MCMA

MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Cables and Standards

Lokman A Dahlan

Technical Advisor

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Development of MS Standard Cables

- *The development of national standards on electric cables takes into account the principles and norms as established internationally, current prevailing conditions and local practices. It is important to understand that these aspects are majorly unbeknown to buyers and users, hence failure to comply on critical aspects may present an undetermined risk on safety.*

- *A brief outlook on the basic design of electric cables will provide an understanding of why the supply of non-standard cables is a lucrative business whilst potentially diminishing the service life and reliability of the product. The impact of safety unfortunately may continue to be unknown as proof on non-compliance will usually be lost in fires and related disasters.*

- *In the way of most industrialized nations, it is important for product standards, certifications and markings to be respected and ingrained as a means of ensuring product quality, reliability and safety for all users.*

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Malaysian Standards (MS) on Cables

1	MS 2108: 2007	Electric Cable : 6.35/11(12)kV single core XLPE insulated cables – non-armoured	MV-XLPE
2	MS 2109: 2007	Electric Cable : 6.35/11(12)kV single core XLPE insulated cables – armoured	
3	MS 2110 :2007	Electric Cable : 19/33(36)kV single core XLPE insulated cables – non-armoured	
4	MS 2111: 2007	Electric Cable : 19/33(36)kV single core XLPE insulated cables –armoured	
5	MS 2113*	Electric Cable : 12.7/22(24)kV single core XLPE insulated cables – non-armoured	
6	MS 2114*	Electric Cable : 12.7/22(24)kV single core XLPE insulated cables – armoured	
7	MS 2115*	Electric Cable : 6.35/11(12)kV three core XLPE insulated cables – non-armoured	
8	MS 2116*	Electric Cable : 6.35/11(12)kV three core XLPE insulated cables –armoured	
9	MS 2117*	Electric Cable : 12.7/22(24)kV three core XLPE insulated cables –armoured	
10	MS 2118*	Electric Cable : 2.7/22(24)kV three core XLPE insulated cables –armoured	
11	MS 2119*	Electric Cable : 19/33(36)kV three core XLPE insulated cables –armoured	
12	MS 2120*	Electric Cable : 19/33(36)kV three core XLPE insulated cables –armoured	
13	MS 2104:2007	Electric Cable and Wire: 600/1000(Um = 1200) V single core XLPE insulated cable – non-armoured	LV-XLPE
14	MS 2105:2007	Electric Cable and Wire: 600/1000(Um = 1200) V single core XLPE insulated cable –armoured	
15	MS 2106:2007	Electric Cable and Wire: 600/1000(Um = 1200) V multi core XLPE insulated cable –non-armoured	
16	MS 2107: 2007	Electric Cable and Wire: 600/1000(Um = 1200) V multi core XLPE insulated cable –armoured	
17	MS 2100:2006	Electric Cable and Wire: 600/1000(Um = 1200) V single core PVC insulated cable – non-armoured	LV-PVC
18	MS 2101:2006	Electric Cable and Wire: 600/1000(Um = 1200) V single core PVC insulated cable –armoured	
19	MS 2102:2007	Electric Cable and Wire: 600/1000(Um = 1200) V multi core PVC insulated cable –non-armoured	
20	MS 2103: 2007	Electric Cable and Wire: 600/1000(Um = 1200) V multi core PVC insulated cable –armoured	
21	MS 2112-1: 2009	Electric Cable and Wire: Polyvinyl Chloride(PVC) insulated cables of rated voltages up to and including 450/750 V – Part 1 : General requirements	450/750V-PVC
22	MS 2112-2: 2009	Electric Cable and Wire: Polyvinyl Chloride(PVC) insulated cables of rated voltages up to and including 450/750 V – Part 2 : Test Methods	
23	MS 2112-3: 2009 **	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	
24	MS 2112-4: 2009 **	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	
25	MS 2112-5: 2009 **	Electric Cable and Wire: Polyvinyl Chloride(PVC) insulated cables of rated voltages up to and including 450/750 V – Part 5 : Flexible cables	
26	MS 2112-6: 2009 **	Electric Cable and Wire: Polyvinyl Chloride(PVC) insulated cables of rated voltages up to and including 450/750 V – Part 6 : Cables for Lifts and flexible connections	
27	MS 2121*	Telecommunication Cable : Plastic Twin pair,triple and unit types, internal cable	Telecoms
28	MS 2122*	Telecommunication Cable : Jumper cable	
29	MS 2123*	Telecommunication Cable : Self supporting drop wire	
30	MS 2124*	Telecommunication Cable :Fully Filled Unit Twin moisture barrier polyethylene sheathed cable (FF PEUT)	
31	MS 2125*	Telecommunication Cable :Integral Barrier Unit Twin moisture barrier polyethylene sheathed cable (IB PEUT)	
32	MS 2126*	Telecommunication Cable :Polyethylene Insulated 25 Pair Unit Twin moisture barrier polyethylene sheathed cable (FS PEUT)	

