No Telefon	044161600
No Fax	044161599
Email	sc@southerncable.com.my
Website	www.southerncable.cc
Jenama	SOUTHERN CABLE
No Laporan	PENSIJILAN SIRIM : PC001885 LAPORAN UJIAN SIRIM : 2014EEA0732
Tarikh Tamat	15-02-2021
Rujukan	MS 2103 : 2007
Catatan	JENIS PVC INSULATED CABLES FOR ELECTRICITY SUPPLY
Negara	MALAYSIA

Bil	Model	Rated Voltage (v)	Size (sq.mm)	No. of Core	Gambar
1	PVC/SWA/PVC - PVC INSULATED, PVC SHEATHED, STEEL WIRE ARMOURED, STRANDED COPPER CONDUCTOR CABLE	600/1000	1.5, 2.5, 4, 6, 10, 16, 25, 35, 50, 70, 95 & 120	2, 3 & 4	

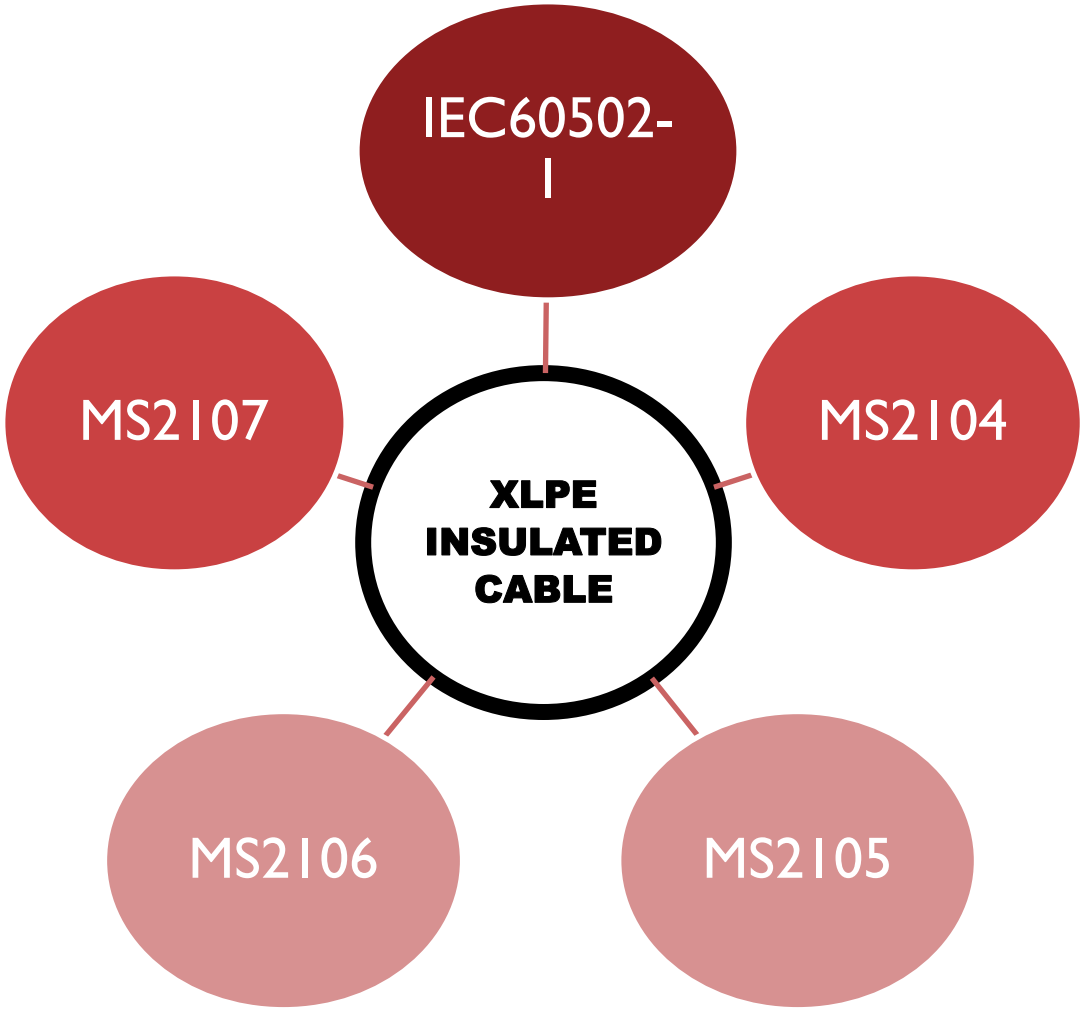
PENYEMAKAN PERMOHONAN PENDAFTARAN BAHAN/BARANGAN CABLE BERPANDUKAN :

1. Standard yang terkini
2. Spesifikasi L-S1 – section 9.1 (*Type of Cable*)
3. *Technical Information* – boleh dimuat turun pada laman sesawang EMAL
4. *Lesson Learnt* - yang telah diluluskan oleh ahli jawatankuasa mengikut keperluan semasa

