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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 2: Plug and socket-outlet system for 5,2 kW

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National foreword

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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.

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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 2: Plug and socket-outlet system for 5,2 kW

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 2: Plug and socket-outlet system for 5,2 kW

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

IEC TS 62735-2, which is a technical specification, has been prepared by IEC technical committee 23: Electrical accessories.

This technical specification is to be used in conjunction with IEC 62735-1:2015.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
23/743/DTS	23/745A/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 document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This Part 2 supplements or modifies the corresponding clauses in IEC 62735-1 so as to convert that publication into the IEC technical specification: *Direct current (DC) plugs and socket-outlets for information and communication technology (ICT) equipment installed in data centres and telecom central offices.*

Where this Part 2 states "addition", "modification" or "replacement", the relevant requirement, test specification or explanatory matter in Part 1 should be adapted accordingly.

Where no change is necessary, this Part 2 indicates that the relevant clause or subclause applies.

In this publication:

1) The following print types are used:
   – Requirements proper: in roman type.
   – *Test specifications: in italic type.*
2) Subclauses, notes, tables or figures which are additional to those in Part 1 are numbered starting from 101 and additional list items are numbered from aa). Additional annexes are lettered AA, BB, etc.

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.

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

Part 2: Plug and socket-outlet system for 5,2 kW

1 Scope

This clause of Part 1 is applicable except as follows:

Replacement:

Replace the first paragraph with the following:

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 5,2 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.

The 2,6 kW system complying with Part 1 is safely compatible with the system complying with this part as it is possible to insert the 2,6 kW plug in the 5,2 kW socket-outlet but it is not possible to insert the 5,2 kW plug into the 2,6 kW socket-outlet.

Replace the third paragraph with the following:

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

– 13 A when the voltage between live contacts is 400 V d.c.
– 17,6 A when the voltage between live contacts is 294 V d.c.

and can rise up to 20 A when the voltage between live contacts decreases to 260 V d.c. for 10 min maximum.

Replace, in the 6th paragraph, the second dash with:

– an overcurrent protection (of 17,6 A or less for each socket-outlet or multiple socket-outlet),

2 Normative references

This clause of Part 1 is applicable.

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

Addition:

Add the following definitions:

3.101
retaining device
mechanical arrangement which holds a plug in the normal position when it is in proper engagement, and prevents its withdrawal in the case of manual interlock

3.102
interlocked plug and socket-outlet system
plug and socket-outlet system, which allows plug insertion and withdrawal only when socket-outlet contacts are not energized

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

Replacement:

Replace the text with the following:

Accessories shall have a rated power of 5,2 kW at any voltage within the rated voltage range of 294 V to 400 V.

7 Classification

This clause of Part 1 is applicable except as follows:

Addition:

Add the following subclause:

7.2.101 Classification according to the type of interlock

Socket-outlets are classified according to the type of interlock:

a) socket-outlets provided with an automatic interlock
b) socket-outlets provided with a mechanical interlock

8 Marking

This clause of Part 1 is applicable except as follows:

8.1 General

Addition:

Add the following list item:

aa) “ON” and “OFF” positions in case of an external user activated switch or control.

8.2 Symbols

Addition:

Add the following symbols before Note 1:

"ON" position I
"OFF" position ..... O

Add the following paragraphs at the end of the subclause:

It is also permitted to use the symbols "I" and "O" to indicate the "ON" and "OFF" position of any primary or secondary power switches, including isolating switches.

A socket-outlet classified according to 7.2.101 a) and its mating plug do not need to be marked.

8.3 Visibility of markings

Addition:

Add, after the second paragraph, the following paragraph:

The "ON" and "OFF" symbols shall be marked on or near the switch.

9 Checking of dimensions

This clause of Part 1 is applicable.

10 Protection against electric shock

This clause of Part 1 is applicable.

11 Provision for earthing

This clause of Part 1 is applicable.

