TESTING AND CERTIFICATION ON ELECTRICAL CABLE TESTING

28th Aug 2018
Presentation Outline

1. Introduction

2. Our roles & services

3. Procedure & standard requirement for electrical cable testing

4. Product Certification Scheme
About Us

Established in 1996 as SIRIM Berhad's wholly-owned subsidiary

Conformity assessment services since 1970s

Staff strength : 760

Malaysian based, internationally recognised

Local and international clients

Malaysia’s Leading Certification, Inspection and Testing Body
# Our Services

<table>
<thead>
<tr>
<th>CERTIFICATION</th>
<th>TESTING</th>
<th>INSPECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Management System Certification</td>
<td>• Product compliance testing to standards, regulatory requirements and specifications</td>
<td>• Engineering Inspection</td>
</tr>
<tr>
<td>• Product Certification</td>
<td></td>
<td>• Inspection on behalf of other CBs</td>
</tr>
<tr>
<td>• Personnel Certification</td>
<td></td>
<td>• Other 3\textsuperscript{rd} party inspections</td>
</tr>
</tbody>
</table>
FOR DETAILS...... http://www.sirim-qas.com.my/

Connect with SIRIM QAS international to get the latest development on industry topics, news and events. Join us via our official social media platforms as below:

- **Facebook**: https://www.facebook.com/SIRIMQASInternational
- **Twitter**: https://twitter.com/SIRIMQASIntl
- **You Tube**: https://www.youtube.com/SIRIMQASInternational
- **Linkedin**: https://www.linkedin.com/SIRIMQASInternational
1) Safety Tests

to verify safety level of the appliances either meeting the relevant Standard or specification

to evaluate either the appliances would cause any danger to users and surrounding
Cable Testing: Procedure & standard requirement
Type of cables

- Low voltage cables up to 1 kV
- Medium voltage cables up to 33 kV
- Submarine cable up to 175 kV
- PVC insulated, XLPE insulated, paper impregnated
- Aluminium conductor for transmission line
- Communication cables and fiber optic
- Automotive cables
- Housing cable
- Flexible cable for appliance
General

- There are a few types of cables used in Malaysia using different standards

<table>
<thead>
<tr>
<th>Type of cables</th>
<th>Standards</th>
<th>Area of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexible cords up to 500V</td>
<td>MS 2112-5, BS 6500, IEC 60227-5</td>
<td>Portable socket-outlet, household appliances, audio-video products</td>
</tr>
<tr>
<td>Housing cables up to 750V</td>
<td>MS 2112-1 to MS 2112-6, BS 6004</td>
<td>Fixed wiring and lighting</td>
</tr>
<tr>
<td>PVC insulated 600V to 1 kV</td>
<td>MS 2100 to MS 2111, BS 6346</td>
<td>Low voltage electricity supply</td>
</tr>
<tr>
<td>XLPE insulated from 1 kV to 3 kV</td>
<td>IEC 60502-1</td>
<td>Low voltage electricity supply</td>
</tr>
<tr>
<td>XLPE insulated from 6 kV to 30 kV</td>
<td>IEC 60502-2</td>
<td>Medium voltage electricity supply</td>
</tr>
<tr>
<td>Type of cables</td>
<td>Standards</td>
<td>Area of usage</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>XLPE insulated cable</td>
<td>IEC 60840</td>
<td>Underground transmission line 30 kV to 150 kV</td>
</tr>
<tr>
<td>Fire rated cables</td>
<td>IEC 60331, IEC 60332, BS 6387, IEC 61034, IEC 754</td>
<td>Oil and gas industry, high rise buildings</td>
</tr>
<tr>
<td>Bare conductor</td>
<td>BS 215, ASTM D 233</td>
<td>Overhead transmission line</td>
</tr>
<tr>
<td>Low frequency cables</td>
<td>IEC 60189, SKMM</td>
<td>Data and communication cables</td>
</tr>
<tr>
<td>Fiber optic cables</td>
<td>IEC 60794</td>
<td>Data and communication cables</td>
</tr>
<tr>
<td>Automotive cable</td>
<td>JIS or mfr spec</td>
<td>Cables used in automobile</td>
</tr>
</tbody>
</table>
## Test Standards

