Avaldatud eesti keeles: xxxxx 202x

Jõustunud Eesti standardina: xxxx 202x

**MADALPINGELISED APARAADIKOOSTED**

**Osa 3: Jaotuskilbid, mida tohivad käsitada tavaisikud**

**Low-voltage switchgear and controlgear assemblies**

**Part 3: Distribution boards intended to be operated by ordinary persons (DBO)**

**(IEC 61439-3:202y)**

**EESTI STANDARDI EESSÕNA**

See Eesti standard on

* Euroopa standardi EN IEC 61439-3:202Y ingliskeelse teksti sisu poolest identne tõlge eesti keelde ja sellel on sama staatus mis jõustumisteate meetodil vastu võetud originaalversioonil. Tõlgenduserimeelsuste korral tuleb lähtuda ametlikes keeltes avaldatud tekstidest;
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Standardi on tõlkinud Andres Beek, standardi on heaks kiitnud EVS/TK 17.

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[EUROOPA EESSÕNA 3](#_Toc2245331)

[EESSÕNA 4](#_Toc2245332)

[SISSEJUHATUS **Error! Bookmark not defined.**](#_Toc2245334)

[1 KÄSITLUSALA 12](#_Toc2245335)

[2 NORMIVIITED 12](#_Toc2245336)

[3 TERMINID JA MÄÄRATLUSED 12](#_Toc2245337)

[4 STANDARDI PÕHIOSA **Error! Bookmark not defined.**](#_Toc2245339)

[4.1 Pealkiri **Error! Bookmark not defined.**](#_Toc2245340)

[4.2 Pealkiri **Error! Bookmark not defined.**](#_Toc2245341)

[Lisa A (normlisa/teatmelisa) Pealkiri **Error! Bookmark not defined.**](#_Toc2245342)

[Lisa B (normlisa/teatmelisa) Pealkiri **Error! Bookmark not defined.**](#_Toc2245343)

[Kirjandus 73](#_Toc2245344)

JOONISED

[jooniste loetelu]

TABELID

[tabelite loetelu]

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Tekst.

Kehtestatud on järgmised tähtpäevad:

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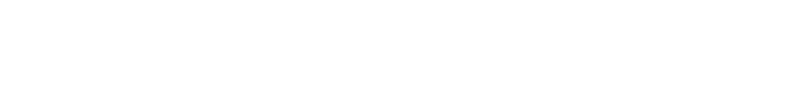
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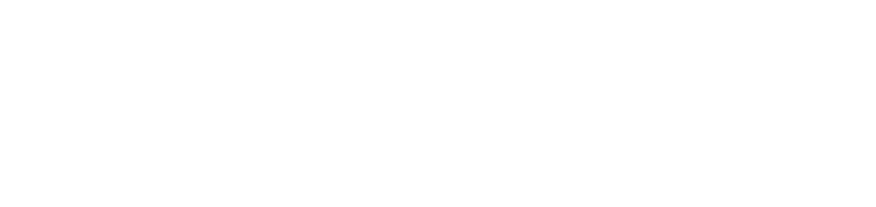


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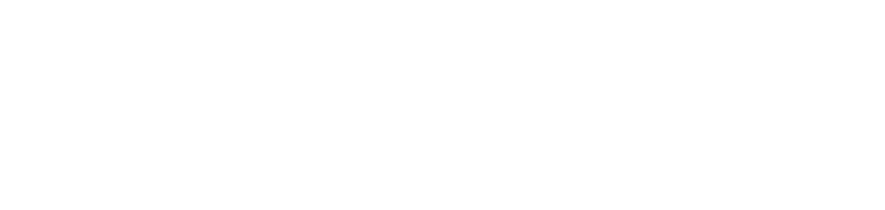


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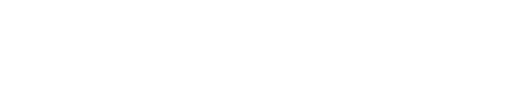
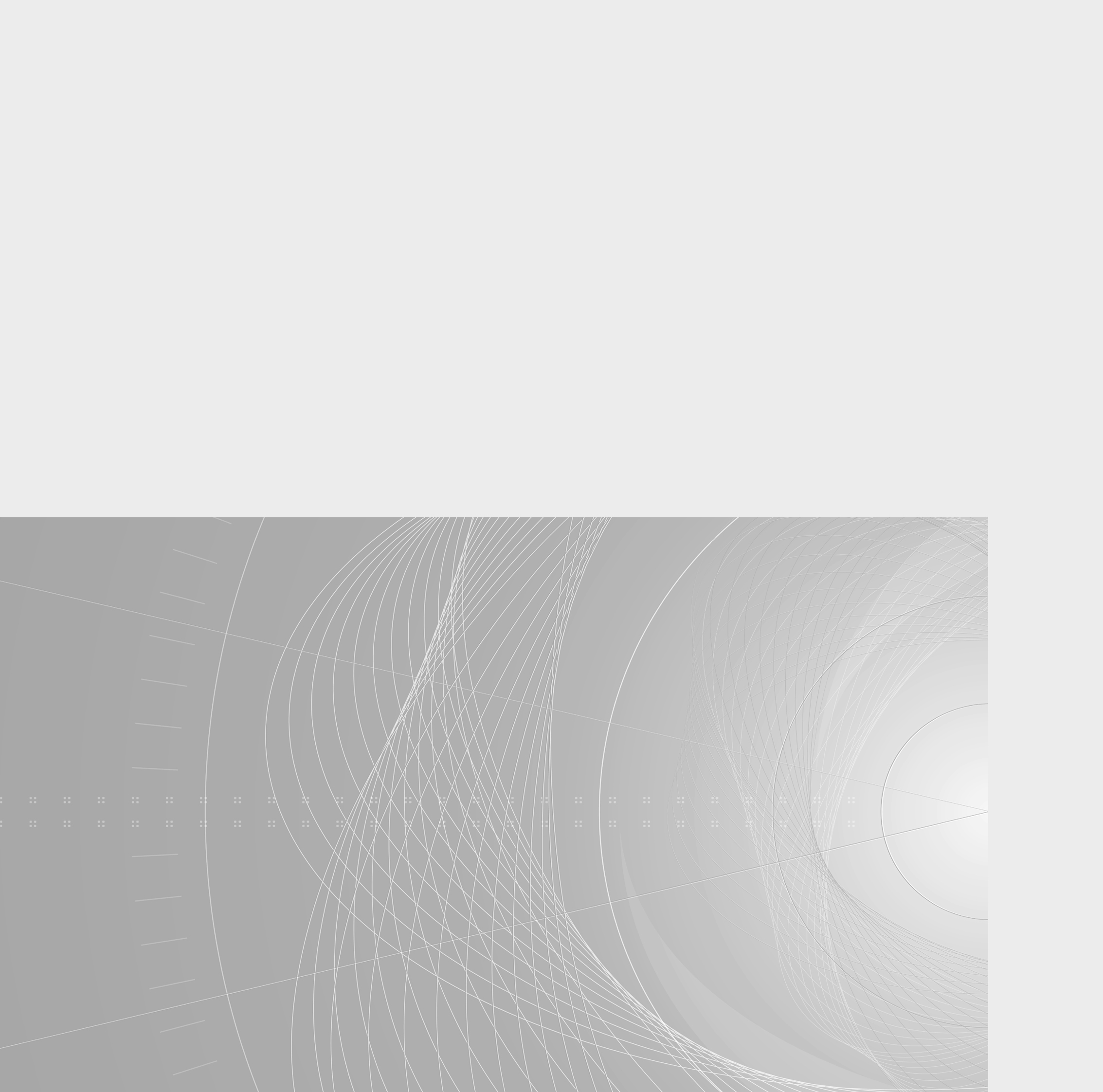
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**Low-voltage switchgear and controlgear assemblies –  
Part 3: Distribution boards intended to be operated by ordinary persons (DBO)**

**Prantsuskeelne pealkiri –  
Partie 3: Prantsuskeelne pealkiri**

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Rahvusvahelise standardi IEC 61439-3 on koostanud IEC tehnilise komitee IEC/TC 121 „Switchgear and controlgear and their assemblies for low voltage“ alamkomitee SC 121B „Low-voltage switchgear and controlgear assemblies“.

See teine väljaanne tühistab ja asendab 2012. aastal välja antud esimest väljaannet. See väljaanne kujutab endast tehnilist uustöötlust.

See väljaanne sisaldab eelmise väljaandega võrreldes järgmisi olulisi tehnilisi muudatusi:

1. alignment with the structure of IEC 61439-1:2020;
2. inclusion in the scope of more examples of the type of protection and control devices;
3. deletion of type A and Type B DBOs;
4. addition of a new Annex BB related to DBOs used in a prosumer’s electrical installation (PEI);
5. addition of a new Annex CC related to rated current of a DBO with additional source of supply in parallel/simultaneously with another source that is connected to the DBO e.g. PV

Selle rahvusvahelise standardi tekst põhineb järgmistel dokumentidel:

|  |  |
| --- | --- |
| Lõppkavand | Hääletusaruanne |
| 121B/XXX/FDIS | 121B/XXX/RVD |

Täieliku teabe selle standardi heakskiiduhääletuse kohta saab ülaltoodud tabelis viidatud hääletusaruandest.

Selle rahvusvahelise standardi väljatöötamisel on kasutatud inglise keelt.

See dokument on kavandatud ISO/IEC direktiivide 2. osa kohaselt ning on välja töötatud ISO/IEC direktiivide 1. osa ja ISO/IEC direktiivide IEC täienduse kohaselt, mis on kättesaadav veebilehelt [www.iec.ch/members\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). Peamisi IEC väljatöötatud dokumendiliike kirjeldatakse üksikasjalikumalt aadressil [www.iec.ch/publications](http://www.iec.ch/publications).

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Jaotised, mis on nummerdatud järelliitega 101 (102, 103 jne), täiendavad sama jaotist standardis IEC 61439-1:2020.

Uued lisad standardis IEC 61439-5:2023 on tähistatud tähtedega AA, BB jne.

