

SS 145 : Part 3 : 2020
BS 1363-3:2016+A1:2018, MOD
(ICS 29.120.30)

SINGAPORE STANDARD

**Specification for 13 A plugs, socket-outlets,
adaptors and connection units**

– Part 3 : Adaptors

SS 145 : Part 3 : 2020
BS 1363-3:2016+A1:2018, MOD
(ICS 29.120.30)

SINGAPORE STANDARD

**Specification for 13 A plugs, socket-outlets,
adaptors and connection units**

– Part 3 : Adaptors

Published by Enterprise Singapore

All rights reserved. Unless otherwise specified, no part of this Singapore Standard may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilming, without permission in writing from Enterprise Singapore. Request for permission can be sent to: standards@enterprisesg.gov.sg.

© BS 2016 – All rights reserved
© Enterprise Singapore 2020

ISBN 978-981-48-9469-2

The content of this Singapore Standard was approved on 28 February 2020 by the Electrical and Electronic Standards Committee (EESC) under the purview of the Singapore Standards Council.

First published, 2020

EESC consists of the following members:

| | Name | Representation |
|------------------------|--|---|
| Chairman | : Er. Peter Leong Weng Kwai | <i>Individual Capacity</i> |
| Deputy Chairmen | : Mr Andrew Chow | <i>Individual Capacity</i> |
| | Dr Kang Cheng Guan | <i>Energy Market Authority</i> |
| Advisor | : Mr Renny Yeo Ah Kiang | <i>Individual Capacity</i> |
| Secretary | : Mr Jason Low | <i>Enterprise Singapore</i> |
| Members | : Dr Ashwin Khambadkone | <i>National University of Singapore</i> |
| | Dr Chua Sze Wey | <i>Agency for Science, Technology and Research</i> |
| | Mr Michael Goh Chye Soon | <i>Singapore Electrical Contractors and Licensed Electrical Workers Association</i> |
| | Assoc Prof Gooi Hoay Beng | <i>Nanyang Technological University</i> |
| | Er. Hashim Bin Mansoor | <i>Building and Construction Authority</i> |
| | Er. Kwang Cheok Sen | <i>Housing & Development Board</i> |
| | Mr Cedric Lee Say Teck | <i>SP Group</i> |
| | Mr Lee Wee Keong | <i>Singapore Civil Defence Force</i> |
| | Er. Lim Say Leong | <i>Individual Capacity</i> |
| | Er. Ling Shiang Yun | <i>Association of Consulting Engineers Singapore</i> |
| | Er. Kenneth Liu | <i>Individual Capacity</i> |
| | Mr Ng Soon Lee | <i>TÜV SÜD PSB Pte Ltd</i> |
| | Mr Sim Wee Meng | <i>Land Transport Authority</i> |
| | Mr Tan Beng Koon | <i>Singapore Manufacturing Federation</i> |
| | Er. Tan Hak Khoon | <i>Individual Capacity</i> |
| | Mr Roland Tan | <i>National Environment Agency</i> |
| | Er. Joseph Toh Siaw Hui | <i>The Institution of Engineers, Singapore</i> |
| Mr Andrew Yap | <i>Enterprise Singapore</i> | |
| Mr Nelson Yeap | <i>Singapore Electrical Trades Association</i> | |