<table>
<thead>
<tr>
<th>Type of cables</th>
<th>MS Standards for PVC cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Cable and Wire: Polyvinyl Chloride(PVC) insulated cables of rated voltages up to and including 450/750 V</td>
<td><strong>MS 2112-1:2009  Part 1:General Requirements</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MS 2112-2:2009  Part 2:Test Method</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MS 2112-3:2009  Part 3:Non-Sheathed Cables for Fixed Wiring</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MS 2112-4:2009  Part 4:Sheathed Cables for Fixed Wiring</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MS 2112-5:2009  Part 5:Flexible Cables</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MS 2112-6:2009  Part 6:Cables for Lift &amp; Flexible Connections</strong></td>
</tr>
</tbody>
</table>
Cables testing
In general – to ensure that they are safe and that they fit for purpose.

Basically, test requirements for cable can be divided into a few categories; Some requirements apply only for specific type of cables

1. Electrical tests
   a) Conductor resistance
   b) Voltage test – on insulation & sheath
   c) Long term stability

2. Mechanical (physical) test
   a) Tensile test
   b) Low temperature properties – bending / impact
   c) Resistance to heat – heat shock

3. Fire test
   a) Resistance to fire
   b) Conductor and armour wire plating thickness
   c) Smoke emission

4. Chemical test
   a) Halogen gas determination
   b) Flame retardance / propagation
   c) Smoke emission
1. ELECTRICAL TESTS

   a) Resistance of conductors
   b) High Voltage at 1000V / 1500V / 2500V
   c) Insulation Resistance at 70°C
<table>
<thead>
<tr>
<th>Name of manufacturer</th>
<th>Cable’s type, sizes and material</th>
<th>Certification mark or name of certification body</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEGA KABEL</td>
<td>2C x 2.5 SQ MM PVC/PVC</td>
<td>SIRIM QAS CERT TO BS 6004 300/500V</td>
<td></td>
</tr>
</tbody>
</table>
Sub-Standard Cables

- Cables which are not designed, constructed, test approved, installed or used in accordance with their prescribed safety standards and specifications.

- Identity / Characteristics of a substandard cable:

  1. **Undersized**
     a) conductor construction not in accordance to prescribed standards on dimensions such as:
        - size & number of wires,
        - thickness
        - Length
     b) conductor does not meet the minimum cross-sectional area as determined by its specific resistance.
     c) reduced size of copper resistance

  2. **Mixed content**
     Instead of pure copper – ‘they’ use mixed content or other metal
Sub-Standard Cables

3. **Reduced in insulation properties**
   a) insulation & protective layers construction not in accordance to prescribed standards on size, thickness or dimensions

   b) Insulation & protective layers type does not meet the required mechanical properties for long term ageing and environmental tests

4. **No identification / certification marking**
   Completed cables are not identified by markings as stipulated by the standards.
Example of sub-standard cable

MARKING on Cable

• Marking vs No marking
  • No manufacturer’s name/trademark
  • No cable markings such as size, electrical parameters

• Marked with label / certification marked vs No label / not certified
  • Certified / Approval body not identified

• Fake labels vs proper label
  • Counterfeit
Example of sub-standard cable

Non-compliant PVC Flexible Cable

- Undersized conductor – low conductivity – 1mm\(^2\) instead of 1.5mm\(^2\)
- Cable sheath fall apart in low temperature bend test
- No compliant with standard marked on sheath
- For fire retardant –
  - Not fire resistance – PVC insulation & PVC sheath – fails within 2 minutes instead of 30 minutes as required by standard
How to identify a sub-standard cable

1) Check and verify MARKINGS on Cable – shall be as per standard requirement

2) Check and verify APPROVAL / CERTIFICATION Mark/Label

3) Measure conductor resistance (need to have a proper meter)

4) Measure size(s)
   • conductor
   • each strand (and no of strands)

5) Check and verify copper content
   • normally by conductor resistance
   • weight the sample
     • Sometimes –by weighing the sample, with some experience, we can identify if the samples / weight of sample due to copper content or sheath of insulation
How can SIRIM assist?