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

MS Std Application

Um (max voltage)	Class	Ref Stds & Specifications		MS Std Application
		Existing/Prev	New	
Above 170kV	EHV	Utility	--	*MS standards not available - cables designed according to Utility and project requirements with variations to suit manufacturers' preference*
37kV - 170kV	HV	IEC/Utility	--	
3.7kV - 36kV	MV	BS/IEC/Utility	Utility/MS	*MS standards available for non-Utility market to facilitate connectivity to local Utility systems*
1.2kV - 3.6kV	LV	BS/IEC/Owner	Utility/MS	
Below 1.2kV	ELV	BS>MS	BS>IEC>MS	*MS standards available for all users*
Telecoms	Various	TMB/Service Providers	TMB>MS	*MS standards available for all users*

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Overview of Standards & Quality of Cables

Um (max voltage)	Class	Ref Stds & Specifications		Control on Quality & Inspection	Risk
		Existing/Prev	New		
Above 170kV	EHV	Utility	--	High scrutiny at all levels	Nil
37kV - 170kV	HV	IEC/Utility	--	High sampling rate of test & inspection	VLow
3.7kV - 36kV	MV	BS/IEC/Utility	Utility/MS	Adequate control on test & inspection	Low
1.2kV - 3.6kV	LV	BS/IEC/Owner	Utility/MS	Adequate control on test & inspection	Low
Below 1.2kV	**ELV**	BS>MS	BS>IEC>MS	**Minimum or no control**	**High**
Telecoms	Various	TMB/Service P	TMB>MS	High sampling rate of test & inspection	VLow

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Controlled Items under Suruhanjaya Tenaga

CATEGORY	ITEM DETAILS	REF STDS (Prev)	NEW MS
Category 31 - WIRES / CABLES / CORDS 0.5 to 35 sqmm	Insulated flexible cords and cables	MS 140 : 1987	Electric Cable and Wire - Polyvinyl Chloride (PVC) Insulated Cables of rated voltages up to and including 450 / 750 V
	PVC insulated cable (non-armoured) for electric power supply	MS 136 : 1987	
	Polyvinyl chloride (PC) insulated flexible cords	MS 140 : 1987	MS2112-1:2009 Part 1 : General Requirements MS2112-2:2009 Part 2 : Test Methods MS2112-3:2009 Part 3 : Non-Sheathed Cables for Fixed Wiring MS2112-4:2009 Part 4 : Sheathed Cables for Fixed Wiring MS2112-5:2009 Part 5 : Flexible Cables MS2112-6:2009 Part 6 : Cables for Lift and Flexible Connections
		Equiv stds : BS/IEC/AS DIN/JIS/UL	
	Rubber insulated cord and flexible cables	MS 140 : 1987	Under review, to retain under MS 140 : 1987