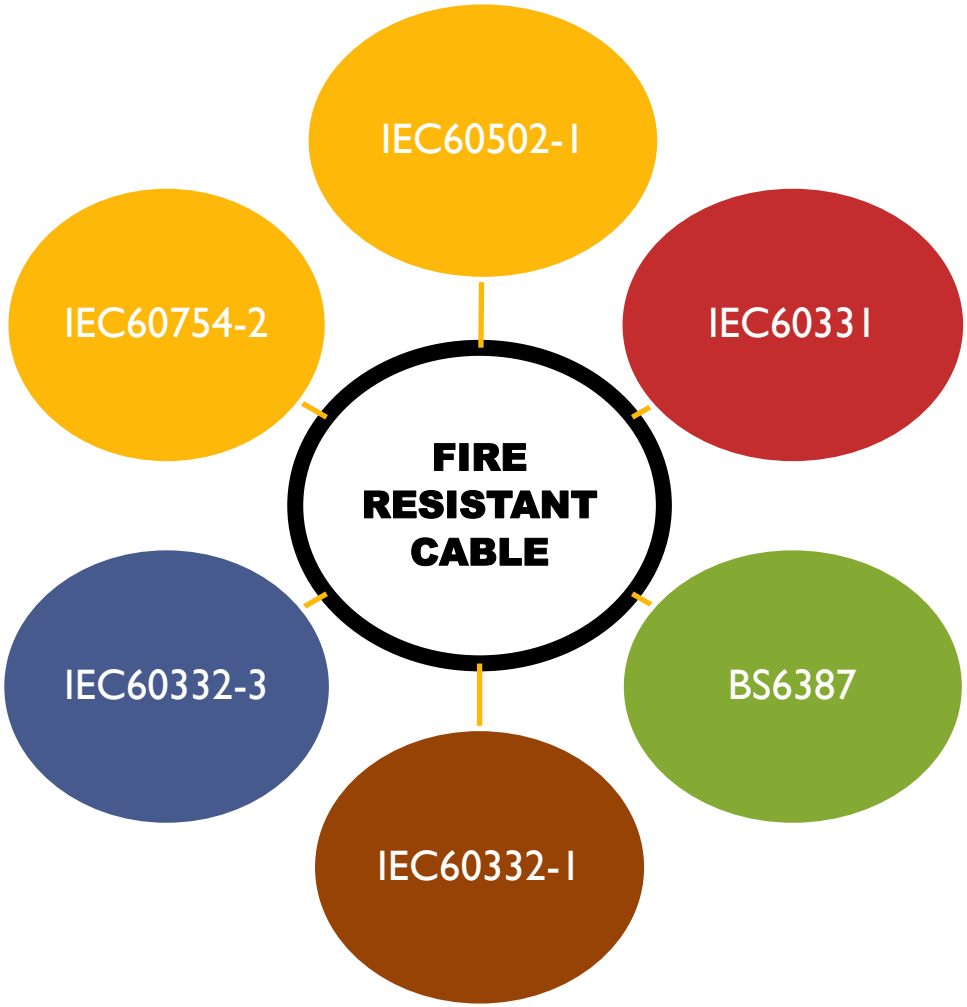
SENARAI STANDARD



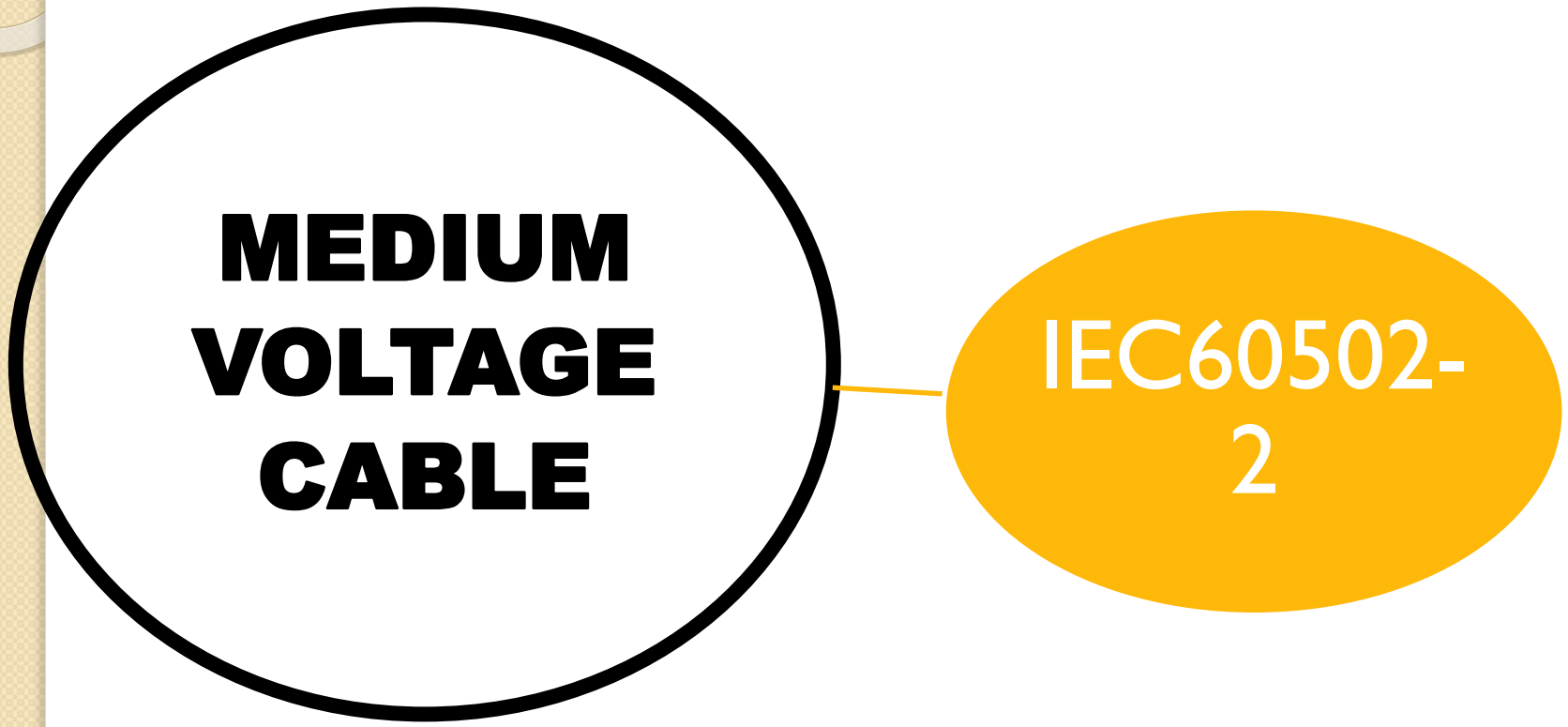
SENARAI STANDARD



SENARAI STANDARD



SENARAI STANDARD



MARKING

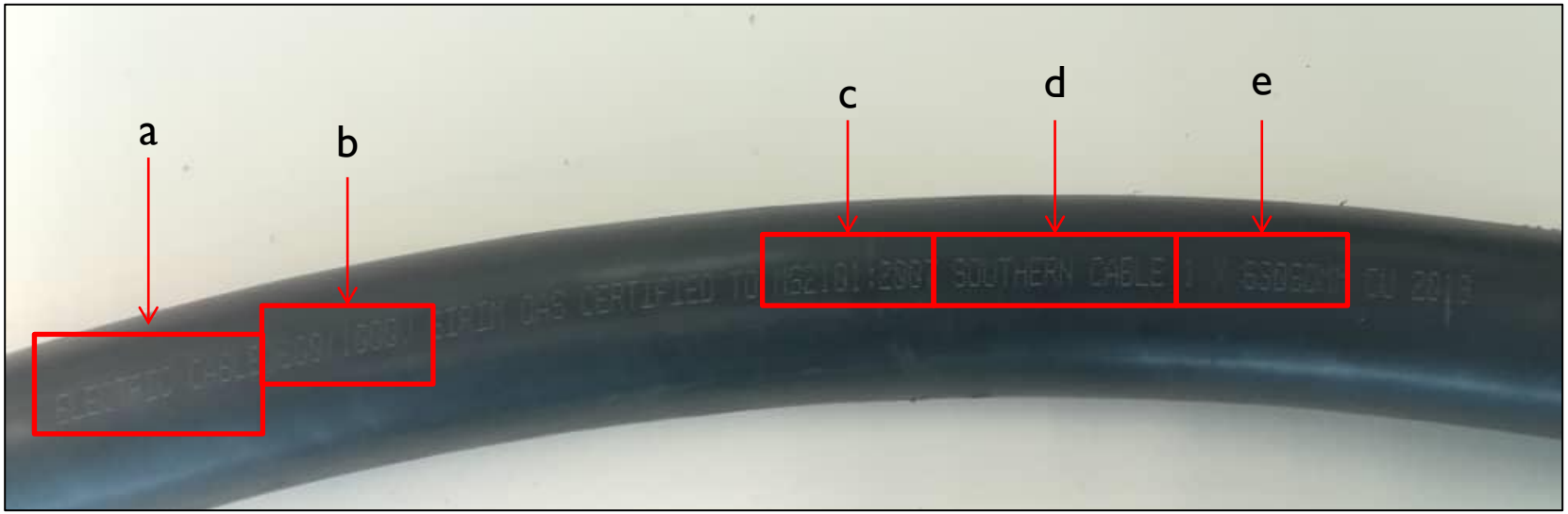
a) Electrical Cable – ELECTRIC CABLE

b) Voltage Designation – 600/1000V

c) Malaysian Standard Number – MS2101:2007

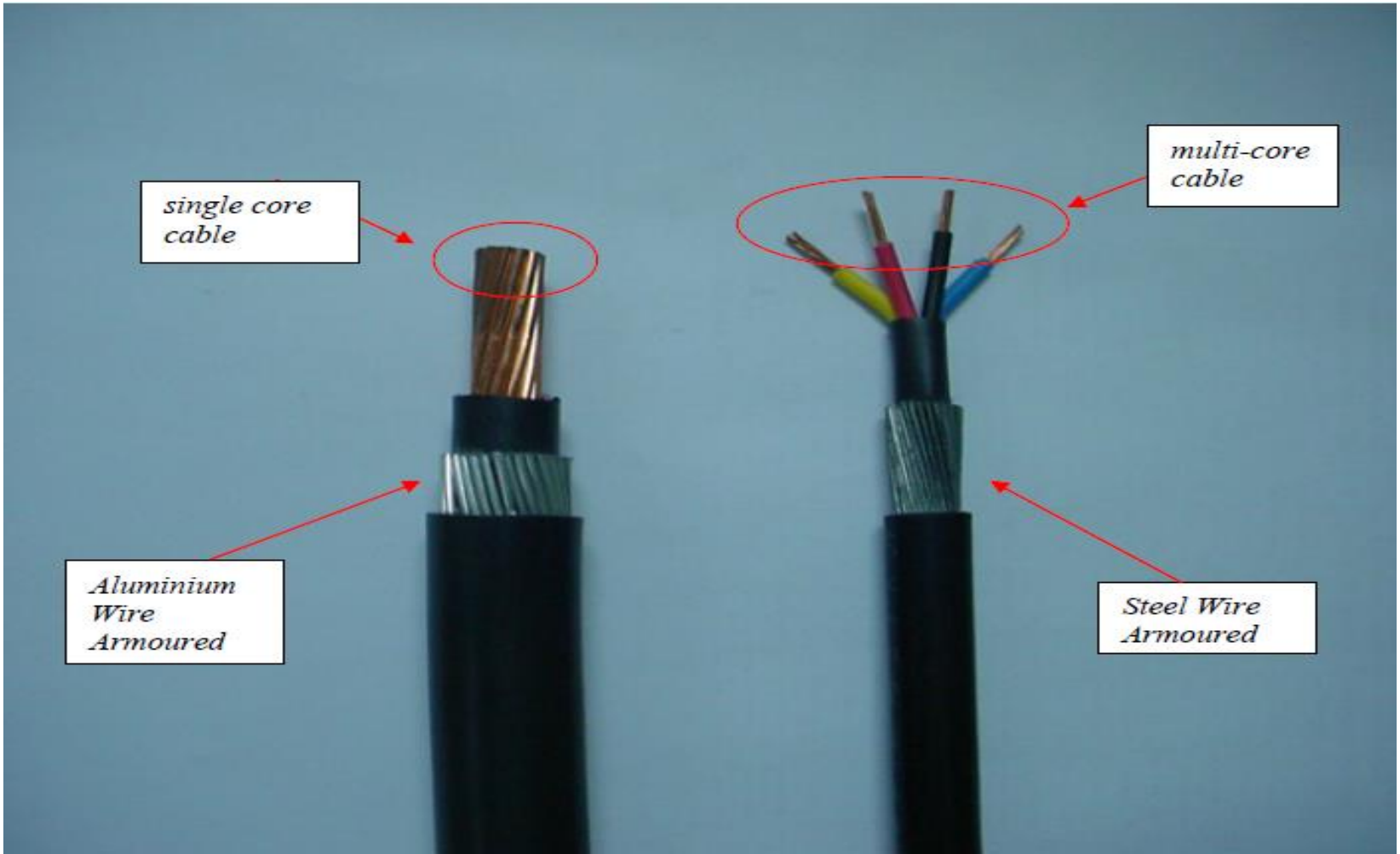
d) Manufacturer's Identification – SOUTHERN CABLE

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



ARMOUR

Steel Wire Armoured for multicore cable (PVC/**SWA**/PVC)
Aluminium Wire Armoured for single core cable (PVC/**AWA**/PVC)
* Boleh diperiksa menggunakan magnet