12 Terminals and terminations

This clause of Part 1 is applicable except as follows:

12.2.1

Replacement:

Replace Table 1 with the following:

Table 1 – Relationship between rated power and connectable nominal cross-sectional areas or American Wire Gauge (AWG) size of copper conductors

Power and type of accessory	Rigid (solid or stranded) copper conductors		Flexible copper conductors	
	Nominal cross-sectional area or AWG size	Diameter of the largest conductor mm	Nominal cross-sectional area or AWG size	Diameter of the largest conductor mm
5,2 kW **2P+** ⏚	From 1,5 mm^2 up to 2,5 mm^2 inclusive or from16 AWG up to 14 AWG	2,13 or 1,85	From 0,75 mm^2 up to 1,5 mm^2 inclusive or from 18 AWG up to 16 AWG	1,73 or 1,50

12.2.6

Replacement:

Replace Table 2 with the following:

Table 2 – Values for pull test for screw-type terminals

Nominal cross-sectional area or AWG size of conductors accepted by the terminal	Pull N
From 1,5 mm^2 up to 2,5 mm^2 inclusive or from 16 AWG up to 14 AWG	50

12.2.7

Table 3 – Composition of conductors for plugs

Addition:

Add the following rows to Table 3:

Nominal cross-sectional area or AWG size	Number of wires (n) and nominal diameter of conductors (d) $n \times d$ [a]		
	Flexible conductor	Rigid solid conductor	Rigid stranded conductor
2,5 mm^2 or	50 x 0,25	1 x 1,78	7 x 0,67
14 AWG	41 x 0,255	1 x 1,63	7 x 0,615

12.3.2

Replacement:

Replace Table 5 with the following:

Table 5 – Relationship between rated power and connectable cross-sectional areas or AWG size of copper conductors for screwless terminals

Rated power kW	Conductors		
	Nominal cross- sectional areas or AWG sizes	Diameter of largest rigid conductor mm	Diameter of largest flexible conductor mm
5,2	From 1,5 mm^2 up to 2,5 mm^2 inclusive or from 16 AWG up to 14 AWG	2,13 or 1,63	2,21 or 1,85

12.3.10

Replacement:

Replace Tables 6 and 7 with the following:

Table 6 – Value for pull test for screwless-type terminals

Rated power kW	Pull N
5,2	40

Table 7 – Values for flexing under mechanical load test for copper conductors

Nominal cross-sectional area or AWG size of the conductor[a]	Diameter of bushing hole[b] mm	Height, H mm	Mass for conductor kg
From 1,5 mm^2 up to 2,5 mm^2 inclusive or from 16 AWG up to 14 AWG	9,5	280	0,7

[a] The approximate relationship between mm^2 and AWG sizes can be found in IEC 60999-1.

[b] If the bushing-hole diameter is not large enough to accommodate the conductor without binding, a bushing having the next larger hole size may be used.

12.3.11

Replacement:

Replace Table 8 with the following:

Table 8 – Test current for the verification of electrical and thermal stresses in normal use for screwless terminals

Rated power kW	Test current A	Nominal cross-sectional area or AWG size of the conductor
5,2	22,8	2,5 mm^2 or 14 AWG

12.3.12

Replacement:

Replace Tables 9 and 10 with the following:

Table 9 – Nominal cross-sectional areas or AWG size of rigid copper conductors for deflection test of screwless terminals

Rated power of the socket-outlet kW	Nominal cross-sectional area or AWG size of the test conductor	
	First test sequence	Second test sequence
5,2	1,5 mm^2 or 16 AWG	2,5 mm^2 or 14 AWG

Table 10 – Deflection test forces

Nominal cross-sectional area or AWG size of the test conductor	Force for deflecting the test conductor [a] N
2,5 mm^2 or 14 AWG	1,0
a The force is chosen so that it stresses the conductor close to the limit of elasticity.	