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

MS2112 :2009 Series

MS 2112 consists of the following parts, under the general title *Electric cable and wire - PVC insulated cables of rated voltages up to and including 450/750 V*:

Part 1: General requirements
Part 2: Test methods
Part 3: Non-sheathed cables for fixed wiring
Part 4: Sheathed cables for fixed wiring
Part 5: Flexible cables
Part 6: Cables for lift and flexible connections

Note : All cable types of conductor sizes up to and including 35 mmsq are controlled items under the Suruhanjaya Tenaga Malaysia

MS 2112-1:2009 Foreword

This Malaysian Standard was developed by the Working Group on Cables and Cable Accessories under the authority of the Industry Standards Committee on Electrotechnical-1. Development of this standard was carried out by the Malaysian Cable Manufacturers Association which is the Standards-Writing Organisation (SWO) appointed by SIRIM Berhad to develop standards for cables and cable accessories.

In the preparation of this standard, reference was made to the following:

a) MS 136:1995, *Specification for PVC-insulated cables (non-armoured) for electric power and lighting*;

b) MS 140:1987, *Specification for insulated flexible cords and cables*; and

c) IEC 60227-1 Edition 3:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 1: General requirements*, published by the International Electrotechnical Commission.

The Working Group on Cables and Cable Accessories has determined that minor differences in requirement to the MS 136, MS 140 and IEC 60227-1 are necessary in order to comply with the prevailing practices of cable manufacturers and users in Malaysia. These are as follows:

a) requirements of PVC/E and PVC/ST10 are based on maximum conductor temperature of 90 ^{o}C and 105 ^{o}C; PVC ST 9 is not applicable;

b) bending test and snatch test for tinsel cord are not applicable;

c) all cable types of conductor sizes up to and including 35 mm^2 are controlled items under the Suruhanjaya Tenaga;

d) standard requirements for drumming and packaging of completed cables have been included;

e) tests at low temperature for insulation and oversheath which are not suited to conditions in Malaysia have been excluded;

f) insulation and sheathing compound shall comply with ROHS requirements;

g) classification of insulation and sheathing are complying to IEC 60227 rather than to MS 138; and

h) tinned conductor is not considered as far as possible.

Ac

Me

Mr
Ms
Ir L

Mr
Ir H
Mr

Mr
Ms
Mr

Mr
Mr
Mr

Mer

Mr
Ms
Mr
Mr
Mr
Mr
Mr
Ms
Mr
Ms
Mr
Mr
Mr
Mr
Ms
Mr
Mr
Mr
Mr

CONTENTS

ELECTRIC CABLE
INSULATED CABLES C
450/750 V - P

1 Scope

This part of Malaysian Standarc
PVC insulation of rated voltages
nominal voltages not exceeding

The particular types of cables a
2112-6.

The testing methods of the parti
and MS 2112-6 are given in MS

2 Normative references

The following normative referenc
dated references, only the editio
the normative reference (includin

MS 2112-2, *Electric cable and*
including 450/750 V - Part 2: Tes

MS 2112-3, *Electric cable and*
including 450/750 V - Part 3: Nor

MS 2112-4, *Electric cable and*
including 450/750 V - Part 4: She

MS 2112-5, *Electric cable and*
including 450/750 V - Part 5: Flex

MS 2112-6, *Electric cable and*
including 450/750 V – Part 6: Cal

MS IEC 60502-1, *Power cables*
voltages from 1 kV (U_m = 1.2 kV)
1kV (U_m = 1.2kV) and 3 kV (U_m =

MS IEC 60811-1-1, *Common tes*
cables and optical cables - Pa
thickness and overall dimensions