Lugeja tähelepanu juhitakse asjaolule, et lisas **DD** on loetletud kõik „mõningaid riike puudutavad märkused“, mis käsitlevad selle dokumendi teemaga seotud erinevaid, vähempüsivad tavasid.

Standardisarja IEC 61439 üldpealkirjaga „Low-voltage switchgear and controlgear assemblies“ kõikide osade loetelu on leitav IEC veebilehelt.

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# KÄSITLUSALA

This part of IEC 61439 defines the specific requirements for distribution boards intended to be operated by ordinary persons (DBO).

DBOs have the following criteria:

* intended to be operated by ordinary persons (e.g. switching operations and replacing fuse-links), e.g. in domestic (household) applications;
* outgoing circuits contain protective devices, intended to be operated by ordinary persons, complying e.g. with IEC 60898-1, IEC 61008, IEC 61009, IEC 62423 and IEC 60269-3;
* rated voltage to earth does not exceed 300 V a.c.;
* rated current (*I*nc) of the outgoing circuits does not exceed 125 A and the rated current (*I*nA) of the DBO does not exceed 250 A;
* intended for the distribution of electrical energy;
* enclosed, stationary;
* for indoor or outdoor use.

DBOs may also include control and/or signaling devices associated with the distribution of electrical energy.

This standard applies to all DBOs whether they are designed, manufactured and verified on a one-off basis or fully standardised and manufactured in quantity.

DBOs may be assembled outside the factory of the original manufacturer.

This standard does not apply to individual devices and self-contained components, such as circuit breakers, fuse switches, electronic equipment, etc. which will comply with the relevant product standards.

This standard does not apply to the specific types of ASSEMBLIES covered by other parts of IEC 61439.

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This clause of Part 1 applies except as follows.

Addition:

IEC 60068-2-75, Environmental testing – Part 2:Tests – Test Eh: Hammer tests

IEC 60269-3, 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 60898-1:2010, Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation

IEC 61008 (all parts), Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)

IEC 61009 (all parts), Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)

IEC 61439-1:2011, Low-voltage switchgear and controlgear assemblies – Part 1: General rules

IEC 62423:2009, Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses

# TERMINID JA MÄÄRATLUSED

For the purposes of this document, the terms and definitions given in IEC 61439-1:2020 and the following apply.

ISO ja IEC hoiavad alal standardimisel kasutamiseks olevaid terminoloogiaandmebaase järgmistel aadressidel:

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Clause 3 of IEC 61439-1:2020 is applicable except as follows.

## General terms

Additional terms and definitions:

3.1.101

distribution board intended to be operated by ordinary persons DBO (*distribution board intended to be operated by ordinary persons DBO*)

assembly used to distribute and control electrical energy for all types of electrical supplies and loads, intended for operation by ordinary persons

Note 1 to entry: For operation by ordinary persons, see 8.4.6.1 of IEC 61439-1:2020.

Note 2 to entry: Switching operations and replacing fuse-links are examples of operations intended to be carried out by ordinary persons.

Note 3 to entry: Definition 3.1.101 does not preclude the DBO from being operated by skilled or instructed persons, and also being used in non-domestic installations.

Note 4 to entry: DBOs can be assembled outside the factory of the original manufacturer. DBOs can be assembled by the original manufacturer or by an assembly manufacturer

assembly used to distribute and control electrical energy for all types of electrical supplies and loads, intended for operation by ordinary persons

Note 1 to entry: For operation by ordinary persons, see 8.4.6.1 of IEC 61439-1:2020.

Note 2 to entry: Switching operations and replacing fuse-links are examples of operations intended to be carried out by ordinary persons.

Note 3 to entry: Definition 3.1.101 does not preclude the DBO from being operated by skilled or instructed persons, and also being used in non-domestic installations.

Note 4 to entry: DBOs can be assembled outside the factory of the original manufacturer. DBOs can be assembled by the original manufacturer or by an assembly manufacturer

# Symbols and abbreviations

Clause 4 of IEC 61439-1:2020 is applicable.

# Interface characteristics

Clause 5 of IEC 61439-1:2020 is applicable except as follows.

## General

Addition:

This objective can be achieved through one of two typical processes; the user will either select a catalogue product, the characteristics of which meet the required user needs, or make a specific agreement with the manufacturer.

In both cases, the specification schedule according to Annex AA is intended to help the user to provide all data necessary to specify, and to help the manufacturer to provide the actual DBO characteristics. In some cases information declared by the DBO manufacturer may take the place of an agreement.

### Rated impulse withstand voltage (*U*imp) (of the assembly)

Replacement:

The rated impulse withstand voltage of the assembly shall be equal to or higher than the values stated for the transient overvoltages occurring in the electrical system(s) to which the circuit is designed to be connected.

DBOs shall comply with a minimum overvoltage category III (see IEC 60364-4-44) according to Table G.1 of IEC 61439-1:2020.

### Rated current of an assembly (*I*nA)

Addition:

See Annex CC for examples of when a generator, for example a photovoltaic system, wind turbine, battery is used as additional source(s) of supply in parallel with another source that is connected to the DBO.

## Rated diversity factor (RDF)

Addition:

In the absence of an agreement between the DBO manufacturer and user concerning the actual load currents, the type of load, the assumed loading of the outgoing circuits of the DBO or group of outgoing circuits can be based on the values in Table 101.

The assumed load current is the rated current of the protective device *I*n, as required by the user, multiplied with the assumed loading factor of Table 101.

NOTE 101 The rated current *I*n of a protective device is defined in their product standard.

# Information

Clause 6 of IEC 61439-1:2020 is applicable except as follows.

## Assembly designation marking

Addition to the first paragraph:

The test of 10.2.7.1 only applies to DBOs intended for outdoor installation.

Addition of the following new item:

1. degree of protection if greater than IP2XC.

### Instructions for handling, installation, operation and maintenance

Addition to the first paragraph:

The original or assembly manufacturer shall provide in their documentation, any routine verification required to be carried out by the installer for the DBO to conform to IEC 61439-3.

## Device and/or component identification

Addition:

For RCDs supplying more than one final circuit, it shall be possible for ordinary persons to identify which outgoing circuits the RCD supplies, for example when the RCD is adjacent to the outgoing group of circuits it supplies or by providing labels for the installer to apply to the DBO after installation. The identification means shall be visible without accessing live parts.

# Service conditions

Clause 7 of IEC 61439-1:2020 is applicable except as follows.



### Pollution degree

Addition:

A minimum pollution degree 2 applies.

## Special service conditions

Addition:

NOTE 101 The effects upon a DBO design and related ratings, instructions, etc. when used in a prosumer’s electrical installation (PEI) can take account of the relevant requirements in IEC 60364 -8-82. See [Annex BB.](#_bookmark17)

# Constructional requirements

Clause 8 of IEC 61439-1:2020 is applicable except as follows.



##### Resistance of insulating materials to normal heat

Addition:

NOTE 101 This Subclause 8.1.3.2.2 also applies to covers and enclosures made of insulating materials.



### Protection against mechanical impact (IK code)

Replacement:

The DBO shall comply with the following IK codes according to IEC 62262:

* IK05 for a DBO for indoor use;
* IK07 for a DBO for outdoor use.

Compliance shall be verified according to 10.2.6.

### Protection against contact with live parts, ingress of solid foreign bodies and water (IP code)

Replacement of the second paragraph:

The degree of protection of a DBO shall be at least IP2XC after installation in accordance with the DBO manufacturer’s instructions.

IP2XC shall be maintained when operating devices e.g. switching and operating test buttons in normal use. The degree of protection can be temporarily reduced when permitted in a product standard for use by ordinary or unskilled persons e.g. IEC 60269-3 for replacing a fuse-link.

NOTE 101 A DBO can have more than one IP rating e.g. door open IP2XC and door closed IP3X or drain holes IPXXD.

Paragraphs 5 and 6 and the associated examples in IEC 61439-1 do not apply to this document.



#### Barriers or enclosures

Replacement of the first paragraph:

Bare live parts shall be inside enclosures or behind barriers. The enclosures or barriers shall provide a degree of protection of at least IPXXC.



### Selection of switching devices and components

Addition:

When a switch-disconnector, circuit-breaker without overcurrent protection or an isolating switch is incorporated in the DBO, it shall conform to IEC 60947-3, IEC 60947-2 or IEC 60669‑2‑4 as appropriate to the DBO ratings.

Outgoing circuits shall contain protective devices, intended to be operated by ordinary persons, for example conforming to IEC 60898-1, the IEC 61008 series, the IEC 61009 series, IEC 62423, IEC 62606 and IEC 60269-3.

An incoming protective device incorporated within the DBO not conforming to a product standard intended to be operated by ordinary persons, shall require a key or tool for re -closing after tripping and for the replacement of a fuse-link. Alternatively, a label shall be located in the vicinity of the incoming protective device stating that re-closing of the tripped device and the replacement of a fuse-link shall only be carried out by an instructed or skilled person.

Circuit-breakers shall be designed or installed in a way that it shall not be possible to modify their settings or calibration without a deliberate act involving the use of a key or tool.

NOTE 101 These requirements reflect that protective device product standards for ordinary people are limited to a maximum rated current of 125 A. Household premises can require electrical supplies greater than 125 A and the use of DBOs therefore, these particular installations are within the scope of IEC 61439-3.



### Main circuits

Replacement of the second paragraph:

Each of the conductors between the incoming unit and outgoing unit as well as the components included in these units can be rated on the basis of the reduced short-circuit stresses occurring on the load side of the respective outgoing short-circuit protective device, provided that these conductors are arranged so that an internal short-circuit between live parts and between live parts and earth is not to be expected as required by 8.6.4 and Table 4 of IEC 61439-1:2020.



## Terminals for external cables

Addition:

When a device or component in an outgoing circuit does not incorporate a neutral terminal, the number of neutral terminals of a DBO shall be not less than one outgoing terminal for each outgoing circuit requiring a neutral terminal. These terminals shall be located or identified in the same sequence as their respective line conductor terminals.

The maximum number of neutral conductors that are permitted to be connected to each device or component neutral terminal, shall be as stated in the manufacturer’s instructions.