13 Construction of socket-outlets

This clause of Part 1 is applicable except as follows:

13.18

Replacement:

Replace Table 14 with the following:

Table 14 – External cable dimension limits for surface-type socket-outlets

Rated power kW	Nominal cross-sectional areas of conductors or AWG size	Number of conductors	Limits of external dimensions of cables mm	
			Minimum	Maximum
5,2	1,5 mm^2 up to and including 2,5 mm^2 or from 16 AWG up to 14 AWG	3	7,4 or 6,60	14,5 or 14,60

14 Construction of plugs

This clause of Part 1 is applicable.

15 Interlocked socket-outlets

Replacement:

Replace the title and text with the following:

15 Interlocked plug and socket-outlet systems

15.1 General

The 5,2 kW plug and socket-outlet system shall be equipped with an automatic or manual interlock to prevent arcing in order to avoid undue damage to the contacts for the use of the 5,2 kW and the 2,6 kW plug.

The electrical switching element of the interlocking means shall be incorporated in the socket-outlet. All plugs of the system (complying with Part 1 and this part) shall be safely compatible with the interlocked socket-outlet.

Compliance is checked by performing the tests of Clauses 20 and 21.

15.2 Effectiveness of the retention

For socket-outlets having means for retaining devices, the effectiveness of the retention shall be verified after the normal operation test.

Compliance is checked by inspection, by manual test and by the following test.

The pins are wiped free from grease before use.

The test plug is inserted into the socket-outlet, the mechanical and electrical switching is performed and then the test plug is withdrawn from the socket-outlet. This sequence of operations is performed ten times. The test plug and the socket-outlet are set as in Figure 16 with the retention means of the socket-outlet engaged. The total mass of the plug, the clamp, the carrier and the weight shall exert a pull force equal to 120 N.

The plug shall not come out of the socket-outlet and the retaining device shall remain in the normal position for 1 min.

Plugs shall be tested to verify the effectiveness of the retention.

Compliance is checked by inspection, by manual test and by the following test.

The pins are wiped free from grease before use.

The plug is inserted into and withdrawn from a gauge having the nominal dimensions of a socket-outlet as given in the standard sheets (tolerance of ±0,2 mm) 10 times. The plug and the gauge are set as in Figure 16 with the retention means of the gauge engaged. The total mass of the plug, the clamp, the carrier and the weight shall exert a pull force equal to 120 N.

The plug shall remain in the normal position for 1 min.

16 Resistance to ageing, protection provided by enclosures, and resistance to humidity

This clause of Part 1 is applicable.

17 Insulation resistance and electric strength

This clause of Part 1 is applicable.

18 Operation of earthing contacts

This clause of Part 1 is applicable.

19 Temperature rise

This clause of Part 1 is applicable except as follows:

19.1

Replacement:

Replace Table 15 with the following:

Table 15 – Nominal cross-sectional areas of copper conductors and test currents for the temperature rise test

Type of accessory	Test current		Cross sectional area for the conductor
	Clause 19	Clause 21	
Fixed socket-outlet, socket-outlet for assemblies and socket-outlet for data centres to be fixed to a wall or a rack	23,2 A	17,6 A	2,5 mm^2 or AWG 14
Plug	17,6 A	13,4 A	1,5 mm^2 or AWG 16
	23,2 A	17,6 A	2,5 mm^2 or AWG 14
Socket-outlets according to this table are to be installed in a circuit which is protected by a 16 A circuit breaker. If a fixed multiple socket-outlet is designed to be connected to the fixed wiring via a CB with a rated current higher than 16 A, the conductor between the CB and the socket-outlet shall be adequately sized.			

19.2 Tests for socket-outlets and plugs

Replacement:

Replace the 3rd paragraph with the following:

First, accessories shall be tested by passing a current as defined in Table 15 through the "+" contact and the "–" contact for a minimum of 4 h or until steady-state is reached, whichever is the longer time. Second, accessories shall be tested by passing a current as defined in Table 15 through either the "+" contact or the "–" contact and the earthing contact for a minimum of 4 h or until steady-state is reached, whichever is the longer time.