MS IEC 60811-1-2, *Common tes*
cables - Part 1: Methods for gene

MS IEC 608
cables - Pa
temperature

MS IEC 608
and optical c
test - Therma

IEC 60304, C

IEC 60227-2,
V - Part 2: Te

IEC 60227-3,
V - Part 3: Nc

IEC 60227-4,
V – Part 4: Si

IEC 60227-5,
V - Part 5: Fle

IEC 60228, C

IEC 60332-1-
for vertical fla
mixed flame

3 Definiti

For the purpo

4 Genera

4.1 Condu

The conducto

The maximum
conductors sh

The classes
particular spe

4.2 Insulati

The insulatior
cable in the p
6):

a) type PVC/

b)

c)

d)

Th

Th
ren
che

Th
eac
211
spe
val

The
limi
1.

4.3

Unl
5 a
or f

The
she
IEC

4.4

The
MS

a)

b)

c)

d)

The

The
she
thicl
tabl

The minimum thickness at any place shall not fall below 85 % of the specified value by not more than 0.1mm. Compliance shall be checked by the test given in 4.7 of MS 2112-2. The sheath shall have adequate mechanical strength and elasticity within the temperature limits to which it may be exposed in normal use, with compliance with tests specified in Table 2.

5 Marking

5.1 Indication of origin and cable identification

Cables shall be marked with the following details:

a) name of manufacturer;

b) voltage designation;

c) number and size of conductor; and

d) standard number.

Cables for use at a conductor temperature exceeding 70 °C shall be marked with the maximum conductor temperature. Marking may be by printing or by embossing on the insulation or sheath.

5.2 Continuity of marks

The distance between the end and start of each element shall not exceed 50 mm while the distance between the end and start of each complete set of elements shall not exceed 550 mm.

5.3 Durability

Printed markings shall be durable. Compliance with this requirement shall be checked by the test given in 4.5 of MS 2112-2.

5.4 Legibility

All markings shall be legible.

6 Core identification

Each core shall be identified as follows:

a) in cables having up to and including five cores by colour, see 6.1; or

b) in cables having more than five cores by number, see 6.2.

6.1 Core identification by colours

Identification of the cores shall be the use of coloured insulation. Each core shall have one colour, except the core identified by a combination of the colours Green-and-Yellow.

For cables supplied in coils, the
manner as deemed appropriate.

8 Test on completed cal

8.1 Electrical properties

The cables shall have adequat
shall be checked by carrying c
conductor at 20 °C shall be in ac
and the results to be obtained in

8.2 Overall dimension

The mean overall dimensions of
the particular specifications (MS

The difference between any two
the same cross-section (ovality)
mean overall diameter.

Compliance shall be checked by

8.3 Mechanical strength of fl

The flexible cables shall be capa
occurring in normal use.

When specified in the particular s
by the test given in Clause 6 of M

8.4 Flexing test for flexible ca

See 6.1 of MS 2112-2.

During the test with 15 000 bac
Neither interruption of the current

After the test, the sample shall wi
MS 2112-2.

8.5 Test for separation of cor

See 6.2 of MS 2112-2.

The force shall be between 3 N ar

8.6 Flame retardance

All the cables shall comply with th

Table 1. Require

Ref. no.	Test
1	Tensile strength and elongation at break
1.1	Properties in the state a delivered:
1.1.1	Values to be obtained fc the tensile strength: - median, minimum
1.1.2	Values to be obtained fc the elongation at break: - median, minimum
1.2	Properties after ageing i oven
1.2.1	Ageing conditions: - temperature - duration of treatment
1.2.2	Values to be obtained fc the tensile strength: - median, minimum - variation[1], maximum
1.2.3	Values to be obtained fc the elongation at break: - median, minimum - variation[1], maximum
2	Loss of mass test
2.1	Ageing conditions: - temperature - duration of treatment
2.2	Values to be obtained fc the loss of mass, maxim
3	Compatibility test[2]
3.1	Ageing conditions
3.2	Mechanical properties a ageing
	Values to be obtained

[1] Only applicable when called u
[2] Only applicable when called u

Ref. no.
1
2
2.1
2.2
2.3
2.4
3
3.1
3.2
3.3
3.4
4
4.1
4.2

MS 2112-1:2009

Annex A
(informative)

Code designation

Cables of the types covered by this standards are designated by two numerals, cable type and MS (Malaysian standard).