DBOs shall have a minimum of two terminals for electrical installation protective bonding conductors.

# Performance requirements

Clause 9 of IEC 61439-1:2020 is applicable except as follows.

### General

Replacement of the existing note:

NOTE IEC 60664-1:2020 contains the requirements for supplementary and reinforced insulation (Class II).

# Design verification

Clause 10 of IEC 61439-1:2020 is applicable except as follows.



#### Severity test A

Addition:

The following is an alternative test.

All grease is removed from the parts or representative samples of the steel enclosures of the DBO to be tested, by immersion in a cold chemical degreaser such as methyl chloroform or refined petrol for 10 min. The parts are then immersed for 10 min in a 10 % solution of ammonium chloride in water at a temperature of (20 ± 5) °C.

Without drying but after shaking off any drops, the parts are placed for 10 min in a box containing air saturated with moisture at a temperature of (20 ± 5) °C.

After the parts have dried for 10 min in a heating cabinet at a temperature of (100 ± 5) °C and have been left at room temperature for 24 h, their surfaces shall show no signs of iron oxidization.

Traces of iron oxide on sharp edges and any yellowish film removable by rubbing are ignored.

For small helical springs and the like, and for inaccessible parts exposed to abrasion, a layer of grease can provide sufficient protection against iron oxidization. Such parts are subjected to the test only if there is doubt about the effectiveness of the grease film, and the test is then made without previous removal of the grease.



#### Results to be obtained

The first paragraph of 10.2.2.4 of IEC 61439-1:2020 does not apply to the alternative test of this document.



##### Verification by test

Addition:

NOTE 101 850 °C does not apply to accessible parts of the enclosure after mounting in hollow walls e.g. covers, doors.



### Verification of protection against mechanical impact (IK code)

Replacement:

Verification of the degree of protection against mechanical impacts shall be carried out in accordance with IEC 62262.

The test shall be carried out by means of a hammer test apparatus as described in

IEC 60068‑2‑75, for example an impact spring hammer at an ambient air temperature between 10 °C and 40 °C immediately after the DBO has been kept for 2 h at a temperature of

−5 °C ± 1 K for indoor use and −25 °C ± 1 K for outdoor use. A test at −25 °C for outdoor use also validates the −5 °C for indoor use, so only one test at −25 °C is required.

Compliance is checked on those exposed parts of the DBO which can be subjected to mechanical impact when mounted as in normal use.

The sample with a cover, or the enclosure, if any, shall be fixed as in normal use or placed against a rigid support.

Three blows shall be applied on separate places of each of the accessible faces and door (if provided). The impacts shall be evenly distributed on the faces of the enclosure(s) under test. In no case shall the impacts be applied in the surroundings of the same point of the enclosure. A new sample for each accessible face is used, unless the previous test has not influenced the results of the subsequent test(s), then the sample may be reused. The blows shall not be applied to knock-outs, built-in components complying with other standards, or other fastening means which are recessed below the surface so as not to be subjected to an actual impact.

Cable entries which are not provided with knock-outs shall be left open. If they are provided with knock-outs, two of them shall be opened.

Before applying the blows, fixing screws of bases, covers and the like shall be tightened with a torque equal to that specified in [Table 102.](#_bookmark13)

After the test, a visual inspection shall verify that:

* the degree of protection (IP code) of the enclosure is not impaired, where doubt exists the appropriate IP test according to 10.3 should be carried out;
* dielectric properties have been maintained, where doubt exists the appropriate dielectric tests according to 10.9 of IEC 61439-1:2020 as modified in this document, should be carried out;
* removable covers can be removed and reinstalled;
* doors can be opened and closed.

#### Verification by test

Addition of a new first paragraph:

This test only applies to DBOs intended for outdoor installation.

### Mechanical operation

#### Verification by test

Replacement of the first and second sentences of the second paragraph:

For parts, required to be verified by test e.g. mobile parts such as doors (see 8.1.5 of IEC 61439-1:2020), satisfactory mechanical operation shall be verified after installation in the DBO. The number of operating cycles shall be 50.

## Degree of protection of assemblies (IP Code)

Replacement of the second paragraph and dashed items:

Degree of protection (IP code) tests shall be carried out:

* for the test of protection against contact with live parts, all covers and doors which are required to be opened or removed without the use of a key or tool shall be opened or removed;
* for the test of protection against contact with live parts, all covers and doors which are required to be opened or removed to provide access for operating devices by ordinary persons, for example resetting circuit-breakers, RCDs or pressing an RCD test button, shall be opened or removed;
* with all covers and doors in place and closed as in normal service, irrespective of whether they can be opened or removed, with or without the use of a key or tool;
* tests shall be carried out in a de-energized state (main and auxiliary circuits).

Where the assembly is made up of multiple sections or is described as extendable, joined sections shall be included.



##### Functional units

Replacement of the second and third paragraphs of 10.10.2.2.3 b):

Where outgoing devices for the DBO have a range of rated currents, a single Inc test can be used to establish the *I*nc ratings for the complete range without further testing where:

1. the ranges covered are from the same manufacturer’s series;
2. the ranges covered all have the same physical dimensions;
3. the ranges covered have the same electrical connection arrangements line and load ;
4. using the data given by the device manufacturer, the device with the highest total power loss within the product range is used for the test;
5. the device is placed in the most onerous position with respect to mutual heating , and insulating effects.

##### General

Addition after the fourth paragraph:

In the absence of manufacturer’s instructions, the tightening torque applied to terminals shall be in accordance with those specified for the temperature rise test in the relevant device product standard.

##### Test conductors

Modification:

Bullet points b), c) and d) do not apply to this document.



##### Verification considering individual functional units separately and the complete assembly

Addition to the second paragraph:

A method to determine the most onerous group for continuously loaded and adjacent circuits to be tested, so that the highest possible temperature-rise is obtained, is for the rated current of the DBO (InA), to be distributed amongst the smallest possible number of adjacent, continually and simultaneously loaded outgoing circuits, so that each of these circuits is loaded with:

1. *I*ng or *I*nc × RDF; *I*ng and RDF being estimated values by the manufacturer so as to estimate the test currents. If verified by the test, this produces a rated value *I*ng and provides the possibility to calculate the RDF; or
2. *I*nc × the assumed loading factor in [Table 101.](#_bookmark12) This method uses the assumed loading factor as a means to estimate the RDF to use for the test. If verified by the test, this produces a rated value *I*ng.

In both (i) and (ii), the actual RDF per circuit is calculated by dividing *I*ng by *I*nc from their verified tested values.

##### Verification considering functional units and the main and distribution busbars separately as well as the complete assembly

Addition to item c):

Where the device tested achieves an *I*nc equal to its rated current In, all other devices in the same constructional range have an Inc equal to their *I*n.

Where the device tested achieves an *I*nc lower than its rated current *I*n, the same reduction is applied to all other devices in the constructional range. For example, a device with an *I*n of 63 A achieves an *I*nc of 55 A: 55 / 63 = 0,874. The *I*nc of the other devices in the same constructional range is *I*n × 0,874.

Addition to item d):

A method to determine the most onerous group for continuously loaded and adjacent circuits to be tested, so that the highest possible temperature-rise is obtained, is for the rated current of the DBO (*I*nA), to be distributed amongst the smallest possible number of adjacent, continually and simultaneously loaded outgoing circuits, so that each of these circuits is loaded with :

1. Ing or *I*nc × RDF; Ing and RDF being estimated values by the manufacturer so as to estimate the test currents. If verified by the test, this produces a rated value *I*ng and provides the possibility to calculate the RDF; or
2. *I*nc × the assumed loading factor in [Table 101.](#_bookmark12) This method uses the assumed loading factor as a means to estimate the RDF to use for the test. If verified by the test, this produces a rated value *I*ng.

In both (i) and (ii), the actual RDF per circuit is calculated by dividing *I*ng by Inc from their verified tested values.



#### Assemblies

Addition:

DBOs with synthetic enclosures are considered representative of DBOs with metallic enclosures, if the highest temperature rise on the inside surfaces of the synthetic enclosure does not exceed the maximum surface temperature rise for the accessible external metal surfaces according to Table 6 of IEC 61439-1:2020. When it has been verified that the highest surface of the enclosure is the hottest location, the internal air thermocouple located at the top of the enclosure can be used to establish the highest temperature rise on the inside surfaces.



##### Results to be obtained

Addition:

NOTE Guidance is in the form of a publication of the maximum rated current at a specified ambient air temperature in the immediate vicinity of the device.

EXAMPLE

1. As a starting point, data identifies that the Ith = 125 A at 50 °C free air ambient temperature of the device therefore, it is derated by 0,8 × 125 A = 100 A. 100 A is used in the calculation to avoid hot spots and the limiting ambient temperature is 50 °C. If the enclosure is capable of dissipating power losses equal to or greater than those generated based on 100 A and the calculated internal air temperature does not exceed 50 °C, it is verified that the continuous permissible load is 100 A.
2. However, if for the same 125 A device derated to 100 A, the calculated air temperature within the enclosure is 60 °C thus exceeding the 50 °C limit, and the 125 A device manufacturer’s information limits the device Ith to 80 A at 60 °C free air ambient temperature, to avoid hot spots, a safety margin is applied i.e. 0,8 × 80 A = 64 A,it is verified that the continuous permissible load is 64 A. No further calculation would be required, as 64 A accounts for both the 0,8 factor and ambient temperature limits.

If a continuous permissible load of 100 A is required, then: an enclosure with higher dissipating power losses, or a device with lower power losses, or a device with a higher rated current for ambient temperature can be used, or a combination to achieve conformity.



##### Results to be obtained

Addition:

NOTE Guidance is in the form of a publication of the maximum rated current at a specified ambient air temperature in the immediate vicinity of the device.