Contoh 2
- Kelulusan *Fire Resistant Cable*

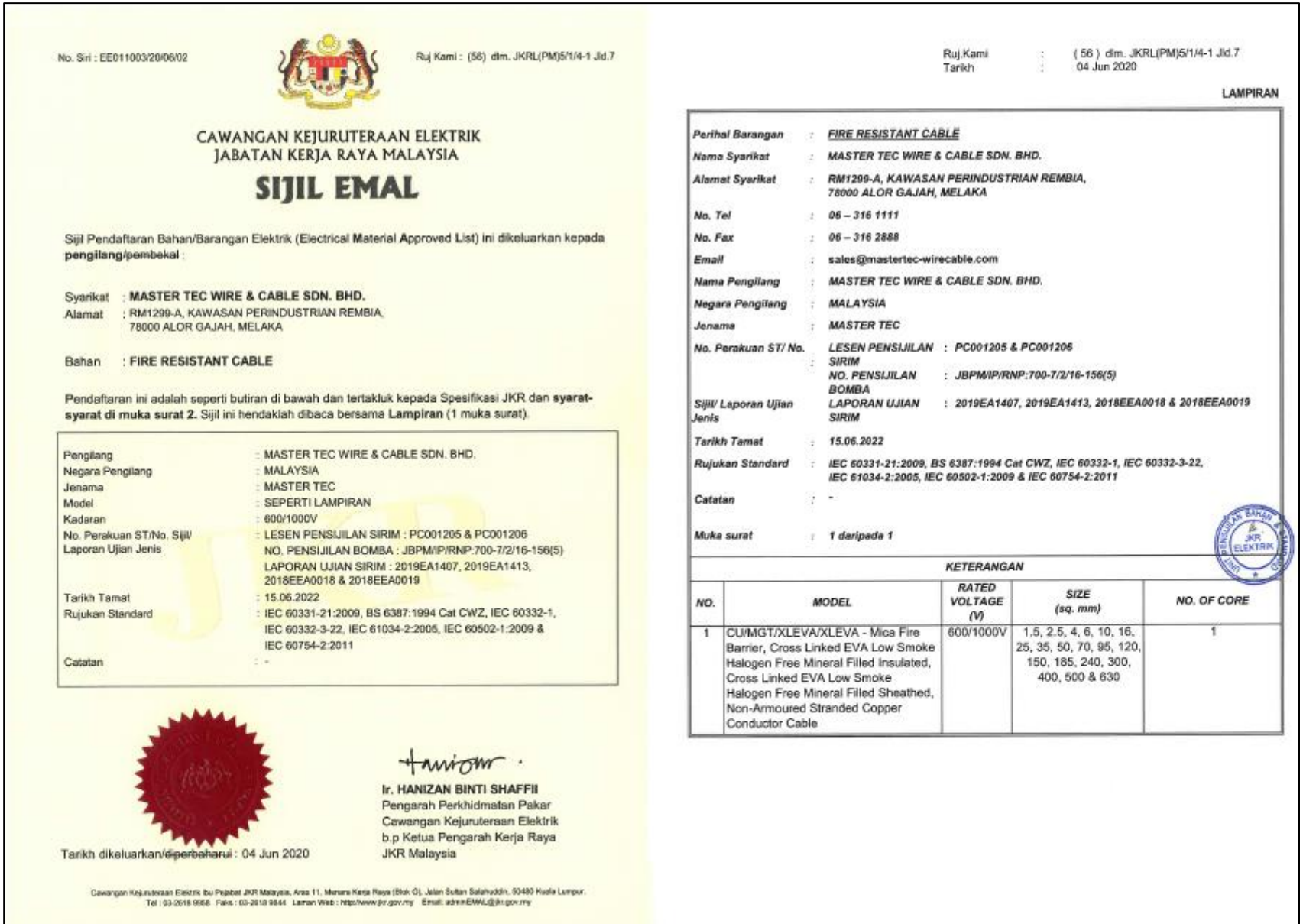
MAKLUMAT BAHAN/BARANGAN YANG DILULUSKAN

Keterangan Barangan	FIRE RESISTANT CABLE
Kod Barangan	EE011003.ME144.A150
Nama Syarikat	MASTER TEC WIRE & CABLE SDN. BHD.
Status Syarikat	PENGILANG
Alamat	RM 1299-A, KAWASAN PERINDUSTRIAN REMBIA,
	78000 ALOR GAJAH MELAKA
No Telefon	06-316 1111
No Fax	06-316 2888
Email	sales@mastertec-wirecable.com
Website	www.mastertec-wirecable.com
Jenama	MASTER TEC
No Laporan	NO. PENSIJILAN BOMBA : JBPM/IP/RNP:700-7/2/16-156(5) NO. PENSIJILAN SIRIM : PC001205 & PC001206 NO. LAPORAN UJIAN SIRIM : 2019EA1407, 2019EA1413, 2018EEA0018 & 2018EEA0019
Tarikh Tamat	15-06-2022
Rujukan	IEC 60331-21:2009, BS 6387:1994 Cat CWZ, IEC 60332-1, IEC 60332-3-22, IEC 61034-2:2005, IEC 60502-1:2009 & IEC 60754-2:2011
Catatan	-
Negara	

Bil	Model	RATED VOLTAGE (V)	SIZE (SQ.MM)	NO. OF CORE	Gambar
1	CU/MGT/XLEVA/XLEVA - Mica Fire Barrier, Cross Linked EVA Low Smoke Halogen Free Mineral Filled Insulated, Cross Linked Eva Low Smoke Halogen Free Mineral Filled Sheathed, Non-Armoured Stranded Copper Conductor Cable	600/1000	1.5, 2.5, 4, 6, 10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300, 400, 500 & 630	1	

1
2
3
4

SIJIL KELULUSAN EMAL



No. Siri : EE011003/20/06/02

Ruj Kami : (56) dlm. JKRL(PM)5/1/4-1 Jld.7

CAWANGAN KEJURUTERAAN ELEKTRIK
JABATAN KERJA RAYA MALAYSIA

SIJIL EMAL

Sijil Pendaftaran Bahan/Barangan Elektrik (Electrical Material Approved List) ini dikeluarkan kepada **pengilang/pembekal** :

Syarikat : **MASTER TEC WIRE & CABLE SDN. BHD.**
Alamat : RM1299-A, KAWASAN PERINDUSTRIAN REMBIA, 78000 ALOR GAJAH, MELAKA

Bahan : **FIRE RESISTANT CABLE**

Pendaftaran ini adalah seperti butiran di bawah dan tertakluk kepada Spesifikasi JKR dan **syarat-syarat di muka surat 2.** Sijil ini hendaklah dibaca bersama **Lampiran** (1 muka surat).

Pengilang	: MASTER TEC WIRE & CABLE SDN. BHD.
Negara Pengilang	: MALAYSIA
Jenama	: MASTER TEC
Model	: SEPERTI LAMPIRAN
Kadaran	: 600/1000V
No. Perakuan ST/No. Sijil/ Laporan Ujian Jenis	: LESEN PENSIJILAN SIRIM : PC001205 & PC001206 NO. PENSIJILAN BOMBA : JBPM/IP/RNP:700-7/2/16-156(5) LAPORAN UJIAN SIRIM : 2019EA1407, 2019EA1413, 2018EEA0018 & 2018EEA0019
Tarikh Tamat	: 15.06.2022
Rujukan Standard	: IEC 60331-21:2009, BS 6387:1994 Cat CWZ, IEC 60332-1, IEC 60332-3-22, IEC 61034-2:2005, IEC 60502-1:2009 & IEC 60754-2:2011
Catatan	: -

Tarikh dikeluarkan/~~diperbaharui~~ : 04 Jun 2020

Ir. HANIZAN BINTI SHAFFII
Pengarah Perkhidmatan Pakar
Cawangan Kejuruteraan Elektrik
b.p Ketua Pengarah Kerja Raya
JKR Malaysia

Cawangan Kejuruteraan Elektrik, Ibu Pejabat JKR Malaysia, Aras 11, Menara Kerja Raya (Blok G), Jalan Sultan Salahuddin, 50480 Kuala Lumpur.
Tel : 03-2618 9668 Faks : 03-2618 9844 Laman Web : http://www.jkr.gov.my Email: admEMAL@jkr.gov.my

Ruj.Kami : (56) dlm. JKRL(PM)5/1/4-1 Jld.7
Tarikh : 04 Jun 2020

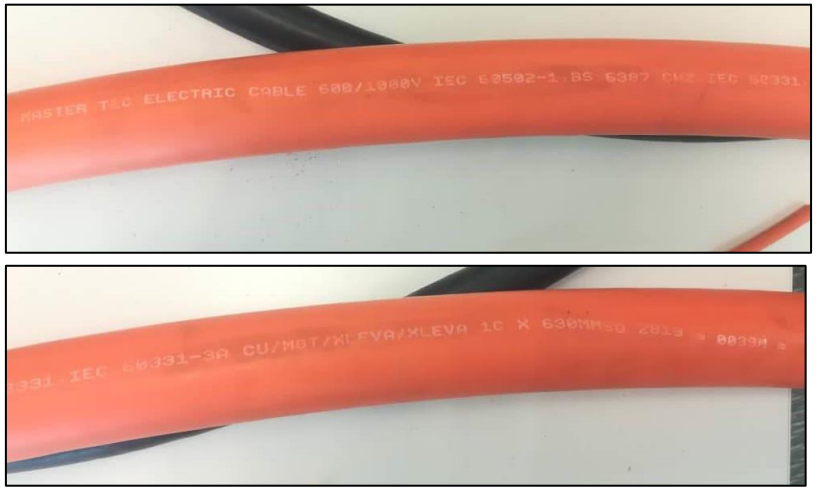
LAMPIRAN

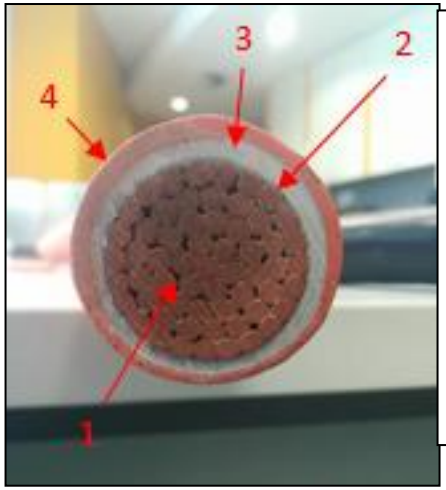
Perihal Barangan	:	*FIRE RESISTANT CABLE*
Nama Syarikat	:	*MASTER TEC WIRE & CABLE SDN. BHD.*
Alamat Syarikat	:	*RM1299-A, KAWASAN PERINDUSTRIAN REMBIA, 78000 ALOR GAJAH, MELAKA*
No. Tel	:	*06 – 316 1111*
No. Fax	:	*06 – 316 2888*
Email	:	sales@mastertec-wirecable.com
Nama Pengilang	:	*MASTER TEC WIRE & CABLE SDN. BHD.*
Negara Pengilang	:	*MALAYSIA*
Jenama	:	*MASTER TEC*
No. Perakuan ST/ No. Sijil/ Laporan Ujian Jenis	:	*LESEN PENSIJILAN SIRIM : PC001205 & PC001206* *NO. PENSIJILAN BOMBA : JBPM/IP/RNP:700-7/2/16-156(5)* *LAPORAN UJIAN SIRIM : 2019EA1407, 2019EA1413, 2018EEA0018 & 2018EEA0019*
Tarikh Tamat	:	*15.06.2022*
Rujukan Standard	:	*IEC 60331-21:2009, BS 6387:1994 Cat CWZ, IEC 60332-1, IEC 60332-3-22, IEC 61034-2:2005, IEC 60502-1:2009 & IEC 60754-2:2011*
Catatan	:	-
Muka surat	:	*1 daripada 1*