The classes and type of cable are as follows:

1. Non-sheathed cables for fixed wiring

a) MS IV 01 - Single-core non-sheathed cable with rigid conductor for general purpose;

b) MS IV 01 - Single-core non-sheathed cable with flexible conductor for general purpose;

c) MS IV 03 - Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 70 °C;

d) MS IV 04 - Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 70 °C;

e) MS IV 05 - Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 90 °C;

f) MS IV 06 - Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 90 °C;

g) MS IV 07 - Single-core non-sheathed cable with solid conductor for internal wiring for a conductor temperature of 105 °C; and

h) MS IV 08 - Single-core non-sheathed cable with flexible conductor for internal wiring for a conductor temperature of 105 °C.

2. Sheathed cables for fixed wiring

a) MS VV 10 - PVC Insulated PVC sheathed cables.

3. Flexible cables

a) MS VVF 20 - light PVC sheathed flexible cable;

b) MS VVF 21 - ordinary PVC sheathed flexible cable;

c) MS VVF 22 - heat resistant light PVC sheathed flexible cable - 90 °C;

d) MS VVF 23 - heat resistant ordinary PVC sheathed flexible cable - 90 °C;

e) MS VVF 24 - heat resistant light PVC sheathed flexible cable - 105 °C; and

f) MS VVF 25 - heat resistant ordinary PVC sheathed flexible cable - 105 °C.

Table 2 – Class 2 stranded conductors for single-core and multi-core cables

1	2	3	4	5	6	7	8	9	10
Nominal cross-sectional area	Minimum number of wires in the conductor						Maximum resistance of conductor at 20°C		
	Circular		Circular compacted		Shaped		Annealed copper conductor		Aluminium or aluminium alloy conductor[c]
	Cu	Al	Cu	Al	Cu	Al	Plain wires	Metal-coated wires	
mm²							Ω/km	Ω/km	Ω/km
0,5	7	-	-	-	-	-	36,0	36,7	-
0,75	7	-	-	-	-	-	24,5	24,8	-
1,0	7	-	-	-	-	-	18,1	18,2	-
1,5	7	-	6	-	-	-	12,1	12,2	-
2,5	7	-	6	-	-	-	7,41	7,56	-
4	7	-	6	-	-	-	4,61	4,70	-
6	7	-	6	-	-	-	3,08	3,11	-
10	7	7	6	6	-	-	1,83	1,84	3,08
16	7	7	6	6	-	-	1,15	1,16	1,91
25	7	7	6	6	6	6	0,727	0,734	1,20
35	7	7	6	6	6	6	0,524	0,529	0,868
50	19	19	6	6	6	6	0,387	0,391	0,641
70	19	19	12	12	12	12	0,268	0,270	0,443
95	19	19	15	15	15	15	0,193	0,195	0,320
120	37	37	18	15	18	15	0,153	0,154	0,253
150	37	37	18	15	18	15	0,124	0,126	0,206
185	37	37	30	30	30	30	0,0991	0,100	0,164
240	37	37	34	30	34	30	0,0754	0,0762	0,125
300	61	61	34	30	34	30	0,0601	0,0607	0,100
400	61	61	53	53	53	53	0,0470	0,0475	0,0778
500	61	61	53	53	53	53	0,0366	0,0369	0,0605
630	91	91	53	53	53	53	0,0283	0,0286	0,0469
800	91	91	53	53	-	-	0,0221	0,0224	0,0367
1 000	91	91	53	53	-	-	0,0176	0,0177	0,0291
1 200	[b]						0,0151	0,0151	0,0247
1 400 [a]	[b]						0,0129	0,0129	0,0212
1 600	[b]						0,0113	0,0113	0,0186
1 800 [a]	[b]						0,0101	0,0101	0,0165
2 000	[b]						0,0090	0,0090	0,0149
2 500	[b]						0,0072	0,0072	0,0127

[a] These sizes are non-preferred. Other non-preferred sizes are recognized for some specialized applications but are not within the scope of this standard.