SIRIM will always playing it’s roles in providing assistance to industry & regulator in fighting issue of sub standard cable

How can we do that? –

a) through compliance testing
b) through our product certification scheme
c) through SIRIM’s market surveillance activities
d) by carrying out verification testing on samples picked up from market - through enforcement & market surveillance –by Suruhanjaya Tenaga
e) by providing a support to ST & MCMA initiatives to raise the issue of sub-standard cable to the widest audience possible
Problems / Challenges

• The ability to buy cable from anywhere in the world means there remains a need for better market surveillance as some imported cable – of which are not in compliance with standard requirement.

• Contractors have little interest in standards while some distributors encourage the manufacturer of ‘undersized cable’.

• Inferior cable product is sold unmarked - making it untraceable and misuse of trade marks is common place.

• No follow-up market surveillance (though is essential) to ensure future compliance.
CONCLUSION

- We all want safer cables and this can only be achieved with;
  - acceptance of the problem,
  - better monitoring and enforcement at every level of the supply chain
A supplier submit test application to SIRIM QAS International test lab.

SIRIM QAS International test lab performs a type test to a standard (MS / IEC Std + National Deviation(if any)).

SIRIM QAS International test lab shall issue a full type test report.

The report shall then be used for submission for a COA application with a regulatory body.

*A supplier includes importer, manufacturer and trader.
PRODUCT
CERTIFICATION
SCHEME
Type 5 Product Certification Scheme

The International Organisation for Standardisation (ISO) and the International Electrotechnical Committee (IEC) have set out a number of different routes to conformity assessment in their document ISO/IEC 17067.

<table>
<thead>
<tr>
<th>Elements of Product Certification System</th>
<th>Product Certification Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1a</td>
</tr>
<tr>
<td>1) Selection (sampling) as applicable</td>
<td>X</td>
</tr>
<tr>
<td>2) Determination of Characteristics as applicable by testing (ISO/IEC 17025)</td>
<td>X</td>
</tr>
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</tr>
</tbody>
</table>

| 3) Review (evaluation)                  | X   | X   | X  | X  | X  | X  | X  |
| 4) Decision on Certification            | X   | X   | X  | X  | X  | X  | X  |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
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|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
| 5) Licensing (attestation)              | X   | X   | X  | X  | X  | X  | X  |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
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|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
|                                        |     |     |    |    |    |    |    |
| 6) Surveillance, as applicable          |     |     |    |    |    |    |    |
| a) testing or inspection of samples from the open market | X   | X   | X  | X  | X  | X  | X  |
| b) testing or inspection of samples from the factory |     |     |    |    |    |    |    |
| c) quality system audits combined with random tests or inspections |     |     |    |    |    |    |    |
| d) assessment of the production process or service |     |     |    |    |    |    |    |
Product Certification Process

General Certification Process (Type 5)

LESEN PENSIJILAN BARANGAN
Product Certification Licence

SIRIM QAS International Sdn. Bhd. hereby grants to
SENAI INDUSTRIAL ESTATE IV
81400 SENAI
JOHOR DARUL TAKZIM

Lesen untuk menggunakan Tanda Pensijilan di atas iaitu a licence to use the Certification Mark on

SIRIM-ST
CERTIFIED TO YY : XXXX
CERTIFICATION NO:xxxxxxxxx
# Product Certification Process