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

| | Name | Representation |
|------------------------|--|---|
| Chairman | : Er. Lim Say Leong | <i>Individual Capacity</i> |
| Deputy Chairman | : Mr Andrew Yap | <i>Enterprise Singapore</i> |
| Secretary | : Mr Jason Low | <i>Enterprise Singapore</i> |
| Members | : Mr Ang Wee Seng | <i>Singapore Semiconductor Industry Association</i> |
| | Er. Thomas Cheang | <i>Association of Consulting Engineers Singapore</i> |
| | Er. Chia Soo Ping | <i>Singapore Polytechnic</i> |
| | Er. Choong Po Siong | <i>Housing & Development Board</i> |
| | Mr Steven Ho | <i>JTC Corporation</i> |
| | Mr Sunny Lee Chwee Thiam | <i>Maritime & Port Authority of Singapore</i> |
| | Er. Ken Liew Kean Thiam | <i>Singapore Electrical Contractors and Licensed Electrical Workers Association</i> |
| | Er. Eric Lim | <i>Singapore Electrical Trades Association</i> |
| | Mr Francis Lim | <i>Land Transport Authority</i> |
| | Mr Seow Swee Lee | <i>PSA Corporation Limited</i> |
| | Dr Shan Yueyan | <i>National Metrology Centre</i> |
| | Assoc Prof So Ping Lam | <i>Nanyang Technological University</i> |
| | Mr Tan Boon Chong | <i>Singapore Manufacturing Federation</i> |
| | Er. Tan Hak Khoon | <i>Energy Market Authority</i> |
| | Ms Tan Lay Hua | <i>SP Group</i> |
| CPT Tan Ping Hao | <i>Singapore Civil Defence Force</i> | |
| Dr Teo Tee Hui | <i>The Institution of Engineers, Singapore</i> | |

The Technical Committee sets up the Working Group on Plugs, Socket-outlets and Switches to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

| | Name |
|------------------|-----------------------------------|
| Convenor | : Mr Tan Boon Chong |
| Secretary | : Ms Aruna Charukesi Palaninathan |
| | Mr Koh Lian Chong |
| Members | : Mr Andrew Chua Kian Chong* |
| | Mr Goh Sheng Sze |
| | Mr Hou Bo |
| | Mr Vincent Loo |
| | Mr Daniel Ng** |
| | Mr Ong Ah Keong |
| | Mr Phua Kim Suah |
| | Mr Kenneth Seow |
| | Mr James Tan |
| | Mr Ting Chiong Seng |

Members : Mr Wong Chee Kian
Er. Yeo Kok Beng
Mr Sebastian Yeo

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

ABB Pte Ltd
Ace Approvals Consultancy
Energy Market Authority
Enterprise Singapore
Hager Electro Systems Pte Ltd
Housing & Development Board
Intertek Testing Services (S) Pte Ltd
Land Transport Authority
Legrand (S) Pte Ltd
MK Electric (S) Pte Ltd
Singapore Electrical Testing Services
Singapore Manufacturing Federation
SP Group
TÜV SÜD PSB Pte Ltd

* Served until May 2019

** Served until April 2019

Contents

| | Page |
|---|-------------|
| National Foreword _____ | 8 |
| 1 Scope _____ | 10 |
| 2 Conditions of use _____ | 11 |
| 3 Terms and definitions _____ | 11 |
| 4 General _____ | 15 |
| 5 General conditions for type testing _____ | 15 |
| <i>Table 1 – Schedule of tests</i> _____ | 16 |
| 6 Classification and rating _____ | 16 |
| 7 Marking and labelling _____ | 17 |
| <i>Table 2 – Not used</i> _____ | 18 |
| 8 Clearances, creepage distances and solid insulation _____ | 19 |
| <i>Table 3 – Minimum clearances for basic insulation</i> _____ | 20 |
| <i>Table 4 – Minimum creepage distances (mm) for basic insulation</i> _____ | 21 |
| <i>Table 5 – Withstand voltages for insulation types</i> _____ | 22 |
| 9 Accessibility of live parts _____ | 22 |
| 10 Provision for earthing _____ | 23 |
| 11 Not used _____ | 24 |
| <i>Table 6 – Not used</i> _____ | 24 |
| 12 Construction of adaptors (plug portion) _____ | 24 |
| 13 Construction of adaptors (adaptor socket-outlet portion) _____ | 31 |
| <i>Table 7 – Actuator test force</i> _____ | 35 |
| 14 Resistance to ageing and to humidity _____ | 36 |
| 15 Insulation resistance and electric strength _____ | 37 |
| 16 Temperature rise _____ | 38 |
| <i>Table 8 – Permitted temperature rises</i> _____ | 39 |
| 17 Breaking capacity of adaptors _____ | 40 |
| 18 Normal operations of adaptors _____ | 40 |
| 19 Not used _____ | 42 |
| <i>Table 9 – Not used</i> _____ | 42 |
| 20 Mechanical strength _____ | 42 |
| 21 Screws, current-carrying parts and connections _____ | 43 |
| 22 Resistance to heat _____ | 44 |
| 23 Resistance to abnormal heat and fire _____ | 45 |
| <i>Table 10 – Application of glow-wire test</i> _____ | 45 |

