

**SS 299:2021+C1:2024**  
**BS 6387:2013, MOD**  
(ICS 13.220.99; 29.060.20)

**SINGAPORE STANDARD**

**Fire-resistant cables of rated voltage up to and including 600/1000 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire – Requirements and test methods**

Incorporating Amendment No. 1

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	Assoc Prof Tang Yi	<i>Nanyang Technological University</i>
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	Ms Beatrice Wong	<i>Enterprise Singapore</i>

EESC set up the Technical Committee on Electrical and Electronic Products to oversee the preparation of this standard. The Technical Committee consists of the following members:

	<b>Name</b>	<b>Representation</b>
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<b>Deputy Chair</b>	: Mr Andrew Yap	<i>Enterprise Singapore</i>
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	Dr Jiang Fan	<i>Singapore Polytechnic</i>
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	Mr Sunny Lee Chwee Thiam	<i>Maritime and Port Authority of Singapore</i>
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	Er. Eric Lim	<i>Singapore Electrical Trades Association</i>
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	Assoc Prof Xu Yan	<i>Nanyang Technological University</i>
	Mr Yap Kong Fui	<i>Singapore Manufacturing Federation</i>
	Er. Yeo Kok Beng	<i>Land Transport Authority</i>

The following standards partners were also involved in the development of this standard in the previous term of the Technical Committee which ended on 31 December 2020:

	<b>Name</b>	<b>Representation</b>
<b>Members</b>	: Mr Ang Wee Seng	<i>Singapore Semiconductor Industry Association</i>
	Mr Steven Ho Mingde	<i>JTC Corporation</i>
	Mr Francis Lim	<i>Land Transport Authority</i>
	Mr Seow Swee Lee	<i>PSA Corporation Limited</i>
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	Mr Tan Boon Chong	<i>Singapore Manufacturing Federation</i>
	Mr Tan Hak Khoon	<i>Individual Capacity</i>
	Dr Teo Tee Hui	<i>The Institution of Engineers, Singapore</i>

The Technical Committee set up the Working Group on Electric Cables to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

	<b>Name</b>
<b>Convenor</b>	: Mr Alfred Chia Yeow Kok* Er. Joseph Michael**
<b>Secretary</b>	: Mr Lim Horng Leong
<b>Members</b>	: Er. Chan Heng Lim Mr Chia Song Khoon Er. Chong Li Li Mr James Jia Mr Lu Changzhi Er. Rao Yimin Mr Ridzwan Mustapa Mr Baghel Bhim Singh*** MAJ Tan Ping Hao Mr Tan Wei Liang Mr James Teng Weng Kee Mr Yap Kong Fui

\* from March 2020

\*\* until January 2020

\*\*\* until September 2020

The organisations in which the experts of the Working Group are involved are:

*Association of Consulting Engineers Singapore*

*Housing & Development Board*

*JTC Corporation*

*Keystone Cable (S) Pte Ltd*

*Land Transport Authority*

*Marian Energy Pte Ltd*

*Reliant International Engineering Pte Ltd*

*Sigma Cable Co. (Pte) Ltd*

*Singapore Cables Manufacturers Pte Ltd*

*Singapore Civil Defence Force*

*Singapore Electrical Contractors and Licensed Electrical Workers Association*

*Tai Sin Electric Limited*

*TÜV SÜD PSB Pte Ltd*

*Wilson Cables Private Limited*

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## National Foreword

This Singapore Standard was prepared by the Working Group on Electric cables set up by the Technical Committee on Electrical and Electronic Products under the purview of EESC.

This standard is a revision of SS 299 : Part 1 : 1998 (2013) and has been re-designated as SS 299 : 2021. It is a modified adoption of British Standard BS 6387:2013, 'Test method for resistance to fire of cables required to maintain circuit integrity under fire conditions' published by BSI Standards Limited. It incorporates Corrigendum No.1, February 2024 denoted by C1 C1.

In this standard, certain modifications due to national requirements and the particular needs of the local industry have been made. These technical deviations and additional information have been added directly to the clauses to which they refer, and are marked by a margin on the left of the standard. A complete list of modifications, is given as follows:

- *Expanded* the Scope in Clause 1 to include requirements for flame propagation, low smoke and halogen-free test.
- *Added* normative National Annex ZA. The annex includes the requirements for:
  - Armoured and non-armoured fire-resistant power and control cables with overall diameter exceeding 20 mm.
  - Construction and performance (mechanical & electrical) of armoured and non-armoured fire-resistant power and control cables.
  - Test of cables having one insulated conductor but no other metallic element.
  - Cable which reduces the amount of smoke as well as toxic and corrosive gases emitted during combustion.
- *Added* informative National Annex ZB which informs users of the applicable standards to various types of cable constructions respectively.
- *Replaced* references to BS or BS EN with applicable Singapore Standards.