KETERANGAN

NO.	MODEL	RATED VOLTAGE (V)	SIZE (sq. mm)	NO. OF CORE
1	CU/MGT/XLEVA/XLEVA - Mica Fire Barrier, Cross Linked EVA Low Smoke Halogen Free Mineral Filled Insulated, Cross Linked EVA Low Smoke Halogen Free Mineral Filled Sheathed, Non-Armoured Stranded Copper Conductor Cable	600/1000V	1.5, 2.5, 4, 6, 10, 16, 25, 35, 50, 70, 95, 120, 150, 185, 240, 300, 400, 500 & 630	1

Sample Fire Resistant Cable



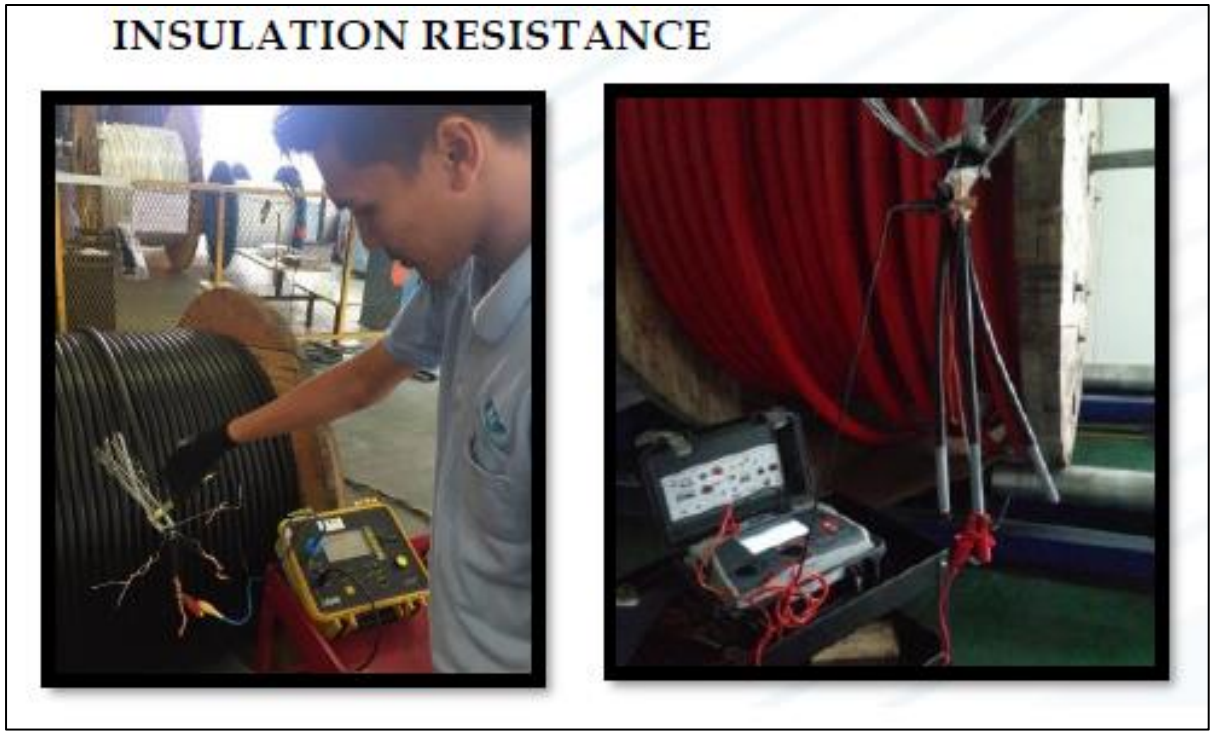


1. *Conductor : Plain Annealed copper Compacted*
2. *Fire proof layer : Mica Tape*
3. *Insulation : XLEVA*
4. *Over sheath : XLEVA*

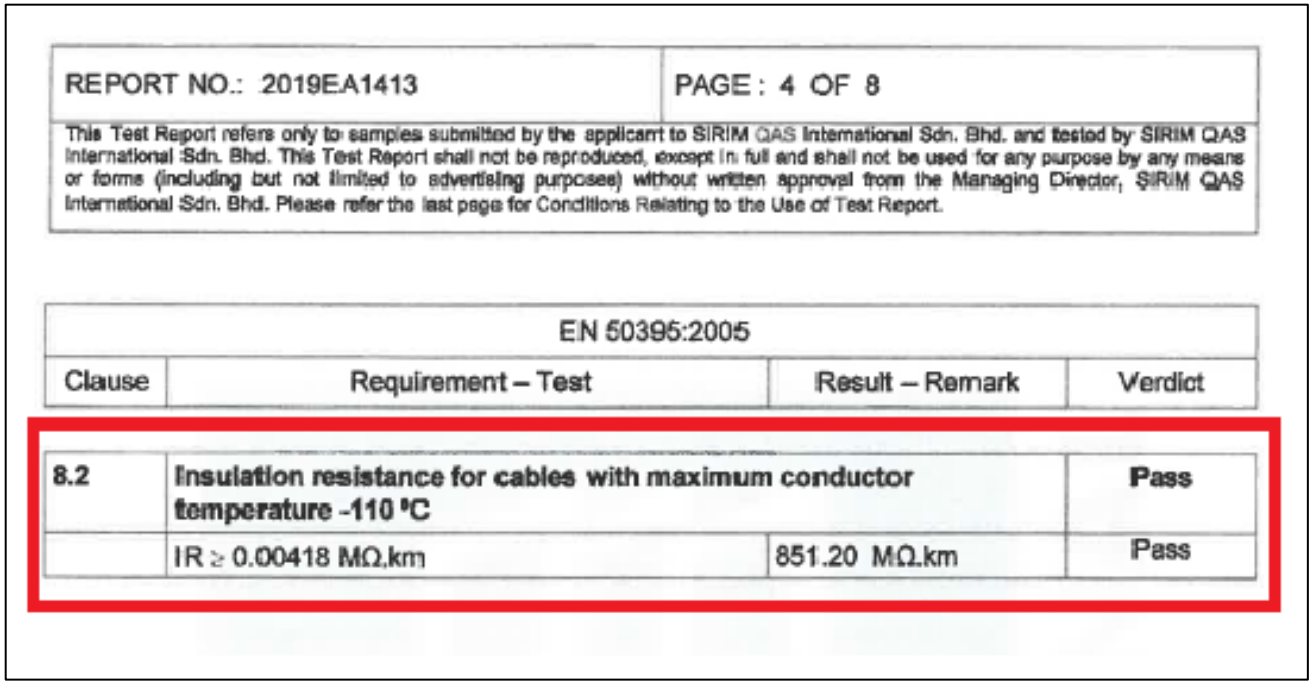
Marking:
MASTER TEC ELECTRIC CABLE 600/1000V IEC 60502-1, BS 6387 CWZ IEC 60331 IEC 60331-3A CU/MGT/XLEVA/XLEVA 1C X 630MM 2019