| | Page |
|----|---|
| 24 | Resistance to excessive residual stresses and to rusting _____ 46 |
| 25 | Not used _____ 47 |
| 26 | Overload tests _____ 47 |
| | <i>Figure 1 – Test pin (see Clause 12) _____ 48</i> |
| | <i>Figure 2a – Apparatus for mechanical strength test on resilient covers (see Clause 9) __ 49</i> |
| | <i>Figure 2b – Hardwood block for Figure 2a _____ 50</i> |
| | <i>Figure 3 – Disposition of socket contacts (see Clause 13) _____ 51</i> |
| | <i>Figure 4a – Dimensions and disposition of pins (see Clause 12) _____ 52</i> |
| | <i>Figure 4b – Concave shrinkage allowance for ISODs _____ 54</i> |
| | <i>Figure 5 – Gauge for plug pins (see Clause 12, Clause 20 and Clause 22) _____ 55</i> |
| | <i>Figure 6 – Apparatus for testing plug cover fixing screws (see Clause 12) _____ 56</i> |
| | <i>Figure 7 – Mounting plate (see Clause 12) _____ 57</i> |
| | <i>Figure 8 – Plug pin deflection test apparatus for resilient adaptors (see Clause 12) ____ 58</i> |
| | <i>Figure 9 – Apparatus for abrasion test on insulating sleeves of plug pins (see Clause 12) _____ 60</i> |
| | <i>Figure 10 – Apparatus for pressure test at high temperature (see Clause 12) _____ 61</i> |
| | <i>Figure 11 – GO gauge for socket-outlet (see Clause 13) _____ 62</i> |
| | <i>Figure 12 – Contact test gauge (see Clause 13) _____ 63</i> |
| | <i>Figure 13 – Test apparatus and circuit for use with contact and non-contact gauges (see Clause 13) _____ 64</i> |
| | <i>Figure 14 – Non-contact test gauge (see Clause 13) _____ 65</i> |
| | <i>Figure 16a – Withdrawal pull gauges for effectiveness of contact: Gauge for earthing socket contact (see Clause 13) _____ 66</i> |
| | <i>Figure 16b – Withdrawal pull gauges for effectiveness of contact: Gauge for line and neutral current carrying socket contacts (see Clause 13) _____ 67</i> |
| | <i>Figure 17a – Test apparatus for temperature rise test (see Clause 16) _____ 68</i> |
| | <i>Figure 17b – Dummy front plate for temperature rise test (see Clause 16) _____ 69</i> |
| | <i>Figure 18 – Not used _____ 70</i> |
| | <i>Figure 19 – Solid link for test on fuse clips (see Clause 20) _____ 70</i> |
| | <i>Figure 20 – Tumbling barrel (see Clause 20) _____ 71</i> |
| | <i>Figure 21a – Pendulum impact test: General view of apparatus (see Clause 20) _____ 72</i> |
| | <i>Figure 21b – Pendulum impact test: Constructional details of striking elements (see Clause 20) _____ 73</i> |
| | <i>Figure 21c – Pendulum impact test: Constructional details of mounting support for test samples (see Clause 20) _____ 74</i> |
| | <i>Figure 23 – Apparatus for pressure test (see Clause 22) _____ 75</i> |
| | <i>Figure 24L – Apparatus for ball pressure test (see Clause 22) _____ 76</i> |