## Test Standards

### 1) Regulated cables by ST

<table>
<thead>
<tr>
<th>34</th>
<th>WIRE / CABLE / CORD (non-armoured) 0.5mm² to 35mm²</th>
<th>Polyvinyl chloride (PVC) Insulated flexible cord and cable</th>
<th>MS 2112-5:2009</th>
<th>BS EN 50525-2-11:2011 or IEC 60227-5:2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• is unscreened and flexible;</td>
<td>Rubber insulated cord and flexible cables</td>
<td>MS 140:1987 or MS 2127-4</td>
<td>BS EN 50525-2-11:2011 or IEC 60245-1:2008 or IEC 60245-4:2011</td>
</tr>
<tr>
<td></td>
<td>• is designed for use at low voltage;</td>
<td>PVC-insulated cable (non-armoured) for electric power and supply:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• consists of two or three elastomer or PVC insulated cores of multistrand construction;</td>
<td>- non-sheathed</td>
<td>MS 2112-3:2009</td>
<td>IEC 60227-3:1997</td>
</tr>
<tr>
<td></td>
<td>• has a cross-sectional area of each conductor from 0.5mm² not exceeding 35mm²</td>
<td>PVC-insulated cable (non-armoured) for electric power and supply:</td>
<td>MS 2112-4:2009</td>
<td>IEC 60227-4:1997</td>
</tr>
</tbody>
</table>

### 2) Other cables

Test standards follow related product standards or other acceptable standards.
Application and Documents Evaluation

- Questionnaire Form (ePCS/FOR/01-1)
- Application Form (ePCS/FOR/01-2)
- Declaration of Approval from relevant authority (ePCS/FOR/01-3)*
- Declaration of Obtaining SIRIM Licence for the Purpose of Relevant Authority Approval (ePCS/FOR/01-3.1)*
- Declaration of Trade Mark (ePCS/FOR/01-4)
- Authorization Letter of Trademark/Brand Name (ePCS/FOR/01-4.1)*
- Authorization Letter of Test Report (ePCS/FOR/01-4.2)*
- Declaration from Manufacturer (ePCS/FOR/01-5)*

* - whenever applicable

http://www.sirim-qas.com.my/
Product Certification Process

New Application

**Application and Documents Evaluation**

- **Type Test Report**
  - Laboratories accredited by national accreditation bodies e.g. DSM, HOKLAS, NATA, UKAS etc.
  - SIRIM QAS International - EEST
  - Laboratories listed under ASEAN EE MRA

- Test Laboratory - CB Scheme
Product Certification Process

New Application

Product and Quality System Evaluation

- Product Certification Requirements
  - Quality Plan
    - Change Management
    - Control of Records
    - Corrective & Preventive Actions
    - Raw Material & Components
    - Routine tests
    - Control of Measuring Equipment
    - Control of Non Conforming Product
    - Product Preservation

Factory Audit
Product Evaluation

Critical Components and Raw Materials

Basic cable components

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conductor</td>
<td>Annealed Copper</td>
</tr>
<tr>
<td>2</td>
<td>Insulation</td>
<td>Polyvinyl Chloride</td>
</tr>
</tbody>
</table>

Sample Selection & Testing (if applicable)
Product Certification Process

New Application

Product Evaluation

Critical Components and Raw Materials

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conductor</td>
<td>Plain Annealed Copper</td>
</tr>
<tr>
<td>2</td>
<td>Insulation</td>
<td>Polyvinyl Chloride/Cross-linked Polyethylene</td>
</tr>
<tr>
<td>3</td>
<td>Filler</td>
<td>Polypropylene Yarn</td>
</tr>
<tr>
<td>4</td>
<td>Separator</td>
<td>Polypropylene Woven Tape</td>
</tr>
<tr>
<td>5</td>
<td>Inner Sheath</td>
<td>Black Polyvinyl Chloride</td>
</tr>
<tr>
<td>6</td>
<td>Armouring</td>
<td>Single Layer Galvanized Steel Round Wire</td>
</tr>
<tr>
<td>7</td>
<td>Wrapping</td>
<td>Binder Tape</td>
</tr>
<tr>
<td>8</td>
<td>Outer Sheath</td>
<td>Black PVC (ST2)</td>
</tr>
</tbody>
</table>
**Factory Audit**

**In-coming Inspection**

All major raw materials /components that have direct influence on product properties / safety shall be subjected to in-coming inspection prior to acceptance and/or production. Manufacturer shall identify inspection / testing to be carried out on each raw material / component and compare the result to the material’s / components specification / test reports for acceptance.

**In-process Inspection**

Manufacturer shall have sufficient control on the intermediate process to ensure that the intended quality of product is achieved. The manufacturer shall identify test to be carried out at various in-process stages and compare the result to the control specifications.