JKR REQUIREMENTS

- Insulation Resistant at maximum conductor temperature 110ºC



Laporan Ujian



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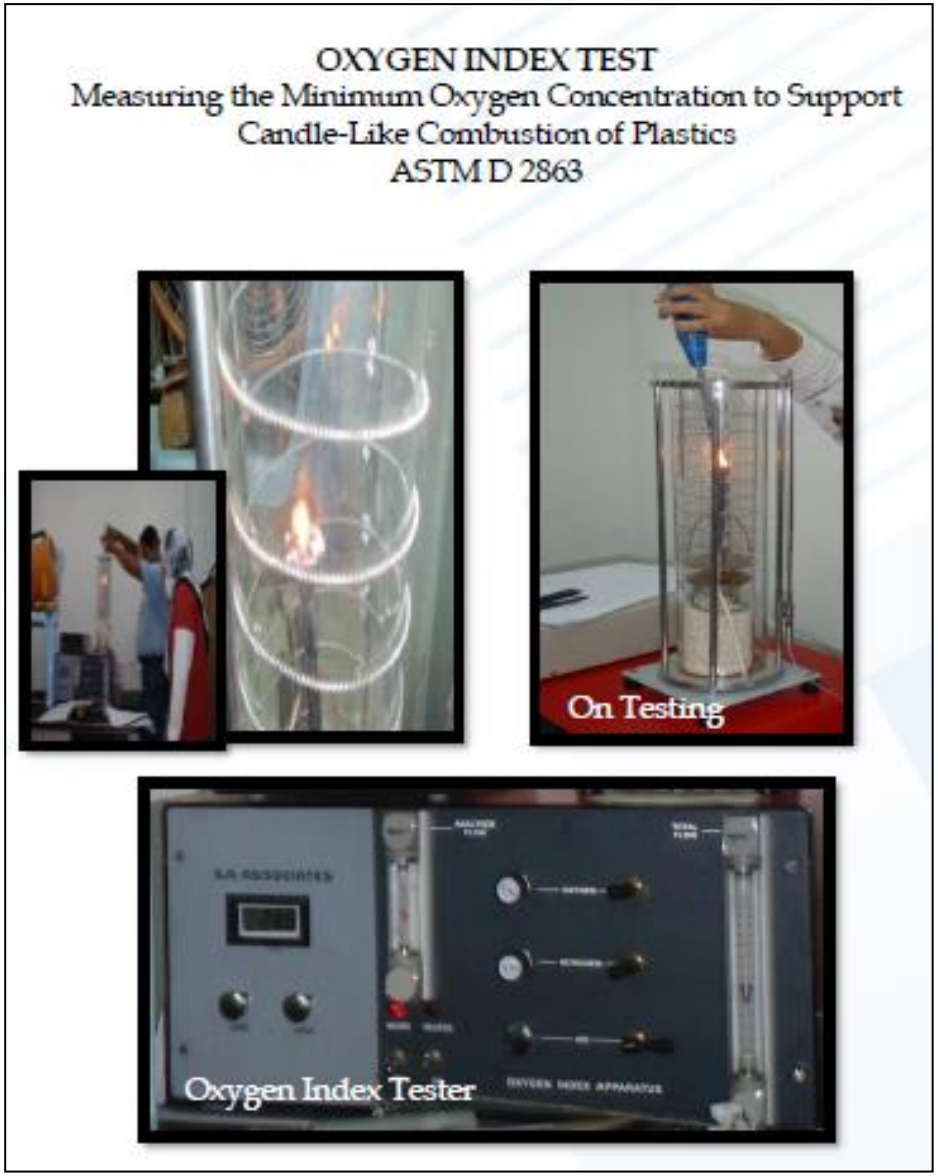
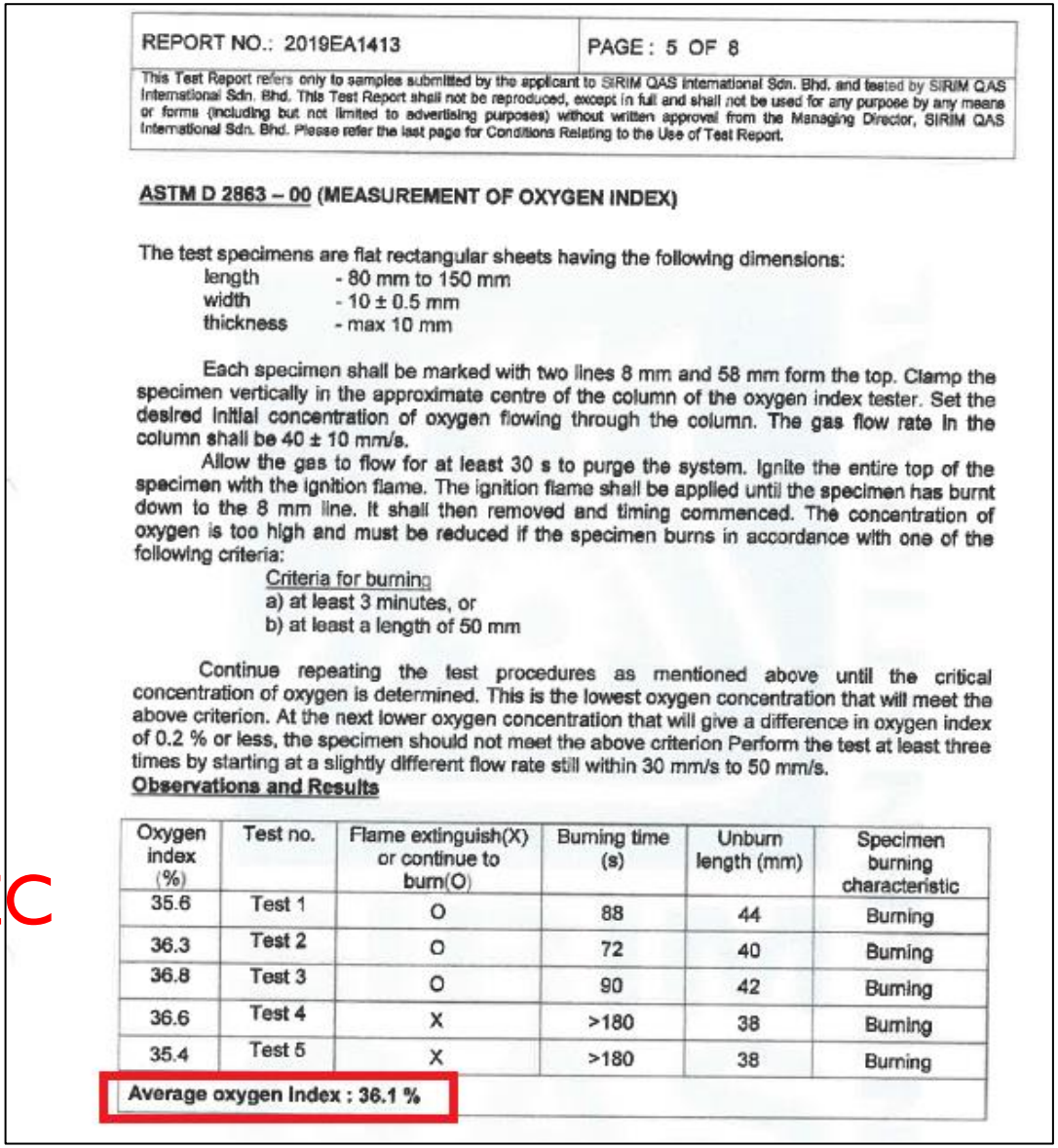
EN 50395:2005			
Clause	Requirement – Test	Result – Remark	Verdict
8.2	**Insulation resistance for cables with maximum conductor temperature -110 °C**		**Pass**
	IR ≥ 0.00418 MΩ.km	851.20 MΩ.km	Pass

Limiting Oxygen Index



- The **limiting oxygen index (LOI)** is the minimum concentration of oxygen, expressed as a percentage, that will support combustion of a polymer. It is measured by passing a mixture of oxygen and nitrogen over a burning specimen, and reducing the oxygen level until a critical level is reached.

Laporan Ujian



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ASTM D 2863 – 00 (MEASUREMENT OF OXYGEN INDEX)

The test specimens are flat rectangular sheets having the following dimensions:

length - 80 mm to 150 mm
width - 10 ± 0.5 mm
thickness - max 10 mm

Each specimen shall be marked with two lines 8 mm and 58 mm form the top. Clamp the specimen vertically in the approximate centre of the column of the oxygen index tester. Set the desired initial concentration of oxygen flowing through the column. The gas flow rate in the column shall be 40 ± 10 mm/s.

Allow the gas to flow for at least 30 s to purge the system. Ignite the entire top of the specimen with the ignition flame. The ignition flame shall be applied until the specimen has burnt down to the 8 mm line. It shall then removed and timing commenced. The concentration of oxygen is too high and must be reduced if the specimen burns in accordance with one of the following criteria:

Criteria for burning
a) at least 3 minutes, or
b) at least a length of 50 mm

Continue repeating the test procedures as mentioned above until the critical concentration of oxygen is determined. This is the lowest oxygen concentration that will meet the above criterion. At the next lower oxygen concentration that will give a difference in oxygen index of 0.2 % or less, the specimen should not meet the above criterion Perform the test at least three times by starting at a slightly different flow rate still within 30 mm/s to 50 mm/s.

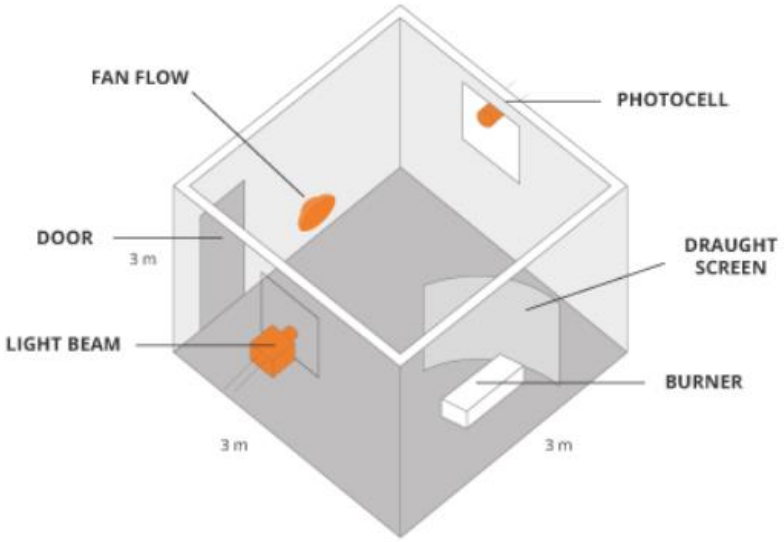
Observations and Results

Oxygen index (%)	Test no.	Flame extinguish(X) or continue to burn(O)	Burning time (s)	Unburn length (mm)	Specimen burning characteristic
35.6	Test 1	O	88	44	Burning
36.3	Test 2	O	72	40	Burning
36.8	Test 3	O	90	42	Burning
36.6	Test 4	X	>180	38	Burning
35.4	Test 5	X	>180	38	Burning