EXAMPLE

1. As a starting point, data identifies that the *I*th = 125 A at 50 °C free air ambient temperature of the device therefore, it is derated by 0,8 × 125 A = 100 A. 100 A is used in the calculation to avoid hot spots and the limiting ambient temperature is 50 °C. If the enclosure is capable of dissipating power losses equal to or greater than those generated based on 100 A and the calculated internal air temperature does not exceed 50 °C, it is verified that the continuous permissible load is 100 A.
2. However, if for the same 125 A device derated to 100 A, the calculated air temperature within the enclosure is 60 °C thus exceeding the 50 °C limit, and the 125 A device manufacturer’s information limits the device Ith to 80 A at 60 °C free air ambient temperature, to avoid hot spots, a safety margin is applied i.e. 0,8 × 80 A = 64 A, it is verified that the continuous permissible load is 64 A. No further calculation would be required, as 64 A accounts for both the 0,8 factor and ambient temperature limits.

If a continuous permissible load of 100 A is required, then: an enclosure with higher dissipating power losses, or a device with lower power losses, or a device with a higher rated current for ambient temperature can be used, or a combination to achieve conformity.



##### Incoming circuit and main busbars

Addition:

A rated conditional short-circuit current can be assigned where the distance of the main and distribution busbar between the load terminals of the incoming device connected to the main busbar and the supply terminals of the outgoing functional unit does not exceed 3 m. The main busbar, distribution busbar and incoming device may be tested and rated on the basis of the reduced short-circuit stresses occurring on the load side of the respective short-circuit protective device within each unit, provided that these conductors are arranged so that an internal short-circuit between live parts or between live parts and earth is not to be expected (see 8.6.4 of IEC 61439-1:2020).

NOTE Examples of conductor types and installation requirements are given in Table 4 of IEC 61439-1:2020.

# Routine verification

Clause 11 of IEC 61439-1:2020 is applicable except as follows.



## Dielectric properties

Addition after the first paragraph:

A dielectric test is not required on a DBO containing busbars or prefabricated main circuit wiring only, where inspection of the conductors and cables, including proper laying is sufficient to validate clearances.

Table 6 – Temperature-rise limits (9.2)

Replacement of footnote c:

c When specified in the device manufacturer's instructions, manual operating means for miniature circuit-breakers, residual current operated circuit-breakers with integral overcurrent protection, residual current operated circuit-breakers without integral overcurrent protection, arc-fault detection devices etc. within the DBO, which are only accessible after a cover or door is opened, are permitted to sustain a 25 K increase on these temperature -rise limits.

**Additional tables and figure:**

Table 101 – Values of assumed loading

|  |  |
| --- | --- |
| **Number of outgoing circuits for general purpose and other specific circuits** | **Assumed loading factor** |
| 2 and 3 | 0,8 |
| 4 and 5 | 0,7 |
| 6 to 9 inclusive | 0,6 |
| 10 and above | 0,5 |
| Circuits such as for EV charging equipment or PV, unless load control load reduction is included in the associated equipment or installed in the DBO or a combination of both. | 1 |

Table 102 – Tightening torque values for the verification of mechanical strength

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Diameter of thread** | | **Tightening torque** | | |
| mm | | Nm a | | |
| **Metric standard values** | **Range of diameters** "d" | I b | II c | III d |
| mm | mm |  |  |  |
| 2,5 | d ≤ 2,8 | 0,13 | 0,26 | 0,26 |
| 3,0 | 2,8 < d ≤ 3,0 | 0,16 | 0,33 | 0,33 |
| – | 3,0 < d ≤ 3,2 | 0,20 | 0,40 | 0,40 |
| 3,5 | 3,2 < d ≤ 3,6 | 0,26 | 0,53 | 0,53 |
| 4 | 3,6 < d ≤ 4,1 | 0,47 | 0,80 | 0,80 |
| 4,5 | 4,1 < d ≤ 4,7 | 0,53 | 1,20 | 1,20 |
| 5 | 4,7 < d ≤ 5,3 | 0,53 | 1,33 | 1,33 |
| 6 | 5,3 < d ≤ 6,0 | 0,80 | 1,66 | 2,00 |
| 8 | 6 < d ≤ 8 | 1,66 | 2,33 | 4,00 |
| 10 | 8 < d ≤ 10 | – | 2,66 | 6,66 |
| 12 | 10 < d ≤ 12 | – | – | 9,33 |
| 14 | 12 < d ≤ 15 | – | – | 12,6 |
| 16 | 15 < d ≤ 20 | – | – | 16,6 |
| 20 | 20 < d ≤ 24 | – | – | 24 |
| 24 | 24 < d | – | – | 33 |
| a For screws and fasteners made of plastic, the tightening torque applied shall be the value specified in the manufacturer’s instructions. 90° locking mechanisms not containing a thread are not subjected to the tightening torques specified in this table, they are operated so as to engage in normal use.  b Column I applies to screws without heads which, when tightened, do not protrude from the hole and to other screws which cannot be tightened by means of a screwdriver with a blade wider than the root diameter of the screw.  c Column II applies to nuts and screws, which are tightened by means of a screwdriver.  d Column III applies to nuts and screws, which can be tightened by means other than a screwdriver . | | | | |

**Annexes**

Annexes of IEC 61439-1:2020 are applicable except as follows. Annex C and Annex D of IEC 61439-1:2020 are not applicable.

Addition of Annex AA, Annex BB and Annex CC:

2. (informative)  
   Items subject to agreement between the DBO manufacturer and the user

The information given in [Table AA.1](#_bookmark16) is subject to an agreement between the DBO manufacturer and the user. In some cases the information declared by the DBO manufacturer may take the place of an agreement.

Table AA.1 – Items subject to agreement between the DBO manufacturer and the user

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Characteristics** | **Reference clause or subclause of IEC 61439-1:2020** | **Default arrangement a** | **Options listed in IEC 61439-3 b** | **User requirement c** |
| **Electrical system** |  |  |  |  |
| Earthing system | 5.6, 8.4.3.1, 8.4.3.2.3, 8.6.2, 10.5, 11.4 | Manufacturer’s standard, selected to suit local requirements | TT / TN-C / TN-C-S / IT / TN-S |  |
| Nominal voltage of the power supply (V) | 3.8.9.1, 5.2.1, 8.5.3 | Local, according to installation conditions | Nominal voltage to earth ≤300 V AC |  |
| Transient overvoltages | 5.2.4, 8.5.3, 9.1, Annex G | Determined by the electrical system | Overvoltage category III |  |
| Temporary overvoltages | 9.1 | Nominal system voltage + 1200 V | None |  |
| Rated frequency *f*n (Hz) | 3.8.12, 5.5, 8.5.3, 10.10.3.1, 10.11.5.4 | According to local installation conditions | 50 Hz / 60 Hz |  |
| Additional onsite testing requirements: wiring, operational performance and function | 11.10 | Manufacturer’s standard, according to application | None |  |
| **Short-circuit withstand capability** |  |  |  |  |
| Prospective short-circuit current at supply terminals *I*cp (kA) | 3.8.7 | Determined by the electrical system | None |  |
| Prospective short-circuit current in the neutral conductor | 10.11.5.3.5 | Min. 60 % of phase values | None |  |
| Prospective short-circuit current in the protective circuit | 10.11.5.6 | Min. 60 % of phase values | None |  |
| SCPD in the incoming functional unit requirement | 9.3.2 | According to local installation conditions | Yes / No |  |
| Co-ordination of short-circuit protective devices including external short-circuit protective device details | 9.3.4 | According to local installation conditions | None |  |
| Data associated with loads likely to contribute to the short-circuit current | 9.3.2 | No loads likely to make a significant contribution allowed for | None |  |
| **Protection of persons against electric shock in accordance with IEC 60364-4-41** |  |  |  |  |
| Type of protection against electric shock – Basic protection (protection against direct contact) | 8.4.2 | Basic protection | According to local installation regulations |  |
| Type of protection against electric shock – Fault protection (protection against indirect contact) | 8.4.3 | According to local installation conditions | Automatic disconnection of supply / Electrical separation / Double or reinforced insulation |  |
| **Installation environment** |  |  |  |  |
| Location type | 3.5, 8.1.4, 8.2 | Manufacturer’s standard, according to application | Indoors / Outdoors |  |
| Protection against live parts, ingress of solid foreign bodies and water | 8.2.2, 8.2.3 | Indoors (enclosed): IP2XC  Outdoors (min.): IP23 | After removal of removable parts:  As for connected position / Reduced protection  to manufacturer’s  standard |  |
| External mechanical impact (IK code) | 8.2.1, 10.2.6 | Indoors IK05 Outdoors IK07 | None |  |
| Resistance to UV radiation (applies for outdoor assemblies only unless specified otherwise) | 10.2.4 | Indoors: Not applicable  Outdoors: Temperate climate | None |  |
| Resistance to corrosion | 10.2.2 | Normal Indoor/Outdoor arrangements | None |  |
| Ambient air temperature – Lower limit | 7.1.1 | Indoors: –5 °C  Outdoors: –25 °C | None |  |
| Ambient air temperature – Upper limit | 7.1.1 | 40 °C | None |  |
| Ambient air temperature – Daily average maximum | 7.1.1, 9.2 | 35 °C | None |  |
| Maximum relative humidity | 7.1.1 | Indoors: 95 % at −5°C to +30 °C 70 % at +35 °C 57 % at +40 °C  Outdoors: 100 % at −25 °C to +27 °C 60 % at 35 °C 46 % at 40 °C | None |  |
| Pollution degree (of the installation environment) | 7.1.2 | 2 | 3, 4 |  |
| Altitude | 7.1.1 | ≤2000 m | None |  |
| EMC environment (A or B) | 9.4, 10.12, Annex J | B | A or B |  |
| Special service conditions (e.g. vibration, exceptional condensation, heavy pollution, corrosive environment, strong electric or magnetic fields, fungus, small creatures, explosion hazards, heavy vibration and shocks, earthquakes) | 7.2, 8.5.4, 9.3.3 Table 7 | No special service conditions | None |  |
| **Installation method** |  |  |  |  |
| Type | 3.3, 5.6 | Manufacturer’s standard | Various e.g. floor-standing / wall-mounted |  |
| Stationary/Movable | 3.5 | Stationary | None |  |
| Maximum overall dimensions and weight | 5.6, 6.2.1 | Manufacturer’s standard, according to application | None |  |
| External conductor type(s) | 8.8 | Manufacturer’s standard | Cable / Busbar trunking system |  |
| Direction(s) of external conductors | 8.8 | Manufacturer’s standard | None |  |
| External conductor material | 8.8 | Copper | Copper / Aluminium |  |
| External line conductor, cross- sections, and terminations | 8.8 | As defined within the standard | None |  |
| External protective, neutral, mid-point, PEL, PEM, PEN conductor cross- sections and terminations | 8.8 | As defined within the standard | None |  |
| Special terminal identification requirements | 8.8 | Manufacturer’s standard | None |  |
| **Storage and handling** |  |  |  |  |
| Maximum dimensions and weight of transport units | 6.2.2, 10.2.5 | Manufacturer’s standard | None |  |
| Methods of transport (e.g. forklift, crane) | 6.2.2, 8.1.6 | Manufacturer’s standard | None |  |
| Environmental conditions | 7.3 | As service conditions | None |  |
| Packing details | 6.2.2 | Manufacturer’s standard | None |  |
| **Operating arrangements** |  |  |  |  |
| Access to manually operated devices | 8.4 | Ordinary persons | None |  |
| Location of manually operated devices | 8.5.5 | Easily accessible | None |  |
| Isolation of load installation equipment items | 8.4.2, 8.4.3.3, 8.4.6.2 | Manufacturer’s standard | Individual / groups / all |  |
| **Maintenance and upgrade capabilities** |  |  |  |  |
| Requirements related to accessibility in service by ordinary persons; requirement to operate devices or change components while the assembly is energized | 8.4.6.1 | Basic protection | None |  |
| Requirements related to accessibility for inspection and similar operations | 8.4.6.2.2 | No requirements for accessibility | None |  |
| Requirements related to accessibility for maintenance in service by authorized persons | 8.4.6.2.3 | No requirements for accessibility | None |  |
| Requirements related to accessibility for extension in service by authorized persons | 8.4.6.2.4 | No requirements for accessibility | None |  |
| Method of functional units connection | 8.5.1, 8.5.2 | Manufacturer’s standard | None |  |
| Protection against direct contact with hazardous live internal parts during maintenance or upgrade (e.g. functional units, main busbars, distribution busbars) | 8.4 | No requirements for protection during maintenance or upgrade | None |  |
| **Current carrying capability** |  |  |  |  |
| Maximum total load current to be supplied by the assembly (from which the rated current of the assembly *I*nA (A) will be determined) | 3.8.10.1, 5.3, 8.4.3.2.3, 8.5.3, 8.8, 10.10.2, 10.10.3, 10.11.5, Annex E | *I*nA ≤250 A | None |  |
| Design current IB and nature / type of load e.g. EV, PV or alternatively, *I*n of the devices and nature of the load (in such cases, the assumed loading factors as given in [Table 101](#_bookmark12) can be used.) | 3.8.10.8 | *I*nc ≤125 A Assumed loading factor as given in [Table 101](#_bookmark12) | None |  |
| Ratio of cross-section of the neutral conductor to line conductors: line conductors up to and including 16 mm2 | 8.6.1 | 100 % | None |  |
| Ratio of cross-section of the neutral conductor to line conductors: phase conductors above 16 mm2 | 8.6.1 | 50 %  (min. 16 mm2) | None |  |
| a In some cases the information declared by the DBO manufacturer may take the place of an agreement.  b 'None' in this column means that there are no options in IEC 61439-3 other than the default condition or value.  c For exceptionally onerous applications, the user may need to specify more stringent requirements to those in this document. | | | | |