**Final Inspection**

Manufacturer shall carry out all tests specified under routine tests. These tests are normally carried out on the finished product after assembly but the manufacturer may perform the tests at any appropriate stage during the production, provided that subsequent manufacturing processes do not affect the results.

Following tests are minimum tests to be conducted to cover the safety aspect of the product. The frequency of testing is 100%. It is the manufacturer’s responsibility to decide if additional routine tests are necessary.

a) Spark Test (as per BS 5099)
**Routine test**

The following are minimum tests that shall be conducted to cover safety aspect of the product. Testing conducted and witnessed during surveillance.

<table>
<thead>
<tr>
<th>Test</th>
<th>Test method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional (100% at production)</td>
<td>Spark tester</td>
<td>No breakdown</td>
</tr>
<tr>
<td>Sampling for QA testing at lab (sampling)</td>
<td>i) Conductor resistance test</td>
<td>As per standard requirement</td>
</tr>
<tr>
<td></td>
<td>ii) High voltage test (Immersed in water)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Constructional and dimensional check</td>
<td></td>
</tr>
</tbody>
</table>
Preparation of Certification Report

Product Certification Process

New Application

Certification Report

Product Certification Scheme

This Certification Report shall not be amended, changed, varied or modified in any manner whatsoever by the licensee or otherwise. If the Certification Report is to be furnished to any third party or to the public, each such Certification Report shall be furnished in full and in its entirety. This Certification Report shall be read in conjunction with the Product Certification Agreement.

File No.: PS-009377
Report No.: RPT009295
Edition: 
Issued By: 
Date Issued: 
Applicant: 

Factory: 
LOT 6, JALAN JELAWAT SATU
KAWASAN PERUSHAAN SEBERANG JAYA
13700, PUSAT
PULAU PINANG, MALAYSIA

Product: PVC-INSULATED CABLES (SHEATHED) FOR FIXED WIRING

Certification Basis: Standard(s): 1. MS 2112-4: 2005 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

Product Certification Requirements in accordance with the Product Certification Agreement
Work Instruction: NIL

Verified By: 
MUHAMAD KAMAL DABRAN
06/08/2015

Approved By: 
BASORI BIN HJ SELAMAT
14/08/2015
Example of Product description:

**Product name:**
PVC-Insulated Cables (Sheathed) for Fixed Wiring.

**Brand:**
As declared by applicant in ePCS/FOR/01-4. If the brand does not belong to the applicant, authorization letter from the owner of the brand has to be obtained.

**Model:**
As declared by applicant in ePCS/FOR/01-1 and ePCS/FOR/01-2.

**Type:**
e.g: MS VV 10

**Rating:**
Voltage: 300/500 V

**Size:**
e.g: (1.0, 1.5, 2.5, 4, 6, 10, 16, 25, 35) mm²

**Marking and Labelling:**
MS mark and label for regulated sizes (1.0, 1.5, 2.5, 4, 6, 10, 16, 25, 35) mm²
Product Certification Process

New Application

Certification Panel Approval
Approval and Award of Licence

SIRIM ST
CERTIFIED TO YY : XXXX
CERTIFICATION NO:xxxxxxxx

Product Certification Process
New Application

LESEN PENSIJILAN BARANGAN
Product Certification Licence

SIRIM QAS International Sdn. Bhd. hereby grants to

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JOHOR DARUL TAKZIM

Lesen untuk menggunakan Tanda Pensijilan di atas barangan
a licence to use the Certification Mark on
Yearly surveillance audit and licence renewal

Product Certification Process

Certification Maintenance

- Product Certification Agreement
- Product Certification Requirements
- Certification Report
- Regulatory Approval

Quality Plan

- Change Management
- Raw Material & Components
- Routine tests
- Control of Measuring Equipment
- Control of Non Conforming Product
- Corrective & Preventive Actions
- Product Preservation
- Control of Records

Factory Audit
Product Certification Process

Surveillance and Renewal

Factory Surveillance Audit
And
Market Sampling

Does not comply

Suspension / Revocation

Comply

Renewal
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THANK YOU FOR YOUR KIND ATTENTION

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