| | Page |
|---|-------------|
| <i>Figure 28 – Calibrated link (see A.1)</i> _____ | 77 |
| <i>Figure 29 – Calibrated jig for calibrated link (see A.2)</i> _____ | 79 |
| <i>Figure 30 – Test plug for temperature rise (see Annex G)</i> _____ | 81 |
| <i>Figure 32a – Apparatus for tests on adaptor pins: An adaptor pin under test (see Clause 12)</i> _____ | 82 |
| <i>Figure 32b – Apparatus for tests on adaptor plug pins: Details of anvils (see Clause 12)</i> _____ | 83 |
| <i>Figure 33 – Apparatus for torsion test on pins (see Clause 12)</i> _____ | 84 |
| <i>Figure 34 – Test plug (see Clause 16)</i> _____ | 85 |
| <i>Figure 35 – Simulated plug and cable devices (see Clause 13)</i> _____ | 85 |
| <i>Figure 36 – Apparatus for calibration of turning moment of simulated plug (see Clause 13)</i> _____ | 87 |
| <i>Figure 37a – Turning moment apparatus: Front view and side view (see Clause 13)</i> ____ | 87 |
| <i>Figure 37b – Turning moment apparatus: Top view and pictorial view (see Clause 13)</i> _ | 88 |
| <i>Figure 38 – Solid links for test on fuse clips (see Clause 20)</i> _____ | 88 |
| Annexes | |
| A (normative) The construction and calibration of a calibrated link _____ | 89 |
| B (normative) Measurement of clearances and creepage distances _____ | 91 |
| <i>Table B.1 – Minimum values of width X</i> _____ | 91 |
| C (normative) Determination of the Comparative Tracking Index (CTI) and Proof Tracking Index (PTI) _____ | 96 |
| D (normative) Relation between rated impulse withstand voltage, rated voltage and overvoltage category _____ | 97 |
| <i>Table D.1 – Rated impulse withstand voltage for adaptors energised directly from the low voltage mains</i> _____ | 97 |
| E (normative) Pollution degree _____ | 98 |
| F (normative) Impulse voltage test _____ | 99 |
| <i>Table F.1 – Test voltages for verifying clearances at sea level</i> _____ | 100 |
| G (normative) Test plug for temperature rise test _____ | 101 |
| H (normative) Requirements for incorporated electronic components _ _____ | 102 |
| I (informative) Specific structure of BS EN 50525 and its derivation from British Standards and from HD 21 and HD 22 (BS EN 50525-1:2011, National Annex NA) ____ | 107 |
| <i>Table I.1 – Specific structure of BS EN 50525 and its derivation from British Standards and from HD 21 and HD 22 (BS EN 50525-1:2011, National Annex NA)</i> _____ | 107 |
| Bibliography _____ | 108 |

National Foreword

This Singapore Standard was prepared by the Working Group on Plugs, Socket-outlets and Switches set up by the Technical Committee on Electrical and Electronic Products under the purview of EESC.

This standard resulted from the review of SS 246 : 2016. It is a modified adoption of BS 1363-3:2016+A1:2018 “13 A plugs, socket-outlets, adaptors and connection units – Part 3: Specification for adaptors” and is implemented with the permission of the British Standards Limited. SS 145 : Part 3 : 2020 replaces SS 246 : 2016.

The following deviations have been made due to national requirements and the particular needs of the local industry:

- *Added* a paragraph to the scope in Clause 1 to give the configurations of plug pins covered in this standard.
- *Added* a sentence to the scope in Clause 1 to inform users that standard is not applicable to adaptors incorporating remote control switching and remote energy monitoring function.
- *Marked 'Not used'/'Text deleted'* the provisions of the following:
 - Rewirable adaptor;
 - Non-rewirable adaptor;
 - Adaptor plug;
 - Intermediate adaptor;
 - Terminal;
 - Screw-type terminal;
- *Changed* the ambient temperature under conditions for use for fused adaptors from “-5 °C ± 40 °C with the average value over 24 h not exceeding +25 °C” to “-5 °C ± 40 °C with the average value over 24 h not exceeding +35 °C”.
- *Changed* the ambient temperature of 20 °C ± 5 °C used for test condition for fused adaptors to 27 °C ± 5 °C.
- *Modified* the definition of the term “Termination” in 3.14.
- *Deleted* reference to BS 546:1950 plug type in 3.1, 13.5.3, 13.10.1, 13.11.1 and 16.1.1.
- *Added* local conformity requirement to 3.3.
- *Deleted* reference to Sheet US 1 in 3.10 and 18.1.3 (b).
- *Changed* the reference to 8.2 in Table 1 under Sequence 11 instead of Sequence 10
- *Added* local requirements in Clauses 6 (see 6.3L), Clause 18 (see 18.1.5L), Clause 22 (see 22.2.2L) and Figure 24L. Where these new requirements are added, they are indicated by ‘L’ immediately after the clause number, term or table.
- *Deleted* the word “wired as” in 9.1, 9.1.1, 9.2 and 9.4.
- *Deleted* the word “or higher” in 16.1.2 (i).
- *Deleted* the phrase “including flexible cable, if any” in 16.1.2 (iii).