In practice, steady-state value is reached when the variation of the temperature rise does not exceed 1 K/h.

Replace the last sentence with the following:

A current as specified in Table 15 is then passed for a minimum of 4 h or until steady-state is reached, whichever is the longer time.

In practice, steady-state value is reached when the variation of the temperature rise does not exceed 1 K/h.

20 Breaking capacity

This clause of Part 1 is applicable except as follows:

Replacement:

Replace the 8th paragraph with the following:

First the test is done with a test voltage of 260 V and a test current of 1,5 times 20 A with an inrush of 300 A with a profile equivalent to that shown in Figure 32, for 100 strokes including switching operation.

Replace the 13th paragraph with the following:

After this test the test is repeated with a test voltage of 410 V and a test current of 1,5 times 13 A with an inrush of 475 A with a profile equivalent to that shown in Figure 32, for 100 strokes including switching operation.

Replace the 17th paragraph with the following:

During the test the contacts shall not be energized during insertion and withdrawal of the test plug.

21 Normal operation

This clause of Part is applicable except as follows:

Replacement:

Replace the 4th and 5th paragraphs with the following:

Socket-outlets with shutters shall be tested while operating shutters during operation.

Replace the 8th and 9th paragraphs with the following:

The specimens are first tested with a direct current of 13,7 A, at a voltage of 400 V, in a circuit producing an inrush current equal to 463 A with a profile equivalent to that shown in Figure 32, for 5 000 strokes at a rate of 30 strokes per minute including switching operation.

Then the specimens are further tested with a direct current of 17,6 A, at a voltage of 294 V, in a circuit producing an inrush current equal to 340 A with a profile equivalent to that shown in Figure 32, for 5 000 strokes at a rate of 30 strokes per minute including switching operation.

Replace the 14th paragraph with the following:

During the test the contacts shall not be energized during insertion and withdrawal of the test plug".

22 Force necessary to withdraw the plug

This clause of Part 1 is applicable except as follows:

22.1 General

Addition:

Add after the 1st paragraph the following:

In case of a manually interlocked plug and socket-outlet system, it shall be possible to withdraw the plug from the socket-outlet only when the electrical and mechanical switching is released.

22.3

Replacement:

Replace Table 16 with the following:

Table 16 – Maximum and minimum withdrawal force for plugs and socket-outlets

Ratings of the accessory	Number of the poles of the accessory	Withdrawal force N	
		Multi-pin gauge maximum	Single-pin gauge minimum
5,2 kW	3	50	1,5

23 Flexible cables and their connection

This clause of Part 1 is applicable except as follows:

23.2

Replacement:

Replace Tables 17 ,18 and 19 with the following:

Table 17 – External dimensions of flexible cables to be accommodated by cord anchorages

Rating of accessory	Number of poles [a]	Types of flexible cable (cable references)	Number of conductors and nominal cross-sectional area or AWG size	Limits for external dimensions for flexible cables mm	
				Minimum	Maximum
5,2 kW 400 V	3	60227 IEC 53 60245 IEC 66	3 x 1,0 mm^2 or 16 AWG	6,4	8,4
			3 x 2,5 mm^2 or 14 AWG	9,2	11,4
[a] The earthing contact is considered as one pole.					

Table 18 – Torque test values for cord anchorages

Rating of plug or socket-outlet for data centres to be fixed to a wall or a rack	Flexible cable (number of cores × nominal cross-sectional area or AWG size)
	(2 or more) × 1 mm^2 or 16 AWG
5,2 kW 400 V	0,425 Nm

Table 19 – Maximum dimensions of flexible cables to be accommodated in rewirable accessories

Rating of accessory	Number of poles [a]	Types of flexible cable (cable references)	Number of conductors and nominal cross-sectional area or AWG size	Maximum dimensions for flexible cables mm
5,2 kW 400 V	3	60245 IEC 53	3 x 2,5 mm^2 or 14 AWG	13
[a] The earthing contact is considered as one pole.				