Average oxygen Index : 36.1 %

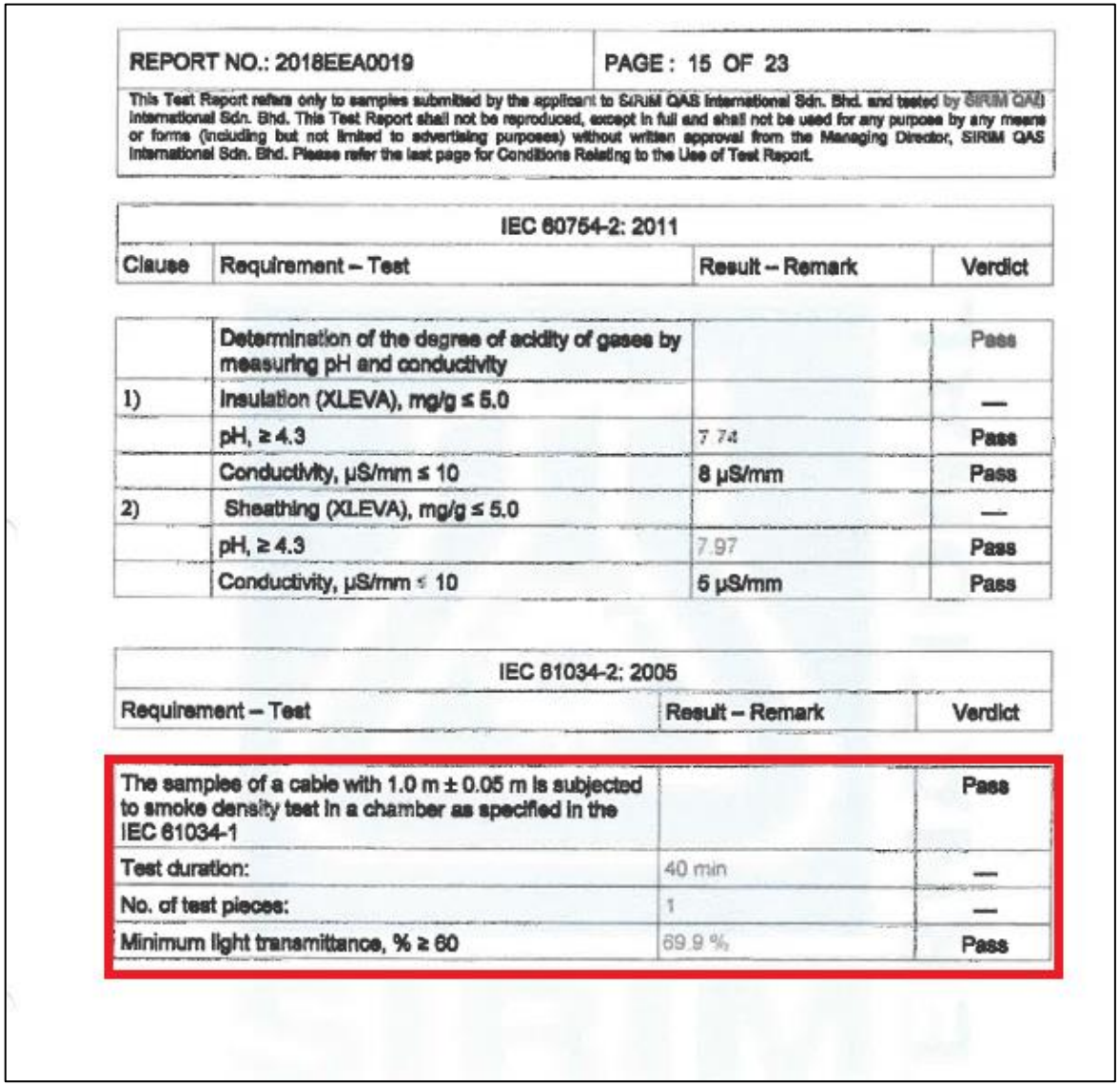
JKR SPEC
>28%

• Smoke Density



- Cable Smoke Density Testing is to determine the volume of smoke generated when cables are burned.

Laporan Ujian



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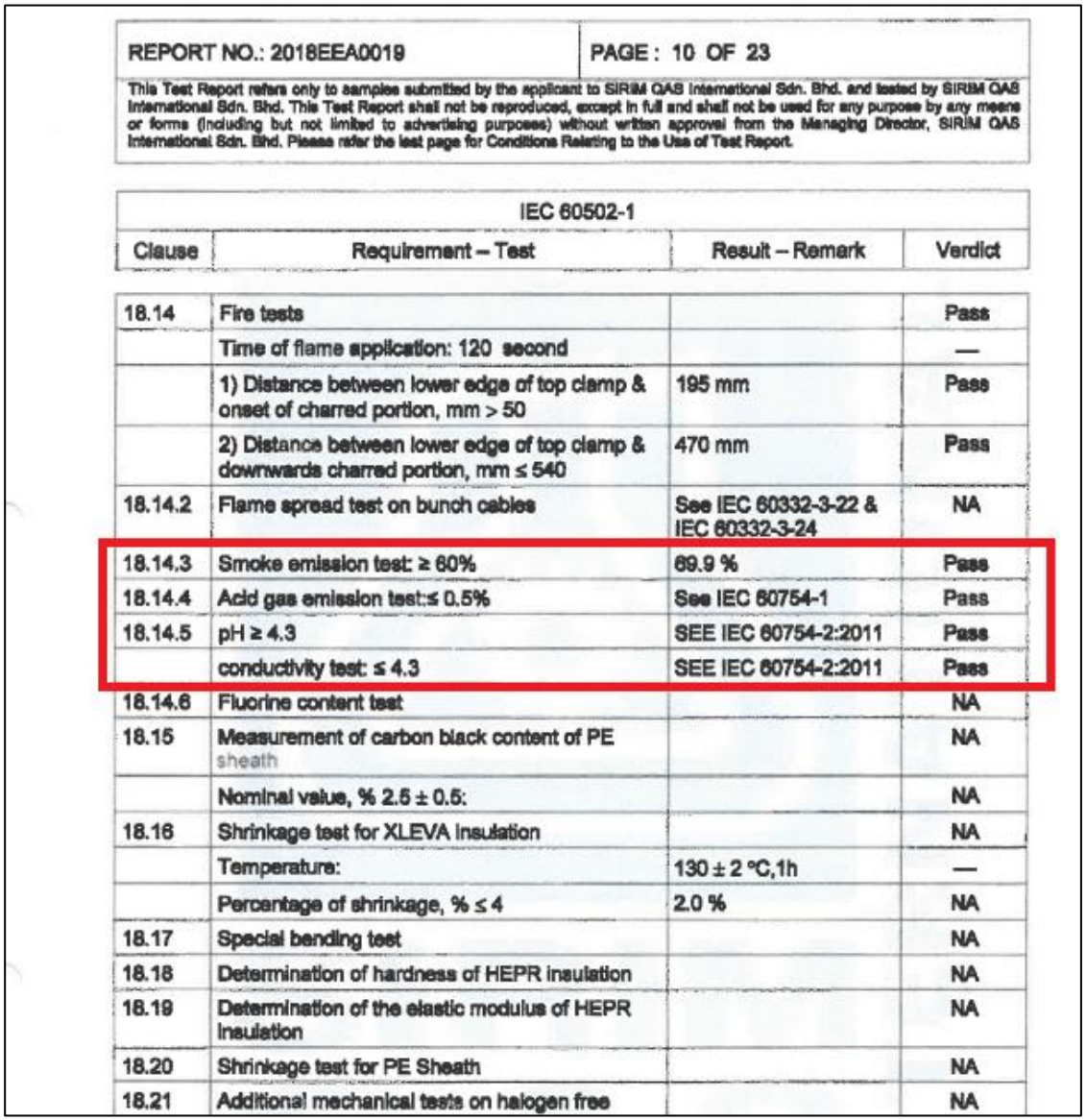
IEC 60754-2: 2011			
Clause	Requirement – Test	Result – Remark	Verdict
	Determination of the degree of acidity of gases by measuring pH and conductivity		Pass
1)	Insulation (XLEVA), mg/g ≤ 5.0		—
	pH, ≥ 4.3	7.74	Pass
	Conductivity, µS/mm ≤ 10	8 µS/mm	Pass
2)	Sheathing (XLEVA), mg/g ≤ 5.0		—
	pH, ≥ 4.3	7.97	Pass
	Conductivity, µS/mm ≤ 10	5 µS/mm	Pass

IEC 61034-2: 2005		
Requirement – Test	Result – Remark	Verdict
The samples of a cable with 1.0 m ± 0.05 m is subjected to smoke density test in a chamber as specified in the IEC 61034-1		Pass
Test duration:	40 min	—
No. of test pieces:	1	—
Minimum light transmittance, % ≥ 60	69.9 %	Pass

- Test on gases

- Tests for corrosive and acid gas, pH and conductivity, and for the presence of halogens

Laporan Ujian



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IEC 60502-1			
Clause	Requirement – Test	Result – Remark	Verdict
18.14	Fire tests		Pass
	Time of flame application: 120 second		—
	1) Distance between lower edge of top clamp & onset of charred portion, mm > 50	195 mm	Pass
	2) Distance between lower edge of top clamp & downwards charred portion, mm ≤ 540	470 mm	Pass
18.14.2	Flame spread test on bunch cables	See IEC 60332-3-22 & IEC 60332-3-24	NA
18.14.3	Smoke emission test: ≥ 60%	69.9 %	Pass
18.14.4	Acid gas emission test:≤ 0.5%	See IEC 60754-1	Pass
18.14.5	pH ≥ 4.3	SEE IEC 60754-2:2011	Pass
	conductivity test: ≤ 4.3	SEE IEC 60754-2:2011	Pass
18.14.6	Fluorine content test		NA
18.15	Measurement of carbon black content of PE sheath		NA
	Nominal value, % 2.5 ± 0.5:		NA
18.16	Shrinkage test for XLEVA insulation		NA
	Temperature:	130 ± 2 °C,1h	—
	Percentage of shrinkage, % ≤ 4	2.0 %	NA
18.17	Special bending test		NA
18.18	Determination of hardness of HEPR insulation		NA
18.19	Determination of the elastic modulus of HEPR insulation		NA
18.20	Shrinkage test for PE Sheath		NA
18.21	Additional mechanical tests on halogen free		NA

- Test of electric cable under fire condition – circuit integrity

  - The performance requirements for cables required to maintain circuit integrity under fire conditions. The test are conducted according to standard BS6387

  - Have 3 condition need to be test :
    1) Resistance to fire alone (Category A, B & C)
    2) Resistance to fire with water (Category W)
    3) Resistance to fire with mechanical shock (Category X, Y & Z)