1. (informative)  
   Effects upon a DBO design and related ratings, instructions, etc. when used in a prosumer’s electrical installation (PEI)

The effects upon a DBO design and related ratings, instructions, etc. when used in a prosumer’s electrical installation (PEI) shall take account of the relevant requirements in IEC 60364-8-82, for example the installation with a local generator, photovoltaic systems, wind turbines, batteries, and potentially with energy management (e.g. load shedding equipment, monitoring device).

A non-exhaustive list of some aspects that should be considered are:

* the maximum short-circuit level (typically PEI in parallel with distribution system) ;
* the minimum short-circuit level (typically island mode) to achieve related disconnection times including thermal constraints for cables, busbars and shock protection. This is because the *I*2*t* can be higher at lower fault levels; see IEC TR 61912-1. The DBO should have suitable short-circuit protection and ratings based on the information provided by the user;
* circuits potentially supplied by both sides and reverse connected; protection devices should be able to function with respect to whatever the direction of the current flow. Protection devices with line and load terminals such as a polarized circuit-breaker should not be reverse connected;
* transient overvoltages in a PEI which can be more frequent than in a usual installation (e.g. due to the switching between sources, load shedding, load shifting) and therefore requiring the use of SPDs to be evaluated.

1. (informative)  
   Rated current of an assembly (*I*nA)

When a generator, for example a photovoltaic system, wind turbine, battery is used as an additional source of supply in parallel and simultaneously with another source that is connected to the DBO, the DBO shall be selected such that:

*I*nA ≥ *I*n + *I*gen(s),

where

*I*nA is the rated current of the assembly;

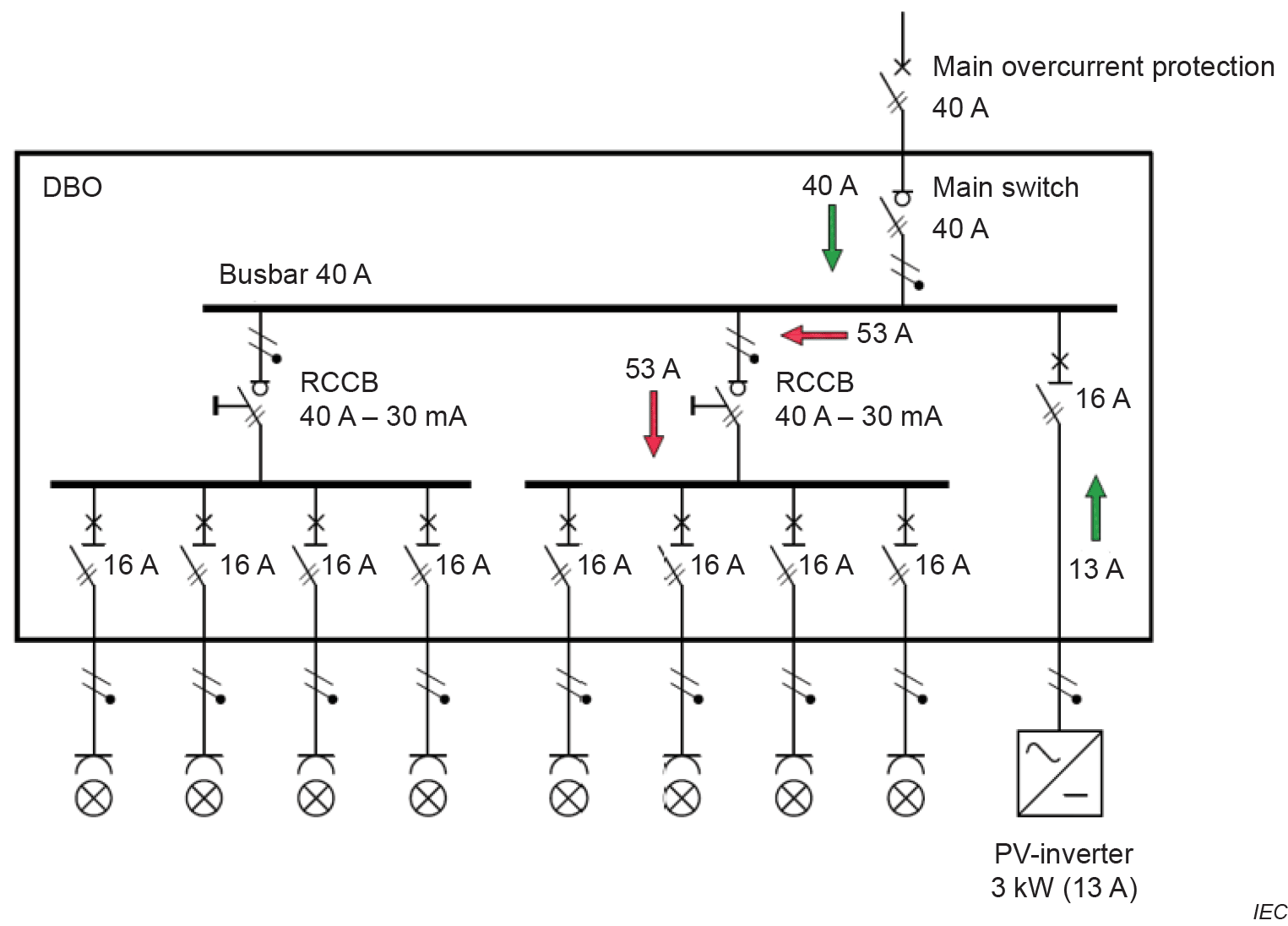
*I*n is the rated current of the incoming circuit overcurrent protective device either incorporated within the DBO or upstream of it ;

*I*gen(s) is the rated output current of the generating set or sets supplied through separate incoming overcurrent protective devices.

See [Figure CC.1.](#_bookmark19)

Alternatively, where the generating set or sets are supplied in parallel with the main incoming supply through a single overcurrent protective device within the DBO, the *I*nA should be greater than or equal to this single overcurrent protective device and the specific arrangements shall be verified.

When a power supply is not arranged to be operated in parallel and simultaneously with other sources, for example a back-up generator connected through a transfer switch, the minimum rated current of the DBO (*I*nA) should be the highest value of the mains power supply or generator aligned with the rated current of the incoming circuit overcurrent protective device, either incorporated within the DBO or upstream of it.



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Figure CC.1 – Example of overloading where *I*n + *I*gen(s) is greater than *I*nA

The required *I*nA is: *I*nA ≥ 40 A circuit-breaker + *I*gen 13 A therefore, *I*nA ≥ 40 + 13 = 53 A.

