

BS EN 61439-6:2012



BSI Standards Publication

Low-voltage switchgear and controlgear assemblies

Part 6: Busbar trunking systems (busways)

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National foreword

This British Standard is the UK implementation of EN 61439-6:2012. It is identical to IEC 61439-6:2012. It supersedes BS EN 60439-2:2000 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear, and HV-LV co-ordination, to Subcommittee PEL/17/3, Low voltage switchgear and controlgear assemblies.

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

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Ensembles d'appareillage
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préfabriquée
(CEI 61439-6:2012)

Niederspannungs-
Schaltgerätekombinationen -
Teil 6: Schienenverteilersysteme
(busways)
(IEC 61439-6:2012)

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Foreword

The text of document 17D/452/FDIS, future edition 1 of IEC 61439-6, prepared by IEC/TC SC 17D "Low-voltage switchgear and controlgear assemblies" of IEC TC 17 "Switchgear and controlgear" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61439-6:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-03-27
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-06-27

This document supersedes EN 60439-2:2000 + A1:2005.

EN 61439-6:2012 includes the following significant technical changes with respect to EN 60439-2:2000 + A1:2005:

- alignment of the second edition of EN 61439-1:2011 regarding the structure and technical content, as applicable;
- introduction of new verifications, accordingly;
- correction of inconsistencies in resistance, reactance and impedance measurements and calculations;
- numerous editorial improvements.

This standard is to be read in conjunction with EN 61439-1:2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 61439-6:2012 was approved by CENELEC as a European Standard without any modification.

The Bibliography of EN 61439-1:2011 is applicable with the addition of the following notes for the standards indicated:

IEC 60570:2003	NOTE	Harmonised as EN 60570:2003 (modified).
IEC 60909-0:2001	NOTE	Harmonised as EN 60909-0:2001 (not modified).
IEC 61439 series	NOTE	Harmonised as EN 61439 series (partly modified).
IEC 61534 series	NOTE	Harmonised as EN 61534 series (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

This clause of EN 61439-1:2011 is applicable with the addition of the following references:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60332-3-10	2000	Tests on electric and optical fibre cables under fire conditions - Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables - Apparatus	EN 60332-3-10 ¹⁾	2009
IEC 60439-2	2000	Low-voltage switchgear and controlgear assemblies - Part 2: Particular requirements for busbar trunking systems (busways)	EN 60439-2	2000
IEC 61439-1	2011	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN 61439-1	2011
IEC 61786	1998	Measurement of low-frequency magnetic and electric fields with regard to exposure of human beings - Special requirements for instruments and guidance for measurement	-	-
ISO 834-1	1999	Fire-resistance tests - Elements of building construction - Part 1: General requirements	-	-

¹⁾ EN 60332-3-10 includes A1 to IEC 60332-3-10.

Annex ZZ (informative)

Coverage of Essential Requirements of EU Directive 2004/108/EC

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers all relevant essential requirements as given in Article 1 of Annex I of the EU Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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LOW-VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES –

Part 6: Busbar trunking systems (busways)

1 Scope

NOTE 1 Throughout this part, the abbreviation BTS is used for a busbar trunking system. Where reference to Part 1 is made, the term ASSEMBLY therefore reads as "BTS".

This part of IEC 61439 lays down the definitions and states the service conditions, construction requirements, technical characteristics and verification requirements for low voltage BTS (see 3.101) as follows:

- BTS for which the rated voltage does not exceed 1 000 V in case of a.c. or 1 500 V in case of d.c.;
- BTS intended for use in connection with the generation, transmission, distribution and conversion of electric energy, and for the control of electric energy consuming equipment;
- BTS designed for use under special service conditions, for example in ships, in rail vehicles, and for domestic applications (operated by unskilled persons), provided that the relevant specific requirements are complied with;

NOTE 2 Supplementary requirements for BTS in ships are covered by IEC 60092-302.

- BTS designed for electrical equipment of machines. Supplementary requirements for BTS forming part of a machine are covered by the IEC 60204 series.

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

The manufacture and/or assembly may be carried out by a manufacturer other than the original manufacturer (see 3.10.1 and 3.10.2 of Part 1).