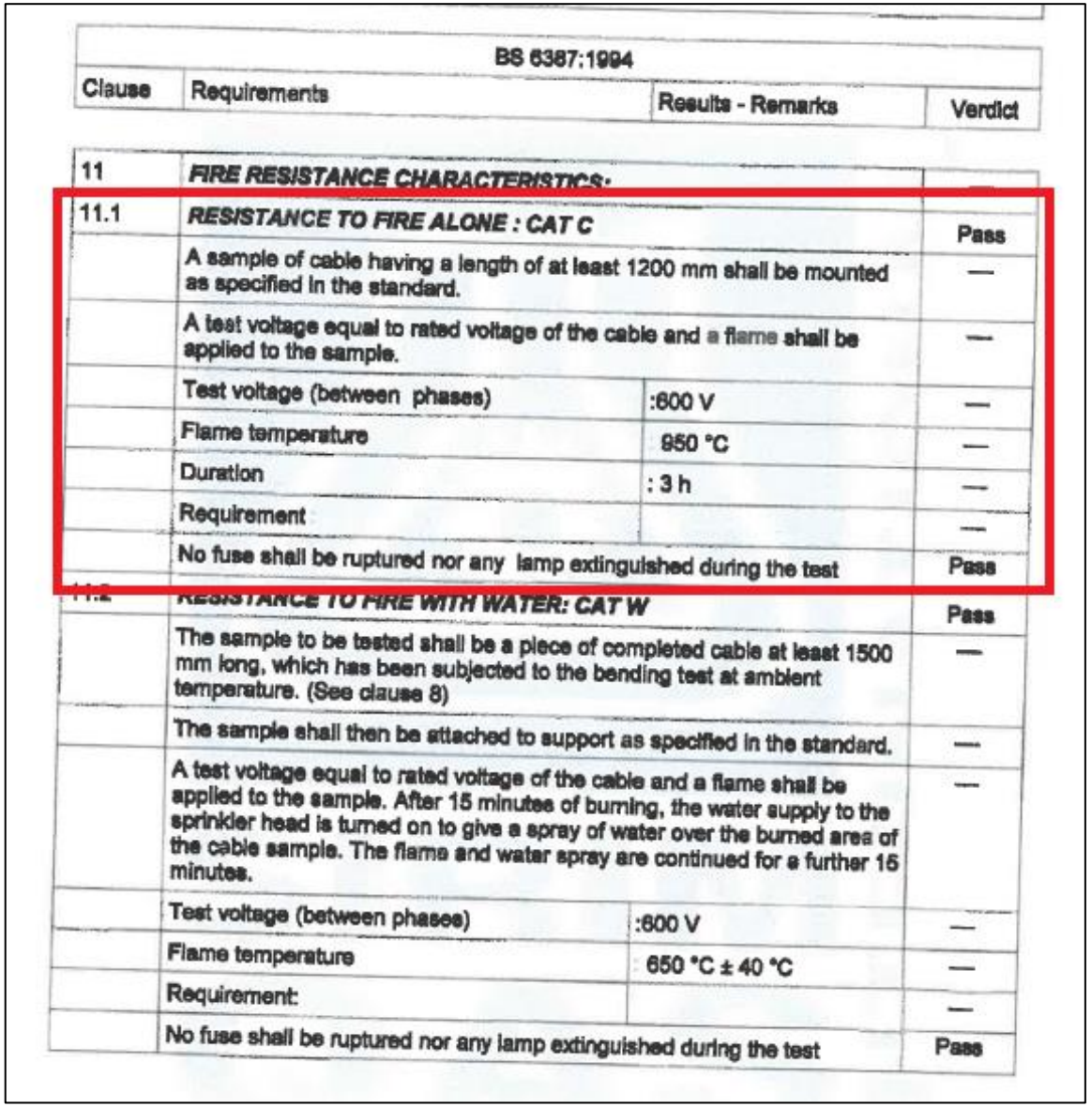
  - The highest standard for BS6387 is category CWZ

1) Resistance to fire alone

JKR SPEC CAT. 'C'

- The cables is tested by gas burner flame while passing a current at its rate voltage. Four survival categories are defined :
  - Cat A (3 hours at 650°C)
  - Cat B (3 hours at 750°C)
  - Cat C (3 hours at 950°C)
  - Cat S (20 minutes at 950°C)

Laporan Ujian



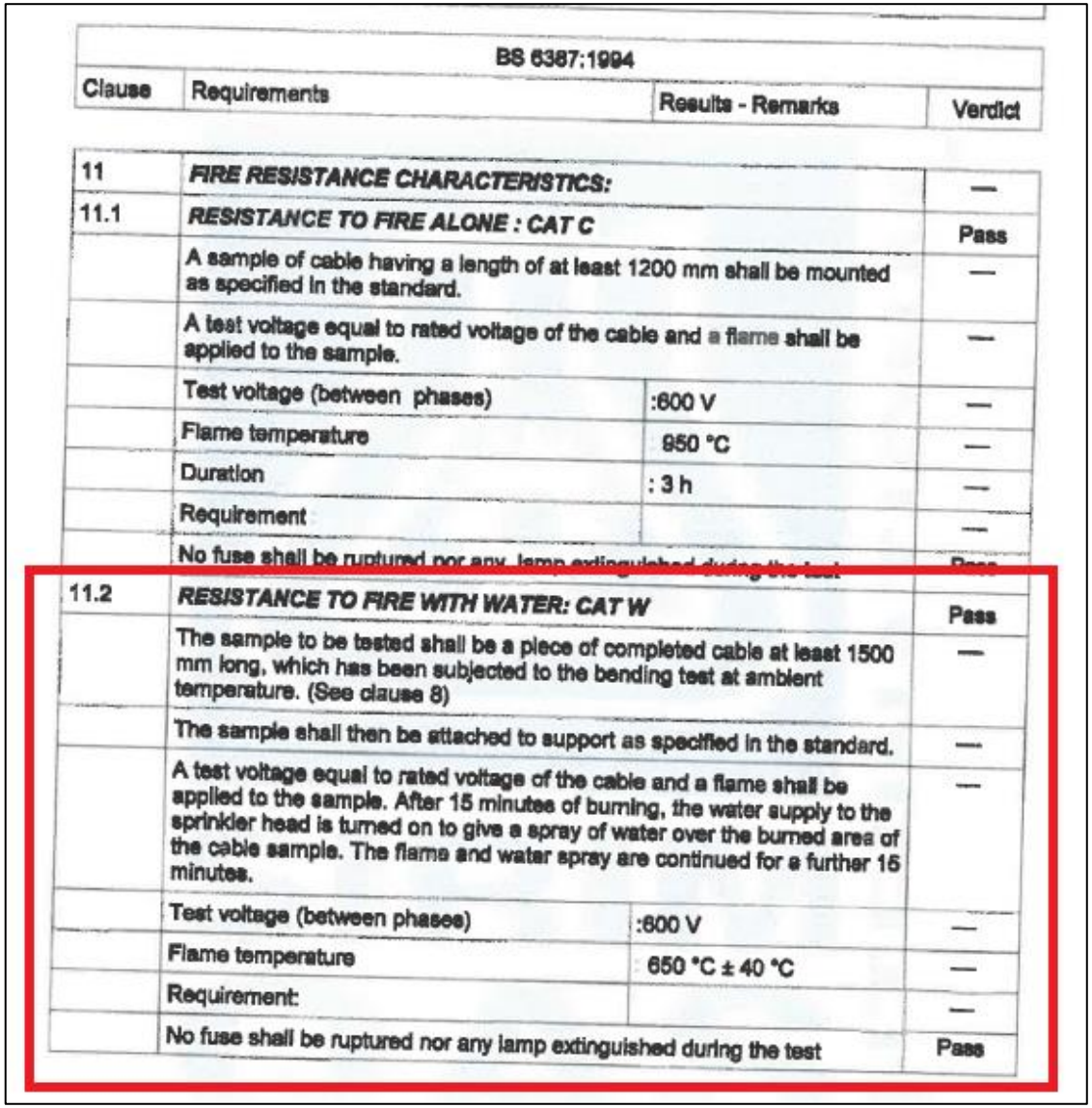
BS 6387:1994			
Clause	Requirements	Results - Remarks	Verdict
11	***FIRE RESISTANCE CHARACTERISTICS:***		
11.1	***RESISTANCE TO FIRE ALONE : CAT C***		Pass
	A sample of cable having a length of at least 1200 mm shall be mounted as specified in the standard.		—
	A test voltage equal to rated voltage of the cable and a flame shall be applied to the sample.		—
	Test voltage (between phases)	:600 V	—
	Flame temperature	950 °C	—
	Duration	: 3 h	—
	Requirement		—
	No fuse shall be ruptured nor any lamp extinguished during the test		Pass
11.2	***RESISTANCE TO FIRE WITH WATER: CAT W***		Pass
	The sample to be tested shall be a piece of completed cable at least 1500 mm long, which has been subjected to the bending test at ambient temperature. (See clause 8)		—
	The sample shall then be attached to support as specified in the standard.		—
	A test voltage equal to rated voltage of the cable and a flame shall be applied to the sample. After 15 minutes of burning, the water supply to the sprinkler head is turned on to give a spray of water over the burned area of the cable sample. The flame and water spray are continued for a further 15 minutes.		—
	Test voltage (between phases)	:600 V	—
	Flame temperature	650 °C ± 40 °C	—
	Requirement:		—
	No fuse shall be ruptured nor any lamp extinguished during the test		Pass

2) Resistance to fire with water

JKR SPEC CAT. 'W'

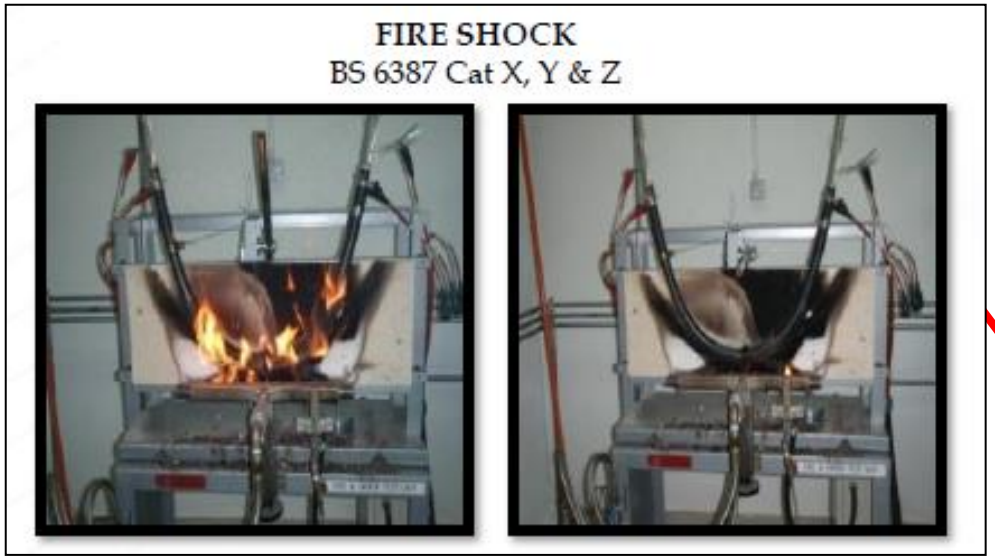
- A new sample of cable is exposed to flame at 650°C for 15 minutes while passing a current at its rated voltage and then the spray is turned on to give exposure to both fire and water for a further 15 minutes. A single survival category W is defined if the cables surpassed the testing requirement