[b] The minimum number of wires for these sizes is not specified. These sizes may be constructed from 4, 5 or 6 equal segments (Milliken).

[c] For stranded aluminium alloy conductors having the same nominal cross-sectional area as an aluminium conductor the resistance value should be agreed between the manufacturer and the purchaser.

Table 3 – Class 5 flexible copper conductors for single core and multi-core cables

1	2	3	4
Nominal cross-sectional area	Maximum diameter of wires in conductor	Maximum resistance of conductor at 20 °C	
		Plain wires	Metal-coated wires
mm²	mm	Ω/km	Ω/km
0,5	0,21	39,0	40,1
0,75	0,21	26,0	26,7
1,0	0,21	19,5	20,0
1,5	0,26	13,3	13,7
2,5	0,26	7,98	8,21
4	0,31	4,95	5,09
6	0,31	3,30	3,39
10	0,41	1,91	1,95
16	0,41	1,21	1,24
25	0,41	0,780	0,795
35	0,41	0,554	0,565
50	0,41	0,386	0,393
70	0,51	0,272	0,277
95	0,51	0,206	0,210
120	0,51	0,161	0,164
150	0,51	0,129	0,132
185	0,51	0,106	0,108
240	0,51	0,0801	0,0817
300	0,51	0,0641	0,0654
400	0,51	0,0486	0,0495
500	0,61	0,0384	0,0391
630	0,61	0,0287	0,0292

ELECTR
INSULATED

1 Scope

This part of Mal
insulated flexible

The types of cabl

a) MS VVF 20 -

b) MS VVF 21 -

c) MS VVF 22 -

d) MS VVF 23 -

e) MS VVF 24 -

f) MS VVF 25 -

2 Normative

The following no
dated references
the normative ref

MS 2112-1, *Ele*
including 450/75

MS 2112-2, *Ele*
including 450/75

MS IEC 60228, C

MS IEC 60811-1
cables and optic
thickness and ov

MS IEC 60811-1
cables - Part 1: M

MS IEC 60811-1
and optical cabl
water absorption

MS IEC 60811-1
and optical cable

4 Ordinary PVC

4.1 Code design

The code designation

4.2 Rated voltage

The rated voltage sha

The maximum condu

4.3 Construction

4.3.1 Conductor

The conductor shall b
IEC 60228. The numb

4.3.2 Insulation

The insulation shall b
around each conduct
The insulation resista

4.3.3 Colours for c

a) two core : Blue ar

b) three core : Blue,

c) four core : Black,

d) five core : Black, I

4.3.4 Assembly of

The cores for circular
material to give a prac
cores.

The cores for flat cabl

Any filler shall not adh

4.3.5 Sheath

The sheath shall be
2112-1 applied aroun
shall not adhere to the

The sheath thickness

Number and nominal cross-sectional area of conductor (mm^2)	Class of co MS IEC
2 x 0.75	5
2 x 1	5
2 x 1.5	5
2 x 2.5	5
3 x 0.75	5
3 x 1	5
3 x 1.5	5
3 x 2.5	5
4 x 0.75	5
4 x 1	5
4 x 1.5	5
4 x 2.5	5
5 x 0.75	5
5 x 1	5
5 x 1.5	5
5 x 2.5	5