1. (informative)  
   List of notes concerning certain countries

| **Country** | **Clause/Subclause** | **Text** |
| --- | --- | --- |
| IT | 1 | Add the following:  In Italy, the standard CEI 23 51 is applicable for domestic household installations with maximum incoming unit of 125 A and rated voltage up to 440 V. |
| FR | 1 | Add the following to the end of the Scope before the note:  In France, this standard does not apply to a meter board which is covered by a local network operator requirement. |
| GB | 3.1 | Add the following terms and definitions which are used in the United Kingdom:  **3.1.102 type A DBO**  DBO designed for single-phase outgoing circuits only, the incoming supply possibly being single or three-phase  Note 1 to entry: A type A DBO can have single-phase outgoing devices which have switched or unswitched neutral connections and may be arranged horizontally and/or vertically.  Note 2 to entry: In the United Kingdom, a type A DBO used principally for domestic (household) installations and having a maximum incoming unit rating of 100 A and a maximum outgoing circuit rating of 63 A, is known as a "consumer unit". |
|  |  | **3.1.103 type B DBO**  DBO designed for single-phase and/or poly-phase outgoing circuits, the incoming supply being poly-phase  Note 1 to entry: A type B DBO can have outgoing devices which have switched or unswitched neutral connections and may be arranged horizontally and/or vertically.  **3.1.104 blank**  component used for closing an opening in the external enclosure to provide basic protection  **3.1.105 consumer unit CU**  integrated assembly, for the control and distribution of electrical energy, principally in a household or similar premise, incorporating manual means of double-pole isolation on the incoming circuit(s), with polarity observed throughout  Note 1 to entry: Consumer units are designed for use exclusively with specific protective devices on the outgoing circuits, and type- tested for use when energized through a BS 88-3 fuse having an Icc of 16 kA rating under the specific test arrangements according to 10.11.5.101 |
| ZA | 5.2 | Add the following:  In South Africa, see IEC 60038 and SANS 1019 for further details on the nominal system voltage. |
| GB | 5.6 of IEC 61439- 1:2020 | Add the following item q) to 5.6:  q) type A or type B DBO (see 3.1.102 and 3.1.103 which are applicable for the United Kingdom). |
| DE, SE | 6.1 | Add the following note after the first paragraph:  NOTE In Germany and Sweden, 10.2.7 applies to DBOs intended for indoor installation. |
| GB | 6.2.1 of IEC 61439-1:2020 | In the United Kingdom, add the following additional subclause.  6.2.1.101 Assembly outgoing unit and outgoing circuit marking Each DBO shall be marked with the *I*nc, RDF and/or *I*ng of each  outgoing unit and each outgoing circuit/functional unit for its specific arrangement/location in the DBO. The marking can be by a single label covering various rated currents and/or RDF.  Verification shall be fulfilled by:  Where an outgoing unit and outgoing circuit/functional unit is supplied fitted in the DBO, the assembly manufacturer shall apply the relevant label to the DBO or device.  Where an outgoing unit and outgoing circuit/functional unit is fitted in the DBO on site by the installer, the DBO manufacturer shall provide labels and instructions with the DBO so that the *I*nc, RDF and/or *I*ng of each outgoing unit and each outgoing circuit/functional unit can be marked by the installer on the DBO or device.  For both a) and b):  The marking shall be readily visible after installation. It can be visible after a hinged/sliding cover or door is opened but not located behind covers designed to be held in place by screws or similar means. |
| US | 8.2.1 | Add the following note after the last paragraph:  NOTE In the United States of America, no IK code is required as the requirements applicable to an "enclosure type" designation cover this consideration.  The United States of America (USA) uses enclosure "Type" designations according to UL 50 and UL 50E. The enclosure Type designations incorporate constructional requirements as well as additional environmental requirements for conditions such as corrosion, rust, icing, oil, and coolants. For this reason, the IEC Enclosure Classification Designations IP are used with an enclosure Type designation number appropriate for these markets. |
| GB | 8.2.2 | Add the following:  For parts of the United Kingdom, the Building Regulations Approved Document P and Approved Document M require consumer units e.g. DBOs to be easily reached and accessible. Therefore, in the United Kingdom, a blank used for closing an opening in the external enclosure to provide basic protection, must be securely retained in position. To meet this condition the following requirements are to be verified by the following additional test:  Verification of blank retention in a DBO  A blank shall be securely retained in position. Conformity is verified by complying with both the push and pull tests.  The blank shall be tested when fitted as in normal use. The tests shall be applied to each construction type and size of blank.  Separate samples may be used for each of the tests below.  **Push test**  A push force of 50 N is applied by test probe 11 of IEC 61032 (rigid test finger) for 10 s without jerks in the centre of the blank.  During and after the push test the blank shall remain in position and not become detached.  Any apertures which are present around the blank after the test shall pass a test of IP2XC.  **Pull test using IEC 60335-1:2020, Figure 7 test fingernail**  The test fingernail tip is located at the centre of the shortest side of the blank and applied with a force of 10 N. If the fingernail tip does not engage under the edge of the blank at any angle, the pull test below is not required.  The test fingernail is then pulled for 10 s without jerks, by means of the loop (eyelet), with a force of 30 N in the direction of removal.  The test fingernail tip is located at the centre of the longest side of the blank and applied with a force of 10 N. If the fingernail tip does not engage under the edge of the blank at any angle, the pull test below is not required.  The test fingernail is then pulled for 10 s without jerks, by means of the loop (eyelet), with a force of 30 N in the direction of removal.  During and after the pull test the blank shall remain in position and not become detached.  Any apertures which are present around the blank after the test shall pass a test of IP2XC. |
| NO | 8.5.3 | Add the following:  In Norway, the alternative of labelling protective devices that re- closing shall only be carried out by skilled or instructed persons shall not be applied.  Add the following note after the last paragraph:  NOTE In Norway, protective devices in outgoing circuits used for wiring protection in building shall comply with IEC 60898-1,  IEC 61008, IEC 61009, IEC 60269-3 or IEC 60947-2 as long as the  requirements in IEC 60898-1 or IEC 61009 are met for all tests except the test for time-current characteristic B, C and D as specified in IEC 60898-1:2002, 9.10.1 or IEC 61009-1:2010, 9.9.2.1. |
| NL | 8.5.3 | Add the following:  In the Netherlands, it is allowed to install a socket outlet in accordance with IEC 60884-1 (NEN 1020) in the DBO without shutters, in such a way that the minimum degree of protection (IP2XC) is not met only at the location of the holes where the plug - pins are inserted to establish the electrical contact. The verification test report that is published shall record the presence of the socket outlet and exception to the requirement in the paragraph of the degree of protection (IP) test. |
| GB | 8.6.1 | Add the following note after the last paragraph:  NOTE In the United Kingdom, the UK Electricity, Safety and Quality Regulations S.I. 2002 No. 2965 require electricity suppliers to state the maximum prospective short-circuit current at the supply terminals. In the United Kingdom, the maximum prospective short- circuit current at the supply terminals of household and similar electrical installations declared by the supply authority in accordance with the Electricity Association Publication P 25 is 16 kA for single- phase supplies up to and including 100 A. |
| ZA | 8.8 | Add the following:  In South Africa, conductor colour coding is covered in SANS 10142 - 1. |
| AT | 8.8 | Add the following:  In Austria, terminals, or components to connect neutral conductors of more than one outgoing circuit must consist of independent terminations for every single circuit to be able to disconnect single circuits independently from others. |
| US | 8.8 | Add the following note after the last paragraph:  NOTE In the United States of America, the neutral conductor is identified by the colour white and the protective earth conductor may be either green/yellow or solid green. |
| GB | 10.10.1 of IEC 61439-1:2020 | In the United Kingdom, building regulations require thermal insulation and/or sound proofing material which influences the temperature rise verification, therefore, replace the second paragraph of 10.10.1 of IEC 61439-1:2020 with the following:  Verification of DBOs:  Surface mounting shall be made with one or more of the following in IEC 61439-1:2020: testing (10.10.2), comparison with a reference design (10.10.3), or assessment (calculation) (10.10.4).  Flush mounting in hollow walls shall be made with one or more of the following: testing (10.10.2) or comparison with a reference design (10.10.3).  The hollow wall test(s) shall be made in a test wall with a width of 200 mm ± 10 mm of thermal insulation in contact with the top, bottom and both sides of the DBO filled to the depth of the wall cavity. The maximum thermal conductivity of the thermal insulation shall be 0,044 W/mK.  The rear of the DBO is not required to have any thermal insulation other than air or the typical finishing material of the mounting wall. The DBO manufacturer’s instructions supplied with the DBO shall specify for flush mounting arrangements the location of the thermal insulation.  Suitability for flush mounting in solid walls e.g. brick, stone, concrete is covered by testing in accordance with b) above.  All temperature rise tests shall be applied with holes for both test cable entries and spare entries closed or sealed.  Annex L of IEC 61439-1:2020 provides guidance on the verification of temperature rise.  Flush mounting hollow wall test arrangements are as follows:  Test wall with a width of 200 mm ± 10 mm of thermal insulation in contact with the top, bottom and both sides of the DBO. |
|  |  | Joonise selgitus  Top insulation 200 mm  LHS insulation 200 mm  RHS insulation 200 mm  Bottom insulation 200 mm  Test sample  Front view  Insulation - filled to a depth of wall cavity  Rear  No insulation  Backboard  Side view  IEC |
| GB | 10.10.2.3.6 | Add the following to the second paragraph:  In the United Kingdom, for an example considering a complete split- load DBO, see [Figure DD.1.](#_bookmark21) |
|  |  |  |
| |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Functional unit** | **Main incoming unit** | **1** | **1a** | **1b** | **1c** | **1d** | **2** | **2a** | **2b** | **2c** | **2d** | | Rating of the device, *I*n | 125 A | 100 A | 80 A | 80 A | 6 A | 0 | 100 A | 32 A | 2 A | NA | NA | | Functional unit rated current, *I*nc | NA | NA | 63 A | 63 A | 63 A | 0 | NA | 63 A | 63 A | NA | NA | | RDF | NA | NA | 0,6 | 0,6 | NA | 0 | NA | 0,6 | 0,6 | NA | NA | | Group rated current *I*ng and test current | 100 A | 80 A | 37,8 A | 37,8 A | 4,4 A\* | 0 | 20 A\* | 19,2 A\* | 0,8 A\* | 0 | 0 | | \* Test current balance not *I*ng. | | | | | | | | | | | | | | |
| NOTE 1 This Figure DD.1 is one example where the DBO is loaded to its rated current ( *I*nA). More tests in different configurations may be required.  NOTE 2 The 80 A outgoing units shown are an example of Inc ratings as a means of verification of temperature rise under normal operation of the outgoing unit at the rated current assigned by the manufacturer. The *I*nc ratings are not restricted to 80 A.  NOTE 3 In DBOs, where the total of the rated currents of the outgoing circuits operating at rated diversity factor, exceeds the capacity of the incoming circuit, the diversity factor applies to any combination of outgoing circuits used to distribute the incoming current.  In this [Figure DD.1,](#_bookmark21) 1a to 1d, each 63 A = (63 × 4) × 0,6 = 151,2 A, which exceeds the capacity of the 100 A incoming circuit.  Therefore, in this example, outgoing circuits are loaded to the Ing of outgoing unit 1 i.e. 80 A, with outgoing unit 2 loaded to the balance of the incoming circuit i.e. 20 A.  NOTE 4 The rated current of a functional unit (the circuit) is the value of current declared by the assembly manufacturer, which may be equal to, or lower than the rated current of the device according to the respective device standard.  NOTE 5 The following overload requirements could influence the Inc of the switch and RCCB assigned by the assembly manufacturer.  Switches and RCCBs should be protected against overload. When using an overcurrent protective device (OCPD) for the overload protection, the OCPD is typically installed upstream of the switch and RCCB in the service/supply cut-out.  Overload coordination can be achieved when the switch/RCCB Inc is greater than or equal to the upstream OCPD rated current (In). Overload protection cannot solely be based on the use of diversity factors of the downstream circuits.  BS 7671 requires the electrical installation designer to arrange the circuits in the installation so that they are appropriately divided across the RCCBs to minimize unwanted operation and inconvenience.  Joonise selgitus  Main incoming unit  Rated current of the DBO  TEST current  Outgoing functional unit  Outgoing circuit  Outgoing unit  An alternative to declaring Ing for each type of outgoing circuit is to declare Inc and the appropriate RDF.  RDF is calculated by dividing Ing by Inc of the same outgoing main circuit, where Ing and Inc are derived by test.  For this example:  Outgoing functional units Inc = 63 A  maximum (lower rated devices may be used when installed)  RDF for the DBO  TEST currents  Circuit 1c is the balance current to load the outgoing unit 1 to its rated circuit current (Inc). so as to achieve the highest temperature rise.  Total test current  Outgoing unit 2 = test current 20 A, which is the balance to obtain incoming unit InA so as to achieve the highest temperature rise. Therefore outgoing circuit 2a = 32 A (1) x 0,6 = 19,2 A and 2b = 2 A() loaded to 0,8 A (balance)  Total test current 20 A  Figure DD.1 – Example of temperature rise verification by test of a complete split‑load DBO as in 10.10.2.3.6 | | |
| GB | 10.11.5 of IEC 61439-1:2020 | Add the following additional paragraph:  In the United Kingdom, a DBO designated as a consumer unit shall have an *I*cc of 16 kA verified by test to additional subclause 10.11.5.101. |
| GB | 10.11.5 of IEC 61439-1:2020 | The UK Electricity, Safety and Quality Regulations S.I. 2002 No. 2965 require electricity suppliers to state the maximum prospective short-circuit current at the supply terminals.  This information is given in Electricity Association publication P25. To meet this condition the following requirements are to be incorporated and also aligned with BS 7671 combined short-circuit protection and back-up protection:  Add the following Subclause 10.11.5. 101:  10.11.5.101 16 kA combined short-circuit and back-up protection verification 10.11.5.101.1 General  Verification of the CU *I*cc 16 rating using combined short-circuit protection and back-up protection as defined in BS 7671. Co-ordination, in short-circuit conditions of two OCPDs in series, using an upstream BS 88 -3 fuse (formerly BS 1361) and an outgoing OCPD in the CU to achieve a higher capability than the CU OCPD alone and providing back-up protection to devices such as a switch or RCCB. This verifies the performance of the incoming device and its connections, and any other item in the CU not separately rated in excess of 16 kA, verifying the complete CU with a conditional rating *I*cc of 16 kA.  The following test(s) are applied to a CU as covered by the definition in 3.1.104.  Test arrangements  The CU shall be set up as in normal use. It will be sufficient to test a single functional unit if the remaining functional units are constructed in the same way and cannot affect the test result.  Short-circuit test procedure   1. It shall be verified that the representative samples of the final circuit protective devices used for the test comply with Table DD.1 and Table DD.2 where applicable. 2. The reference fuse shall be a 100 A fuse-link complying with type II of BS 88-3. Details of the fuse-links used for the test, i.e. manufacturer’s name, reference, rated current, rated voltage and pre-arcing (*I*2*t*), shall be given in the test report. 3. Where BS 1361 type II fuse-links are available for test/certification purposes, they may be used in place of BS 88 -3 fuse-links as key performance characteristics are identical. This test using a 100 A fuse - link is deemed to cover 60 A and 80 A ratings. 4. The final circuit protective device shall be mounted as in service in the manufacturer’s smallest recommended enclosure (metal if offered in the catalogue). The connection on the load side of the protective device under test shall be in accordance with Table DD.3 and 0,6 m ± 0,05 m in length. 5. The test circuit shall be connected as shown in Figure DD.3. The relative positions of the closing switch, inductive reactor and resistor are not obligatory, but the inductive reactor and resistor shall be in series with the master circuit-breaker. 6. The impedance used for limiting the prospective short-circuit fault current to the required value shall be inserted on the supply side of the circuit.   Resistors shall be connected between line and neutral, after the impedances for adjusting the prospective current, so as to draw current of 10 A per phase at rated voltage from the supply.  If an air-cored inductor is used, a resistor taking approximately 1 % of the current through the inductor shall be connected in parallel with it.  A lower value of shunt current may be used with the consent of the manufacturer. |