23.4

Replacement:

Replace the 13th paragraph with the following:

A current equal to 13,7 A is passed through the conductors.

24 Mechanical strength

This clause of Part 1 is applicable.

25 Resistance to heat

This clause of Part 1 is applicable.

26 Screws, current-carrying parts and connections

This clause of Part 1 is applicable.

27 Creepage distances, clearances and distances through sealing compound

This clause of Part 1 is applicable.

28 Resistance of insulating material to abnormal heat and to fire

This clause of Part 1 is applicable.

29 Resistance to rusting

This clause of part 1 is applicable.

Annexes

The annexes of Part 1 are applicable.

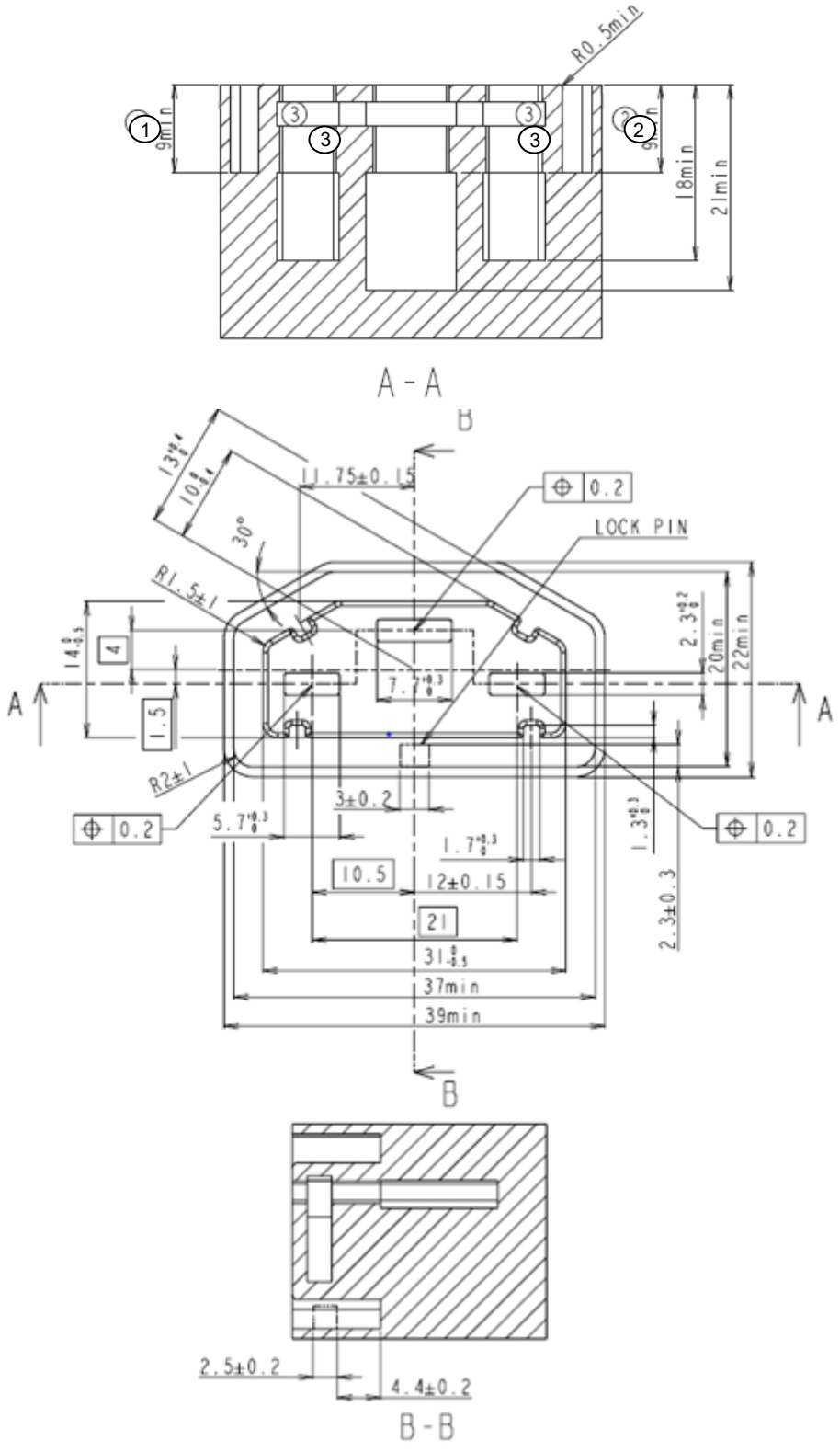
Addition:

Add the following annex:

Annex AA
(normative)

Standard sheets and gauges

See Figures AA.1 to AA.3.



Key

1) The minimum recess for the skirt of the plug.
2) The minimum distance between the engagement face and the first point of contact.
3) Space intended for shutters.

The entry holes are being checked using the gauges

for the minimum openings: C1A min, C1Bmin

for the maximum openings: C2A max, C2B max, C2C max

The checking of the first point of contact is done by applying the gauge C3

NOTE Gauges are defined in Annex D of Part 1.

Figure AA.1 – Standard sheet 4: 5,2 kW / 294 V to 400 V d.c. socket-outlet for class I equipment

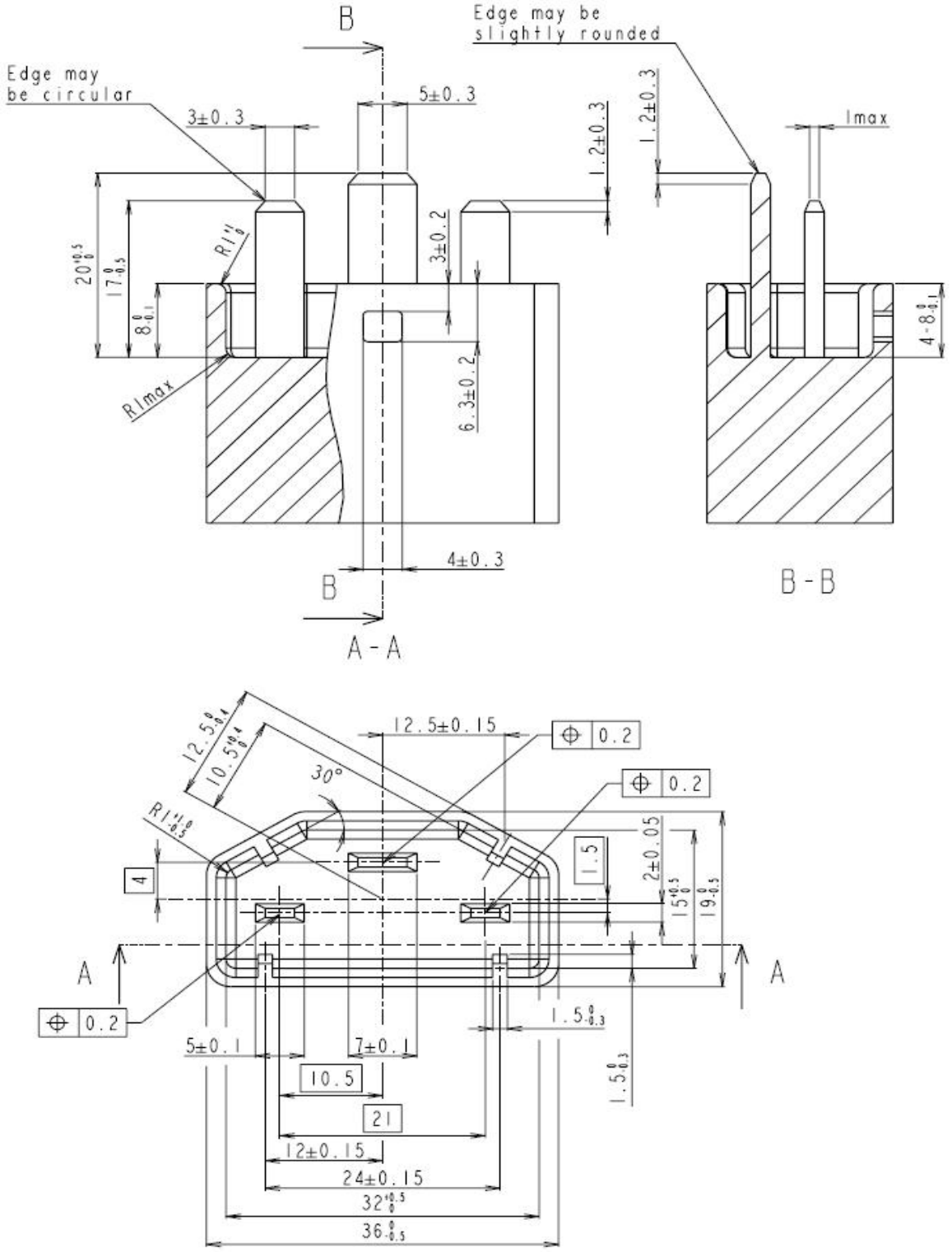


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Figure AA.2 – Standard sheet 5: 5,2 kW / 294 V to 400 V d.c. plug for class I equipment

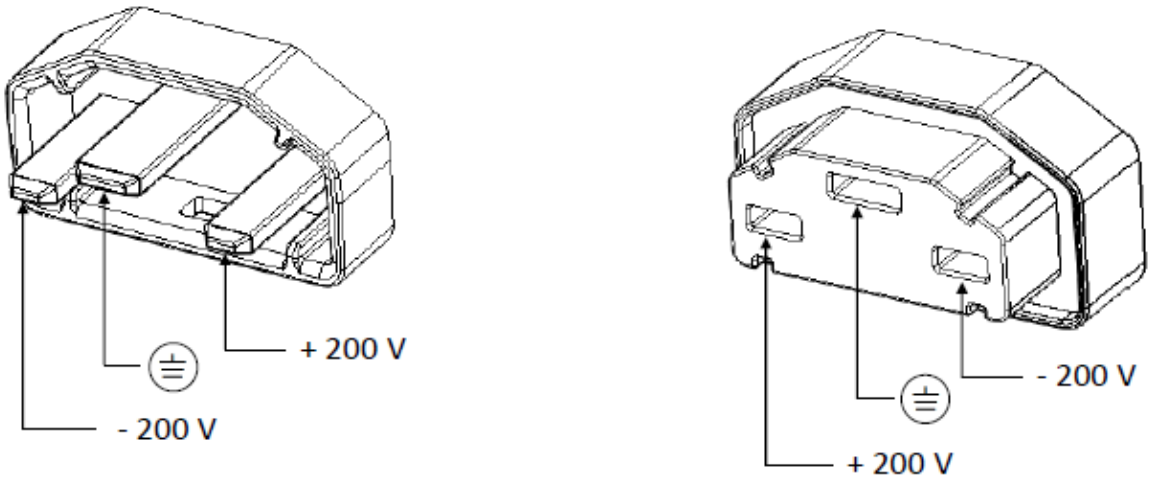

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Figure AA.3 – Standard sheet 6: positioning of the “+” and “−” pins/socket-contacts

Bibliography

The Bibliography of Part 1 is applicable except as follows:

Addition:

Add the following reference:

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm^2 up to 35 mm^2 (included)*

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