Table 4. Tests for type MS VVF 21

Ref. no.	Test	Category of test	Test method	
			Standard	Subclause
1	Electric tests			
1.1	Resistance of conductors	T, S	MS 2112-2	5.1
1.2	Voltage tests on cores according to voltage thickness:			
1.2.1	- at 1 500 V up to and including 0.6mm	T, S	MS 2112-2	5.3
1.2.2	- at 2 000 V exceeding 0.6mm	T, S	MS 2112-2	5.3
1.3	Voltage test on completed cable at 2 000 V	T	MS 2112-2	5.2
1.4	Insulation resistance at 70 °C	T	MS 2112-2	5.4
2	Provisions covering constructional and dimensional characteristics		MS 2112-1 and MS 2112-2	
2.1	Checking of compliance with constructional provisions	T, S	MS 2112-2	Inspection and manual test
2.2	Measurement of insulation thickness	T, S	MS 2112-2	4.6
2.3	Measurement of sheath thickness	T, S	MS 2112-2	4.7
2.3	Measurement of overall dimension	T, S	Ms 2112-2	4.8
3	Mechanical properties of insulation	T, S		
3.1	Tensile test before ageing	T	MS IEC 60811-1-1	9.1
3.2	Tensile test after ageing	T	MS IEC 60811-1-2	8.1, 3.1
3.3	Loss of mass test	T	MS IEC 60811-3-2	8.1
4	Mechanical properties of sheath	T	MS IEC 60811-1-1	9.2
4.1	Tensile test before and after ageing	T	MS IEC 60811-1-2	8.1
4.2	Loss of mass test	T	MS IEC 60811-3-2	8.2
5	Pressure test at high temperature			
5.1	Insulation	T	MS IEC 60811-3-1	8.1
5.2	Sheath	T	MS IEC 60811-3-1	8.2
6	Heat shock test			
6.1	Insulation	T	MS IEC 60811-3-1	9.1
6.2	Sheath	T	MS IEC 60811-3-1	9.2
7	Thermal stability			
7.1	Insulation	T	MS IEC 60811-3-2	9
7.2	Sheath	T	MS IEC 60811-3-2	9
8	Mechanical strength of completed cable			
8.1	Flexing test	T	MS 2112-2	6.1
9	Test of flame retardance	T	IEC 60332-1-2	

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

NON-STANDARD CABLES

Cables which are designed and constructed to other standards which may not comply to the prevailing requirements & regulations on test approvals and/or installation conditions

The development of national standards for electric cables takes into account the principles and norms as established internationally, current prevailing conditions and local practices. It is important to understand that these aspects are majorly unbeknown to buyers and users, hence failure to comply on critical aspects may present an undetermined risk on safety.

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

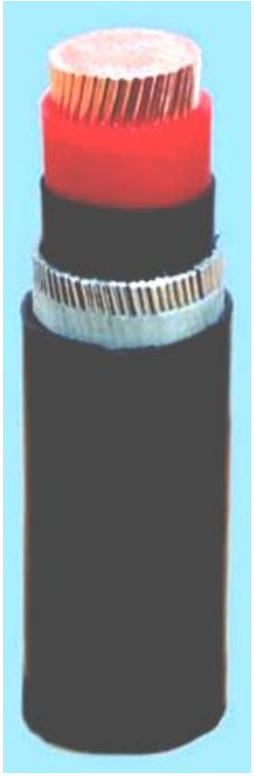
SUB-STANDARD CABLES

Cables which are not designed, constructed, test approved, installed or used in accordance to their prescribed standards and/or specifications

The development of national standards for electric cables takes into account the principles and norms as established internationally, current prevailing conditions and local practices. It is important to understand that these aspects are majorly unbeknown to buyers and users, hence failure to comply on critical aspects may present an undetermined risk on safety.