Table DD.1 – Requirements for final circuit protective devices:  
Circuit-breakers complying with BS EN 60898 and RCBOs complying with BS EN 61009

|  |  |  |  |
| --- | --- | --- | --- |
| **Circuit-breaker or RCBO type** | **Time** | **Test current in multiples of rated current** | **Result** |
|  | **h** | **(*I*n)** |  |
| B, C, D | 1 | 1,13 | No trip |
|  | 1a | 1,45 | Trip |
| NOTE Test to be conducted at specified reference ambient temperature.  a This test shall commence within 5 s of the end of the test at 1,13 *I*n. | | | |

Table DD.2 – Requirements for final circuit protective devices: Semi-enclosed fuses complying with BS 3036 and cartridge fuses complying with BS 88.3

|  |  |  |  |
| --- | --- | --- | --- |
| **Test current**  **A** | **Time**  **h** | **Test current in multiples ofrated current**  **(*I*n)** | **Result** |
| 5(6) | 0,75 | 1,0 | Fuse intact |
| 15(16) | 1 |
| 20 | 1 |
| 30(32) | 1,25 |
| 45 | 1,5 |
| 5(6) | 0,75 | 2.0 | Fuse melted |
| 15(16) | 1 |
| 20 | 1 |
| 30(32) | 1,25 |
| 45 | 1,5 |
| Where BS 1361 fuse-links are available for test/certification purposes, they may be used in place of BS 88 -3 fuse- links as key performance characteristics are identical. | | | |

Table DD.3 – Cross-sections of copper conductors on load side of protective device under test