Laporan Ujian



BS 6387:1994			
Clause	Requirements	Results - Remarks	Verdict
11	***FIRE RESISTANCE CHARACTERISTICS:***		—
11.1	***RESISTANCE TO FIRE ALONE : CAT C***		Pass
	A sample of cable having a length of at least 1200 mm shall be mounted as specified in the standard.		—
	A test voltage equal to rated voltage of the cable and a flame shall be applied to the sample.		—
	Test voltage (between phases)	:600 V	—
	Flame temperature	950 °C	—
	Duration	: 3 h	—
	Requirement		—
	No fuse shall be ruptured nor any lamp extinguished during the test		Pass
11.2	***RESISTANCE TO FIRE WITH WATER: CAT W***		Pass
	The sample to be tested shall be a piece of completed cable at least 1500 mm long, which has been subjected to the bending test at ambient temperature. (See clause 8)		—
	The sample shall then be attached to support as specified in the standard.		—
	A test voltage equal to rated voltage of the cable and a flame shall be applied to the sample. After 15 minutes of burning, the water supply to the sprinkler head is turned on to give a spray of water over the burned area of the cable sample. The flame and water spray are continued for a further 15 minutes.		—
	Test voltage (between phases)	:600 V	—
	Flame temperature	650 °C ± 40 °C	—
	Requirement:		—
	No fuse shall be ruptured nor any lamp extinguished during the test		Pass

3) Resistance to fire with mechanical shock



JKR SPEC CAT. 'Z'

- The final requirement is mechanical shock damage. A fresh sample is mounted on a backing panel in an S bend and is exposed to flames while the backing panel is stuck with a steel bar with the same diameter as the cables under test every 30 seconds for 15 minutes. The cables will be tested under the following temperatures:
  - X (650°C/15min)
  - Y(750°C/15min)
  - Z (950°C/15min).

Laporan Ujian

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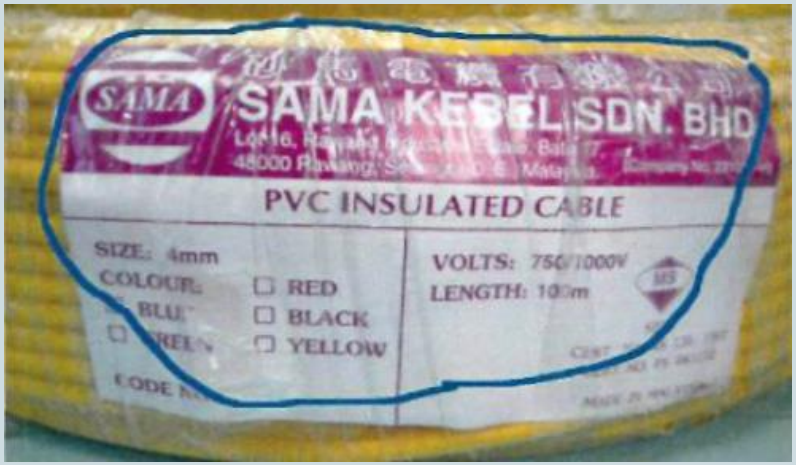
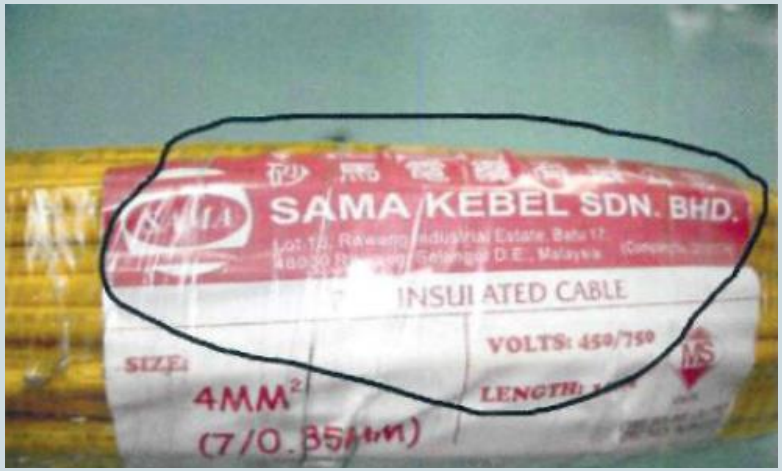
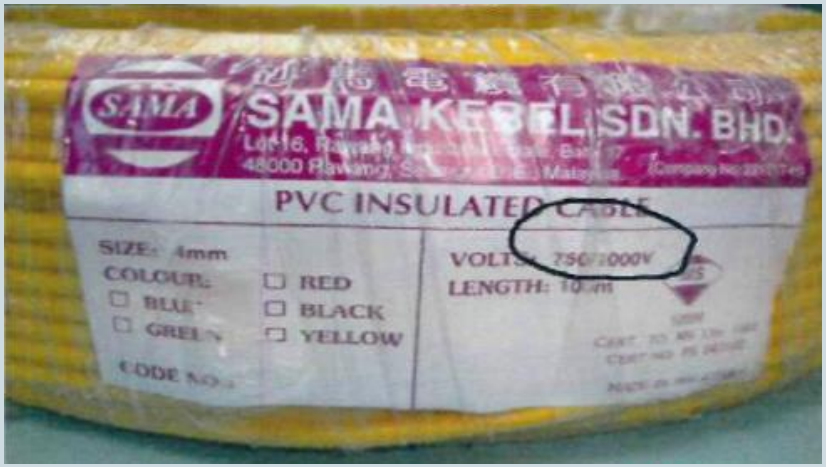
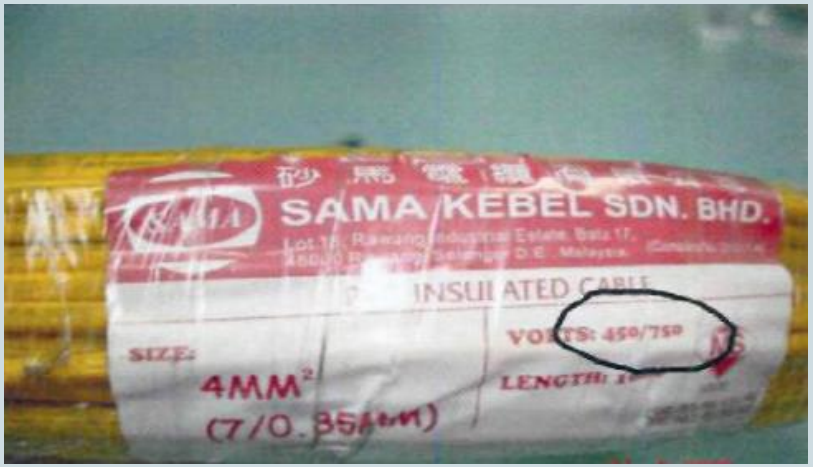
BS 6387:1994			
Clause	Requirements	Results - Remarks	Verdict
11.3	***RESISTANCE TO FIRE WITH MECHANICAL SHOCK:CAT Z***		Pass
	A sample of cable not less than 1200 mm long shall be mounted on a vertical wall comprising a board of heat-resisting incombustible material fastened to steel runners as specified in the standard.		—
	A test voltage equal to the rated voltage of the cable shall be applied to the sample. Start the shock producing device and ignite the burners. Continue the test for 15 minutes.		—
	Test voltage (between phases)	:600 V	—
	Flame temperature	: 950 °C ± 40 °C	—
	Requirement:		—
	No fuse shall be ruptured nor any lamp extinguished during the test		Pass

CONTOH PEMALSUAN I

Imitation Cable	*Original Cable*
	

- Perbezaan warna pada *labelling*

CONTOH PEMALSUAN 2

Imitation Cable	*Original Cable*
	

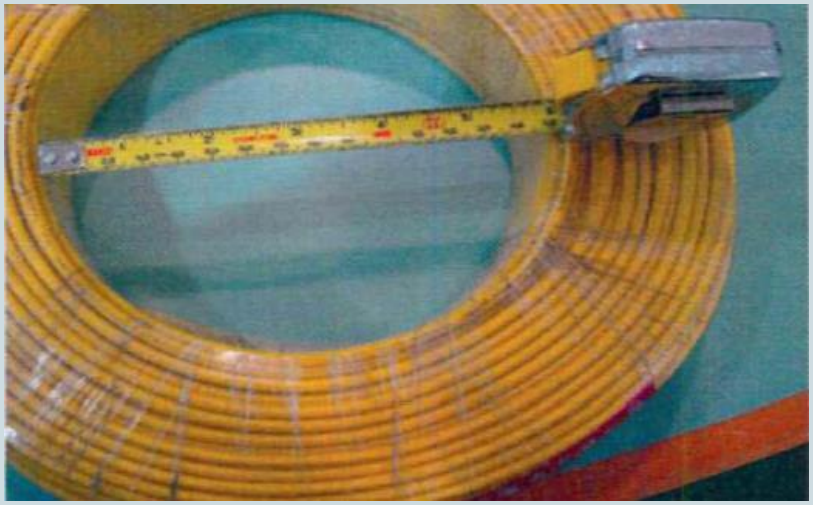
- Perbezaan *rated voltage* pada *labelling*
- *Imitation Cable* (750/1000V), *Original Cable* (450/750V)
- Merujuk pada *standard MS2112-3 rated voltage* 450/750V

CONTOH PEMALSUAN 3

Imitation Cable	*Original Cable*
	

- *Marking for Original Cable is ink printed*

CONTOH PEMALSUAN 4

Imitation Cable	*Original Cable*
	

- *Inner pakaging diameter for imitation cable is around 7 inch and for original cable is around 6 inch.*

CONTOH PEMALSUAN 5

Imitation Cable	*Original Cable*
	

- Perbezaan berat pada keseluruhan *pakaging*

CONTOH PEMALSUAN 6

- Perbezaan jenama pada *packaging* dan kabel