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Basic Elements of Electric Cables



- CONDUCTOR
  determines base current ratings
- INSULATION
  determines voltage / stress levels
- PROTECTIVE LAYER
  determines protection level
  & installation conditions

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Myths of Sub-Standard Cables

- *Conductors are smaller due to "technological improvements"*
- *Copper purity is higher*
- *Able to withstand higher temperatures hence more current*
- *The standards have "changed"*
- *"There is no problem, it still works.."*

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Sub-Standard Element : Conductors

CRITERIA

- **Metal content not meeting specifications (copper >99.9%, alum >99.7%)**
- **Undersized – conductor does not meet the minimum cross-sectional area as determined by its specific resistance**
- **Construction not in accordance to prescribed standards on size & number of wires, buildup or dimensions**

IMPACT

- **Non-compliance to any of the above will result in conductor overload in excess of the maximum current loading of the cable**
- **This condition would lead to eventual breakdown of cable insulation, joints or connectors at installed positions or distribution boards**
- **Excessive overheating may result in short circuit conditions leading to an electrical fire**

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Sub-Standard Element : Insulation

CRITERIA

- **Insulation material or type does not meet the required chemical and thermo-mechanical properties for long term ageing and environmental tests**
- **Applied insulation does not meet the requirement on thickness and physical aspects of the standards stipulated for the type and rated voltage of cable**
- **Insulated conductors are not identified by markings or colours as stipulated by the standards**

IMPACT

- **The use of non-compliant insulation material or construction will result in premature deterioration of the cable insulation in service**
- **This condition may eventually lead to breakdown of cable insulation, joints or connectors at installed positions or distribution boards**
- **Condition of undetected exposure caused by deteriorated insulation will be hazardous to users**

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

Sub-Standard Element : Protective Layers

CRITERIA

- **Material for protective layers do not meet the required chemical and/or thermo-mechanical properties for long term ageing and environmental tests**
- **Applied protective layers do not meet the requirement on thickness and physical aspects of the standards stipulated for the type and rated voltage of cable**
- **Completed cables are not identified by markings as stipulated by the standards**

IMPACT

- **Cables will not perform or its service life will be greatly reduced if the above properties do not meet their intended installed conditions**
- **Fire rated or alarm cables may be rendered inactive in fire related situations**
- **Cables which are incorrectly identified or installed in unintended locations may be hazardous to the environment or users**

MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

1Malaysia vs Sub-Standard Cables – The Way Forward

- ✓ To review & establish MS standards for cables & wires in full compliance with international standards and with due consideration given to meet pertinent local requirements, conditions & practices
- ✓ To publicize and promote the use of MS standards where available on cables and wires for domestic use, local installations and elsewhere by Malaysian contractors
- ➢ To combat against the manufacture, importation and use of sub-standard cables in the interest of public safety and towards sustaining an equitable and economically viable business for the cable manufacturing sector
- ➢ To support all measures by the relevant authorities including the imposition of clear labeling and the prohibition of retail selling of cables and wires without the MS standard mark of approval for items listed under the control of Suruhanjaya Tenaga (ST)
- ❖ To advocate the registration of all local manufacturers under MCMA as a prerequisite to be a supplier of the ST controlled MS standard cables
- ❖ To continually support and enhance the local economy and the Buy Malaysia campaign via the use of a wide range of cables in full compliance to applied standards, Made in Malaysia







MCMA
MALAYSIAN CABLE MANUFACTURERS ASSOCIATION

The *Malaysian Cable Manufacturers Association* or *MCMA (formerly known as the Malaysian Electrical Cable & Wire Assoc. or MECWA)*, was established in 1980 comprising manufacturers of power and telecommunication cables with the following objectives:

To provide a platform of communication and enhance the cooperation of all members on matters of common interest to the industry

To promote the products & services and activities of members locally and abroad via a common website and by participation in seminars, exhibition and conferences

To represent and safeguard the interest of members through channels of discussion and liaison with customers, government agencies and other organisations

To actively participate and contribute to the development of MS Standards on Electric Cables and related products

To enhance the reputation of MCMA as an ethical and responsible association of members with a positive contribution to the community

www.mcma.org.my