- *Added* point (i) in 7.1 to cover the marking and labelling of multiway adaptors with 2 pin socket contacts.
- *Marked* 'Text deleted' for 21.1, 21.1.1, 21.2 and 21.2.1.
- Under Clause 22.2.1,
 - *Amended* the test temperature for parts of insulating material not necessary to retain current-carrying parts in position, to be 75 °C ± 5 °C.
 - *Amended* the test temperature for parts of insulating material necessary to retain current-carrying parts in position, to be 125 °C ± 5 °C.
- *Replaced* references to BS or BS EN with applicable Singapore Standards.

To facilitate identifications, the affected texts of the British Standard which were changed within this standard are marked by a margin bar on the left.

NOTE 1 – Where BS EN is an adoption of IEC standard, the IEC standard should be referred to.

NOTE 2 – The numbering of the clauses, tables, figures and annexes follows that of BS 1363-3.

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.*

Specification for 13 A plugs, socket-outlets, adaptors and connection units – Part 3 : Adaptors

1 Scope

This standard specifies requirements for adaptors having insulated sleeves on the line and neutral plug pins and suitable for socket-outlets conform to SS 145, with particular reference to safety in normal use. Adaptors specified in this standard are intended for household, commercial and light industrial purposes. The adaptors are suitable for the connection of portable appliances, sound-vision equipment, luminaires, etc. in a.c. circuits only, operating at voltages not exceeding 250 V r.m.s. at 50 Hz. Adaptors incorporating electronic components detailed in Annex H are included within this part of SS 145.

This standard also applies to shaver adaptors which have the earth pin replaced with a similarly dimensioned protrusion made of insulating material designated as an insulated shutter opening device (ISOD) designed to operate the shutter mechanism of a socket-outlet conforming to SS 145 : Part 2.

Adaptors conforming to this standard are shuttered and therefore do not require the use of additional means to shield the current-carrying contacts when no plug is present in the adapter socket-outlets.

The socket contacts of the adaptor only accept plug pins with the following configurations:

- (a) 13 A plug according to SS 145 : Part 1;
- (b) 2.5 A flat non-rewirable plug according to BS EN 50075 : 1991 Standard Sheet 1;
- (c) 2 pin reversible plug according to BS 4573 : 1970.

Assemblies comprising a plug and one or more portable socket-outlets connected together by a flexible cable are not considered to be adaptors according to this part of SS 145. Devices incorporating transformers, timers, thermostats or other control means are outside the scope of this part of SS 145.

NOTE 1 – The titles of the publications referred to in this standard are listed in the bibliography.

NOTE 2 – In order to maintain safety and interchangeability with plugs and socket-outlets it is necessary that these products conform to the requirements of Clause 9, Clause 12 and Clause 13, however their body outline need not be limited at a distance of 6.35 mm from the plug engagement surface.

An adaptor is mechanical by nature of construction. The product is therefore immune from electromagnetic interference.

An adaptor that does not incorporate electronic devices does not emit intolerable electromagnetic interference since significant electromagnetic disturbances are only generated during insertion and withdrawal which are not continuous.

This standard does not cover travel adapters.

NOTE 3 – Attention is drawn to BS 8546:2016, which covers travel adapters.

This standard is not applicable to adaptors incorporating remote control switching and remote energy monitoring functions.