NOTE – Where BS EN is an adoption of IEC standard, the IEC standard should be referred to.

It is presupposed that in the course of their work, users will comply with all relevant regulatory and statutory requirements. Some examples of relevant regulations and acts are listed in the Bibliography. The Singapore Standards Council and Enterprise Singapore will not be responsible for identifying all of such legal obligations.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

### NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "mature standards". Mature standards will not be subject to further review, unless there are requests to review such standards.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

# Fire-resistant cables of rated voltage up to and including 600/1000 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire – Requirements and test methods

## 1 Scope

This Singapore standard specifies the construction and performance on mechanical and electrical requirements and describes the methods of test relating to circuit integrity, for armoured and non-armoured fire-resistant power and control cables of rated voltages up to and including 600/1000 V having low emission of smoke and corrosive gases when affected by fire.

This standard specifies those requirements of cable related to characteristics required to enable circuit integrity to be maintained under fire conditions. It also specifies requirements of cable which exhibits properties of reduced flame spread, low levels of smoke emission and halogen-free gas emission when exposed to fire.

The tests given in this standard are applicable to cables having two or more insulated conductors, whether or not the cables incorporate other metallic elements such as armour, screen or circuit protective conductor. The tests are also applicable to cable having one insulated conductor provided that the cable incorporates at least one other metallic element.

Mineral insulated copper-clad and communication cables are outside the scope of the standard.



The cables specified in this standard are intended to be used in fixed installations in residential, commercial, institutional and industrial buildings and similar applications, where maintenance of electricity supply during a fire is required for a defined period of time. For details, refer to relevant regulatory requirements.

## 2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 6724	☐☐ Electric cables. Thermosetting insulated, armoured cables of rated voltages of 600/1 000 V and 1 900/3 300 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire – Specification ☐☐
BS 7846	Electric cables. Thermosetting insulated, armoured, fire-resistant cables of rated voltage 600/1 000 V for fixed installations, having low emission of smoke and corrosive gases when affected by fire – Specification
BS 8573	Electric cables. Thermosetting insulated, non-armoured cables with a voltage of 600/1 000 V, for fixed installations, having low emissions of smoke and corrosive gases when affected by fire
BS 8592	Electric cables. Thermosetting insulated, non-armoured, fire – resistant, single core non-sheathed cables of rated voltage 450/750 V, having low emission of smoke and corrosive gases when affected by fire – Specification



BS EN 50525-3-41	Electric cables. Low voltage energy cables of rated voltages up to and including 450/750 V ( $U_0/U$ ). Cables with special fire performance. Single core non-sheathed cables with halogen-free cross-linked insulation, and low emission of smoke
 BS EN 60332-1-2	Tests on electric and optical fibre cables under fire conditions – Test for vertical flame propagation for a single insulated wire or cable. Procedure for 1 kW pre-mixed flame
BS EN 60332-3-24	Tests on electric and optical fibre cables under fire conditions – Test for vertical flame spread of vertically-mounted bunched wires or cables. Category C. 
BS EN 60584-1	Thermocouples – Part 1: Reference tables (IEC 60584-1)
BS EN 60695-4	Fire hazard testing – Part 4: Terminology concerning fire tests for electrotechnical products
BS EN 60754-1	Test on gases evolved during combustion of materials from cables – Part 1: Determination of the halogen acid gas content
BS EN 60754-2	Test on gases evolved during combustion of materials from cables – Part 1: Determination of the acidity (by pH measurement) and conductivity
BS EN 61034-2	Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedures and requirements
BS EN ISO 13943	Fire safety – Vocabulary
IEC 61034-2	Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements
IEC 60269-3:2010	Low-voltage fuses – Part 3: Supplementary requirements for fuses for use by unskilled persons (fuses mainly for household and similar applications) – Examples of standardized systems of fuses A to F
IEC 60332-1-2	Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame
IEC 60332-3-24	Tests on electric and optical fibre cables under fire conditions – Part 3-24: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category C
IEC 60502-1	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1,2$ kV) up to 30 kV ( $U_m = 36$ kV) – Part 1: Cables for rated voltages of 1 kV ( $U_m = 1,2$ kV) and 3 kV ( $U_m = 3,6$ kV)
IEC 60754-1	Test on gases evolved during combustion of materials from cables – Part 1: Determination of the halogen acid gas content
IEC 60754-2	Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity