



BSI Standards Publication

# Direct current (DC) plugs and socket-outlets for information and communication technology (ICT) equipment installed in data centres and telecom central offices

Part 1: Plug and socket-outlet system for 2,6 kW

### **National foreword**

This Published Document is the UK implementation of IEC/TS 62735-1:2015.

The UK participation in its preparation was entrusted to Technical Committee PEL/23, Electrical accessories.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2015.

Published by BSI Standards Limited 2015

ISBN 978 0 580 75800 3

ICS 29.120.01; 29.120.30

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

### **Amendments/corrigenda issued since publication**

<b>Date</b>	<b>Text affected</b>
-------------	----------------------

---



# TECHNICAL SPECIFICATION



---

**Direct current (DC) plugs and socket-outlets for information and communication technology (ICT) equipment installed in data centres and telecom central offices  
Part 1: Plug and socket-outlet system for 2,6 kW**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

---

ICS 29.120; 29.120.30

ISBN 978-2-8322-2869-2

**Warning! Make sure that you obtained this publication from an authorized distributor.**

## CONTENTS

FOREWORD .....	6
1 Scope .....	8
2 Normative references .....	9
3 Terms and definitions .....	10
4 General requirements .....	14
5 General notes on tests .....	14
6 Ratings .....	16
7 Classification .....	16
7.1 Accessory classifications .....	16
7.1.1 Classification according to the method of connecting the cable .....	16
7.1.2 Classification according to the type of terminals .....	16
7.2 Socket-outlet classifications .....	16
7.2.1 Classification according to the degree of protection against electric shock .....	16
7.2.2 Classification according to the existence of shutters .....	16
7.2.3 Classification according to the method of application/mounting of the socket-outlet .....	16
7.2.4 Classification according to the method of installation .....	17
8 Marking .....	17
8.1 General .....	17
8.2 Symbols .....	17
8.3 Visibility of markings .....	18
8.4 Marking for plugs .....	18
8.5 Marking of terminals .....	18
8.6 Durability of marking .....	19
9 Checking of dimensions .....	19
10 Protection against electric shock .....	19
11 Provision for earthing .....	22
12 Terminals and terminations .....	23
12.1 General .....	23
12.2 Terminals with screw clamping for external copper conductors .....	24
12.3 Screwless terminals for external copper conductors .....	29
12.4 Flat quick-connect terminations .....	35
12.4.1 General .....	35
12.4.2 Constructional requirements .....	35
12.4.3 Electrical requirements .....	36
12.5 Permanent connections .....	36
13 Construction of socket-outlets .....	36
14 Construction of plugs .....	43
15 Interlocked socket-outlets .....	48
16 Resistance to ageing, protection provided by enclosures, and resistance to humidity .....	48
16.1 Resistance to ageing .....	48
16.2 Protection provided by enclosures .....	49
16.2.1 General .....	49

16.2.2	Protection against access to hazardous parts and against harmful effects due to ingress of solid foreign objects .....	49
16.3	Resistance to humidity .....	50
17	Insulation resistance and electric strength .....	51
18	Operation of earthing contacts .....	52
19	Temperature rise .....	53
20	Breaking capacity .....	56
21	Normal operation .....	57
22	Force necessary to withdraw the plug .....	58
22.1	General.....	58
22.2	Verification of the maximum withdrawal force for socket-outlets .....	59
22.3	Verification of the minimum withdrawal force.....	59
23	Flexible cables and their connection .....	60
24	Mechanical strength .....	63
25	Resistance to heat.....	72
26	Screws, current-carrying parts and connections.....	73
27	Creepage distances, clearances and distances through sealing compound.....	75
28	Resistance of insulating material to abnormal heat and to fire .....	77
29	Resistance to rusting .....	78
Annex A (normative) Safety-related routine tests for factory-wired accessories (protection against electric shock and correct polarity).....		107
A.1	General remarks .....	107
A.2	Polarized systems, “+” and “-” – correct connection.....	107
A.3	Earth continuity.....	108
A.4	Short-circuit/wrong connection and reduction of creepage distance and clearances between “+” and “-” to earth ( ) .....	108
Annex B (normative) Survey of specimens needed for tests .....		109
Annex C (informative) Alternative gripping tests.....		110
C.1	Gripping test C1.....	110
C.2	Gripping test C2.....	112
Annex D (normative) Standard sheets and gauges.....		114
D.1	Standard sheets.....	114
D.2	Gauges for checking the dimensions of the entry holes.....	118
Bibliography.....		121
Figure 1 – Examples of accessories.....		80
Figure 2 – Pillar terminals .....		81
Figure 3 – Screw terminals and stud terminals .....		82
Figure 4 – Saddle terminals .....		83
Figure 5 – Mantle terminals.....		84
Figure 6 – Example of thread-forming screw .....		84
Figure 7 – Example of thread-cutting screw .....		84
Figure 8 – Arrangement for compression test of 10.2 and 24.6 .....		85
Figure 9 – Gauge for checking non-accessibility of live parts, through shutters .....		86
Figure 10 – Gauge for checking non-accessibility of live parts, through shutters, and of live parts of socket-outlets with increased protection.....		87

Figure 11 – Arrangement for checking damage to conductors .....	88
Figure 12 – Information for deflection test .....	89
Figure 13 – Device for checking the resistance to lateral strain .....	90
Figure 14 – Example of apparatus for breaking capacity and normal operation test.....	91
Figure 15 – Circuit diagram for breaking capacity and normal operation tests .....	92
Figure 16 – Apparatus for verification of maximum withdrawal force .....	92
Figure 17 – Apparatus for testing cord retention.....	93
Figure 18 – Apparatus for flexing test .....	94
Figure 19 – Sketches showing the application of the blows according to Table 20.....	95
Figure 20 – Apparatus for impact test at low temperature of 24.5 .....	96
Figure 21 – Example of test arrangement to verify the fixation of pins in the body of the plug .....	97
Figure 22 – Arrangement for test on covers or cover-plates .....	97
Figure 23 – Gauge (thickness about 2 mm) for the verification of the outline of covers or cover-plates.....	98
Figure 24 – Examples of application of the gauge of Figure 23 on covers fixed without screws on a mounting surface or supporting surface .....	99
Figure 25 – Examples of application of the gauge of Figure 23 in accordance with the requirements of 24.16 .....	100
Figure 26 – Gauge for verification of grooves, holes and reverse tapers .....	101
Figure 27 – Sketch showing the direction of application of the gauge of Figure 26 .....	101
Figure 28 – Ball pressure test apparatus.....	101
Figure 29 – Apparatus for compression test for the verification of resistance to heat of 25.5 .....	102
Figure 30 – Test procedures for normal operation (see Clause 21) .....	103
Figure 31 – Clamping unit for the temperature rise test of Clause 19 .....	104
Figure 32 – The profile of the inrush current for the test of Clause 20 .....	105
Figure 33 – Annex to Figure 32 with additional information on a possible circuit to produce the inrush current as given in Figure 32.....	105
Figure 34 – Circuit diagram for testing socket-outlets and plugs according to 18.2.....	106
Figure 35 – Possible test setup for the temperature rise test for Clauses 19 and 21 .....	106
Figure C.1 – Reference plug for gripping test.....	111
Figure C.2 – Example of the test apparatus for plug gripping test .....	112
Figure D.1 – Standard sheet 1: 2,6 kW / 294 V to 400 V d.c. socket-outlet for class I equipment.....	115
Figure D.2 – Standard sheet 2: 2,6 kW / 294 V to 400 V d.c. plug for class I equipment.....	116
Figure D.3 – Standard sheet 3: positioning of the “+” and “-” pins/socket-contacts .....	117
Figure D.4 – Minimum gauges for checking the dimensions of the entry holes: C1 .....	118
Figure D.5 – Maximum gauges for checking the dimensions of the entry holes: C2 .....	118
Figure D.6 – Gauge for checking the first point of contact: C3.....	119
Figure D.7 – Gauges for checking the minimum withdrawal force (see 22.3) .....	119
Figure D.8 – Gauge for checking the maximum withdrawal force: C4max (see 22.2) .....	120
Table 1 – Relationship between rated power and connectable nominal cross-sectional areas or American Wire Gauge (AWG) size of copper conductors .....	24
Table 2 – Values for pull test for screw-type terminals .....	26