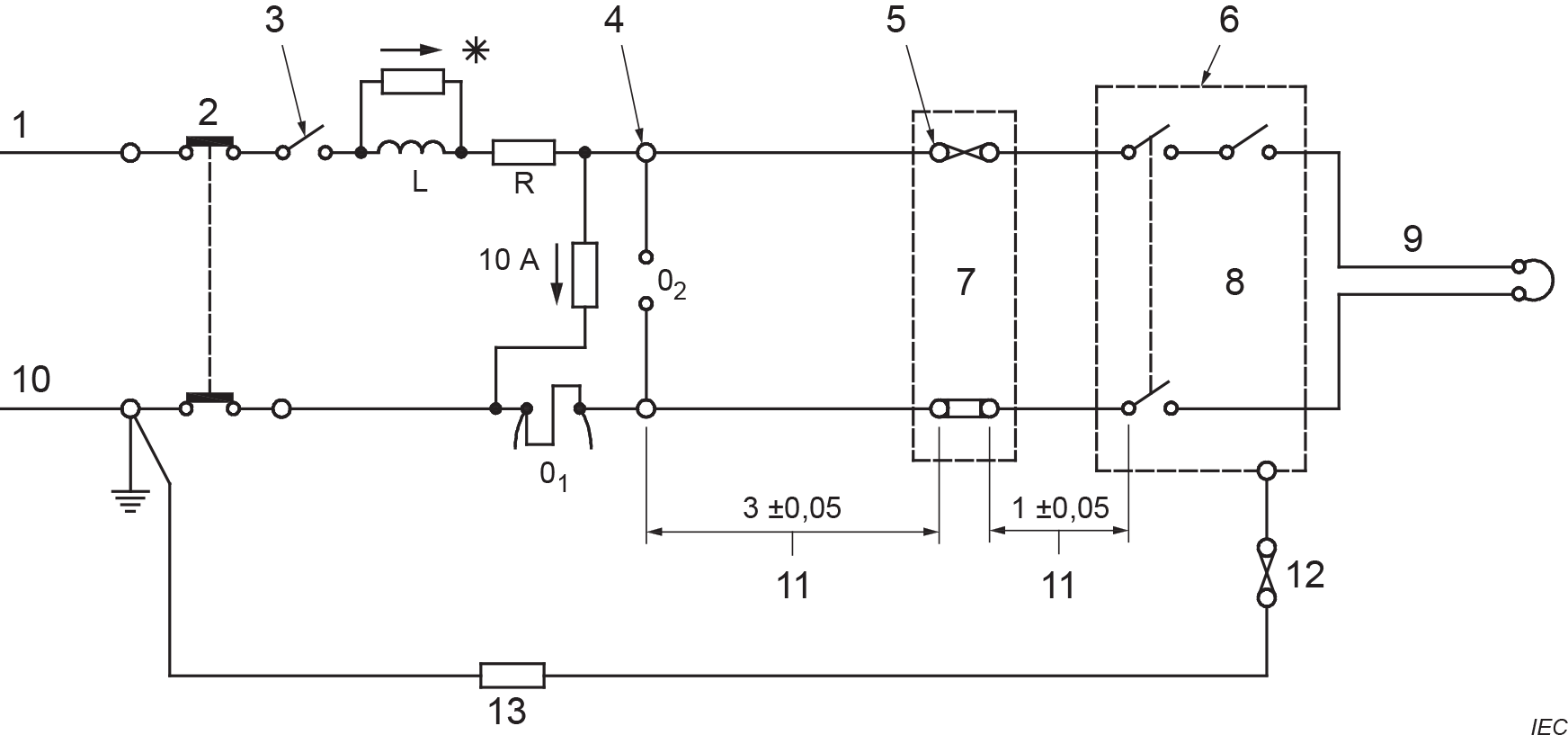
|  |  |  |
| --- | --- | --- |
| **Device rating** | | **Conductor** |
| **A** | | **mm2** |
|  | ≤ 6 | 1,0 |
| > 6 | ≤ 10 | 1,5 |
| > 10 | ≤20 | 2,5 |
| > 20 | ≤ 32 | 6,0 |
| > 32 | ≤ 50 | 10,0 |
| > 50 | ≤ 63 | 16,0 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Country** | | **Clause/Subclause** | | **Text** | |
|  | |  | | 10.11.5.101.4 Circuit conditions | |
|  | |  | | The applied voltage shall be that which is necessary to produce the necessary power frequency recovery voltage.  The value of the power frequency voltage shall be equal to 110 % (0, -5 %) of the rated recovery voltage of the CU.  The voltage on the supply side shall be measured during the first complete cycle after arc extinction and after all high frequency phenomena have subsided.  NOTE The value of 110 % (0,  −5 %) of the rated voltage is deemed to cover the variations of system supply voltage under normal service conditions. The upper limit may be increased with the approval of the manufacturer. | |
|  | |  | | The value of the prospective short-circuit current shall be 16 kA -0 % + 5 % at a power factor of 0,6 ± 0,05 determined from a calibration oscillogram taken with a link of negligible impedance positioned as shown in [Figure DD.3.](#_bookmark27) All parts of the equipment normally earthed in service, including its enclosure, shall be insulated from earth, but shall be connected to the neutral of the supply or to a substantially inductive artificial neutral, permitting a prospective fault current of at least 100 A . | |
|  | |  | | This connection shall include a reliable device, such as a fuse consisting of a copper wire of 0,1 mm diameter and not less than 50 mm in length for the detection of the fault current and, if necessary, a resistor to limit the value of the prospective fault current to approximately 100 A. | |
| Joonise selgitus  Calibration of circuit  Prospective peak making current  Prospective symmetrical breaking current (RMS value)  Applied voltage (RMS value)  Current  Voltage  O or CO operation  Breaking capacity (RMS value)  Making capacity (RMS value)  Recovery voltage (RMS value)  CO operation  O operation  NOTE The amplitude of the voltage trace, after initiation of the test current, varies according to the relative positions of the closing device, the adjustable impedances, and the voltage sensing devices, and according to the test diagram.  Figure DD.2 – Calibration of the test circuit | | | | | |
|  | | | | | |
|  | |  | | 10.11.5.101.5 Test sequence | |
|  | |  | | The CU shall be subject to the following tests A and B with the outgoing way fitted with a final circuit protective device of the maximum thermal current rating. | |
|  | |  | | If the final circuit protective devices have a short -circuit rating less than 16 kA, further tests A and B shall be carried out with a device of the minimum thermal rating fitted. In addition, if the CU is designed to accept different types or ranges of outgoing devices, each type or range shall be further tested separately. | |
| **Country** | | **Clause/Subclause** | | **Text** | |
|  | |  | | The tests are as follows:  Test A1. With the circuit connected as described above, with the service cut-out fuse in place and a new outgoing fuse, cartridge or fuse wire, installed, the test voltage is applied with the point on wave controlled to provide initiation of the fault at between 0° and 20° (electrical) on the rising voltage wave.  Test A2. With the circuit connected as described above, with the service cut-out fuse in place and all circuit breakers closed, the test voltage is applied with the point on wave controlled to provide initiation of the fault at between 55° and 65° (electrical) on the rising voltage wave.  Test B. A further short-circuit operation shall be applied after suitable preparation as indicated in Table DD.4 dependent on which of the alternative results of test A 1 is achieved.  If circuit-breakers are included in the CU, the test shall be applied by reclosing the circuit-breaker with the test circuit energized. If fuses are used, the test shall be as in Test A 1.  During the tests a cheesecloth shall be placed on the outside of the enclosure at all openings, e.g. arc vents and handles. There shall be no ignition of the cheesecloth.  The cheesecloth shall be clean and dry bleached plain cotton of approximately 30 g to 40 g per square metre. When placed into position the cheesecloth shall be folded loosely in such a manner that cut and torn edges will not be exposed directly to the arc or flash. Ignition of the cheesecloth is considered to have occurred when a flame is visible.  Smouldering is not considered to be evidence of ignition. The cheesecloth may be changed following each Test B.  Details of the *I*2*t* let through by the combination of devices during the test shall be given in the test report. A new CU of the same design may be used for each of the two test sequences.  An alternative to cheesecloth is to use clear polyethylene foil placed in front of the circuit-breaker for Test A2 only. The polyethylene foil shall show no holes visible with normal or corrected vision without additional magnification.  The clear polyethylene foil shall be 200 mm × 200 mm reasonably stretched in a frame, placed 10 mm from the front of the circuit -breaker.  The foil should have the following physical properties:  Thickness (0,05 ± 0,01) mm  Density at 23 °C (0,92 ± 0,05) g/m3  Melting point (110 to 120) °C | |

Table DD.4 – Preparation for Test B

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | **Result of Test A1 or Test A2** | | |
| Reference fuse complying with BS 88-3 (formerly BS 1361) | | Intact | Blown | |
| Protective device in the CU | | Operated | | Not operated |
| Final circuit preparation for Test B | Circuit-breaker complying with BS EN 60898 or RCBO complying with BS EN 61009 | No action  (circuit breaker or RCBO ready for Test B closing test) | Replace reference fuse | Replace reference fuse, open circuit breaker or RCBO |
| Fuse complying with BS 3036 | Rewire test fuse | Replace reference fuse  Rewire test fuse | Replace reference fuse |
| Fuse complying with BS 88-3 (formerly BS 1361) | Replace test fuse | No action | No action |

|  |  |  |
| --- | --- | --- |
| **Country** | **Clause/Subclause** | **Text** |
|  |  | 10.11.5.101.6 Conditions after test  Where the incoming switch is a protective device, the test report shall state which of the protective devices operated during the test, i.e. the incoming and/or outgoing devices.  The earth fault indicating device shall be intact and the degree of protection of the enclosure shall not be impaired.  The insulation resistance a) shall be measured within 3 min of the conclusion of the series of tests. The insulation resistance for b) and c) shall be measured as soon as practical after measurement of a), the times of measurement of b) and c) being recorded in the test report. The values shall be measured at 500 V DC and shall not be less than the following:   1. 0,10 MΩ between the final circuit protective device incoming terminal and the corresponding outgoing terminal, with the isolating device open and with the blown fuse in position or the circuit-breaker or RCBO opened, whichever is applicable. 2. 0,25 MΩ between the final circuit protective device terminals and earth, with the final circuit fuse rewired, the final circuit cartridge fuse replaced, or the circuit-breaker or RCBO reclosed, whichever is applicable, and with the incoming isolating device open. 3. 0,25 MΩ between the final circuit protective device incoming terminals and any other metal parts which are unearthed and exposed in service.   The condition of the incoming isolating device shall comply with its product specification with regard to isolating properties. The conductors shall not be deformed such that the clearance and creepage distances specified in 8.3 of IEC 61439-1:2020 are impaired. There shall be no loosening of parts used for the connection of the conductors.  Where an RCCB/RCBO is included in the CU its operation shall be checked. With the RCCB/RCBO closed and connected to a supply at 0,85 times the rated voltage ± 5 % the test device shall be operated. The RCCB/RCBO shall open. |



Key

1) line conductor

2) circuit breaker

3) closing switch

4) calibration point

5) 100 A Fuse-link complying with type II of BS88.3 or BS 1361

6) consumer unit (metalclad, if applicable (see 10.11.5.101.3 )

7) house service cut-out

8) device under test

9) 0,6 m of twin cable (see [Table DD.3)](#_bookmark24)

10) neutral conductor

11) 25 mm2 copper cable

12) fine wire fuse 0,1 mm in diameter and at least 50 mm long tinned copper wire

13) resistor to limit earth fault current to 100 A

\* shunt resistor

o1,o2 oscillograph connections

Figure DD.3 – Test circuit to prove coordination of characteristics

Kirjandus

The bibliography of IEC 61439-1:2020 is applicable in addition to the following:

Addition:

1. IEC 60664-1:2020, Insulation coordination for equipment within low-voltage supply systems Part 1: Principles, requirements and tests
2. IEC 60670-24, Boxes and enclosures for electrical accessories for household and similar fixed electrical installations – Part 24: Particular requirements for enclosures for housing protective devices and other power dissipating electrical equipment
3. IEC 61009-1:2010, Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules
4. NPR 5310: Netherlands interpretation guide for NEN 1010