Table 3 – Composition of conductors .....	27
Table 4 – Tightening torques for the verification of the mechanical strength of screw-type terminals .....	28
Table 5 – Relationship between rated power and connectable cross-sectional areas or AWG size of copper conductors for screwless terminals .....	30
Table 6 – Value for pull test for screwless-type terminals.....	32
Table 7 – Values for flexing under mechanical load test for copper conductors .....	32
Table 8 – Test current for the verification of electrical and thermal stresses in normal use for screwless terminals.....	33
Table 9 – Nominal cross-sectional areas or AWG size of rigid copper conductors for deflection test of screwless terminals.....	34
Table 10 – Deflection test forces.....	35
Table 11 – Forces to be applied to tabs .....	36
Table 12 – Relationship between tab size and maximum current.....	36
Table 13 – Forces to be applied to covers, cover-plates or actuating members whose fixing is not dependent on screws .....	38
Table 14 – External cable dimension limits for surface-type socket-outlets .....	40
Table 15 – Nominal cross-sectional areas of copper conductors and test currents for the temperature rise test.....	54
Table 16 – Maximum and minimum withdrawal force for plugs and socket-outlets.....	60
Table 17 – External dimensions of flexible cables to be accommodated by cord anchorages.....	60
Table 18 – Torque test values for cord anchorages.....	61
Table 19 – Maximum dimensions of flexible cables to be accommodated in rewirable accessories .....	62
Table 20 – Height of fall for impact tests .....	65
Table 21 – Torque test values for glands .....	68
Table 22 – Resistance to heat of different types or parts of accessories .....	72
Table 23 – Creepage distances, clearances and distances through insulating sealing compound.....	76
Table B.1 – Number of specimens needed for the tests according to 5.5.....	109

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIRECT CURRENT (DC) PLUGS AND SOCKET-OUTLETS FOR  
INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) EQUIPMENT  
INSTALLED IN DATA CENTRES AND TELECOM CENTRAL OFFICES****Part 1: Plug and socket-outlet system for 2,6 kW**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62735-1, which is a Technical Specification, has been prepared by IEC technical committee 23: Electrical accessories.

In this standard, the following print types are used:

- compliance statements: in *italic* type

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
23/692/DTS	23/708A/RVC

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62735 series, published under the general title *Direct current (DC) plugs and socket-outlets for information and communication technology (ICT) equipment installed in data centres and telecom central offices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

# DIRECT CURRENT (DC) PLUGS AND SOCKET-OUTLETS FOR INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) EQUIPMENT INSTALLED IN DATA CENTRES AND TELECOM CENTRAL OFFICES

## Part 1: Plug and socket-outlet system for 2,6 kW

### 1 Scope

This part of IEC 62735, which is a Technical Specification, applies to plugs and fixed socket-outlets for class I equipment with two active contacts plus an earthing contact, a rated power of 2,6 kW and a rated voltage range from 294 V to 400 V d.c. They are intended to power d.c. information and communication technology equipment only, products according to IEC 60950.

The accessories according to this part of IEC 62735 are intended to be used by ordinary persons in data centres only where the value of the d.c. voltage distribution system is defined as follows:

- 380 V with a tolerance of  $\pm 20$  V for installations with no backup battery or with a voltage regulation system;
- 380 V with a voltage range of 294 V to 400 V for installations with a backup battery where voltage regulation is not guaranteed;
- the voltage value between each live conductor and earth does not exceed 200 V d.c. during normal operation;
- there are two abnormal voltage ranges (duration below 10 min):
  - 260 V up to 294 V, and
  - above 400 V to 410 V.

The maximum current of the plug and the socket-outlet is

- 6,5 A when the voltage between live contacts is 400 V d.c.,
- 8,8 A when the voltage between live contacts is 294 V d.c.

and can rise up to 10 A when the voltage between live contacts decreases to 260 V d.c. for 10 min maximum.

The voltage between live conductors can fall down to 260 V d.c. when the voltage discharge value of the battery reaches the disconnecting level. The consequence is that the current increases accordingly.

The accessories according to this part of IEC 62735 do not require maintenance.

Plugs and socket-outlets covered by this part of IEC 62735 are intended for use in circuits where

- basic protection,
- an overcurrent protection (of 8,8 A or less for each socket-outlet or multiple socket-outlet),
- the fault protection (indirect contact protection), and
- additional protection

are already assured.