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

This standard does not apply to the specific types of ASSEMBLIES covered by other parts of the IEC 61439 series, to supply track systems in accordance with IEC 60570, to cable trunking and ducting systems in accordance with the IEC 61084 series, nor to power track systems in accordance with the IEC 61534 series.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60332-3-10:2000, *Tests on electric and optical fibre cables under fire conditions – Part 3-10: Test for vertical flame spread of vertically-mounted bunched wires or cables – Apparatus*

IEC 60439-2:2000, *Low-voltage switchgear and controlgear assemblies – Part 2: Particular requirements for busbar trunking systems (busways)*

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

IEC 61786:1998, *Measurement of low-frequency magnetic and electric fields with regard to exposure of human beings – Special requirements for instruments and guidance for measurements*

ISO 834-1:1999, *Fire-resistance tests – Elements of building construction – Part 1: General requirements*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

Additional definitions:

3.101

busbar trunking system

BTS

busway

enclosed ASSEMBLY used to distribute and control electrical energy for all types of loads, intended for industrial, commercial and similar applications, in the form of a conductor system comprising busbars which are spaced and supported by insulating material in a duct, trough or similar enclosure

[SOURCE: IEC 60050-441:1984, 441-12-07 modified]

Note 1 to entry: See 3.1.1 of Part 1 for the definition of ASSEMBLY.

Note 2 to entry: The BTS may consist of a full range of mechanical and electrical components such as:

- busbar trunking units with or without tap-off facilities;
- phase transposition, expansion, flexible, feeder and adapter units;
- tap-off units;
- additional conductors for communication and/or control.

Note 3 to entry: The term "busbar" does not presuppose the geometrical shape, size and dimensions of the conductor.

3.102

busbar trunking unit

BTU

unit of a BTS complete with busbars, their supports and insulation, external enclosure and any fixing and connecting means to other units, with or without tap-off facilities

Note 1 to entry: BTUs may have different geometrical shapes such as straight length, elbow, tee or cross.

3.103

busbar trunking run

BT run

number of BTUs connected together to form the BTS, excluding the tap-off units

3.104

busbar trunking unit with tap-off facilities

BTU with tap-off facilities

BTU designed to enable tap-off units to be installed at one or more points as predetermined by the original manufacturer

3.105

busbar trunking unit with trolley-type tap-off facilities

BTU with trolley-type tap-off facilities

BTU designed to permit the use of roller- or brush-type tap-off units

3.106

busbar trunking adapter unit

adapter BTU

BTU intended to connect two units of the same system but of different type or of different rated current

3.107

busbar trunking thermal expansion unit

thermal expansion BTU

BTU intended to permit a certain movement in the axial direction of the BT run due to thermal expansion of the system

Note 1 to entry: This term does not presuppose which elements permit movement, e.g. the conductors within the enclosure or both conductors and enclosure

3.108

busbar trunking phase transposition unit

phase transposition BTU

BTU intended to change the relative positions of the phase conductors in order to balance the inductive reactances or to transpose the phases (such as L1-L2-L3-N to N-L3-L2-L1)

3.109

flexible busbar trunking unit

flexible BTU

BTU having conductors and enclosures designed to allow a specified change of direction during installation

3.110

busbar trunking feeder unit

feeder BTU

BTU serving as an incoming unit

Note 1 to entry: See 3.1.9 of Part 1 for the definition of incoming unit.

3.111

tap-off unit

outgoing unit, either fixed or removable, for tapping-off power from the BTU

Note 1 to entry: See 3.1.10, 3.2.1 and 3.2.2 of Part 1 for the definition of outgoing unit, fixed part and removable part.

Note 2 to entry: A plug-in tap-off unit is a removable tap-off unit (see 8.5.2) which can be connected or disconnected by manual operation

3.112

busbar trunking unit for building movements

BTU for building movements

BTU intended to allow for building movements due to thermal expansion, contraction and/or flexing of the building

3.113

busbar trunking fire barrier unit

fire barrier BTU

BTU or a part of, intended to prevent the propagation of fire through building divisions for a specified time under fire conditions

4 Symbols and abbreviations

This clause of Part 1 is applicable except as follows.

Addition:

Symbol / Abbreviation	Term	Subclause
k_{1A}	temperature factor of the BTS	5.3.1
k_{1c}	temperature factor of a circuit	5.3.2
k_{2c}	mounting factor of a circuit	5.3.2
R, X, Z	phase conductor and fault-loop characteristics	5.101

5 Interface characteristics

This clause of Part 1 is applicable except as follows.

5.1 General

Replacement:

The characteristics of the BTS shall ensure compatibility with the ratings of the circuits to which it is connected and the installation conditions and shall be declared by the BTS manufacturer using the criteria identified in 5.2 to 5.6 and 5.101 to 5.102.

The specification schedule according to informative Annex C is intended to help the user and the BTS manufacturer to meet this objective, whether the user:

- select catalogue products the characteristics of which meet their needs, and the requirements of this standard,
- and/or make a specific agreement with the manufacturer.

NOTE Annex C also relates to the topics dealt with in Clauses 6 and 7.

In some cases information provided by the BTS manufacturer may take the place of an agreement.

5.2.4 Rated impulse withstand voltage (U_{imp}) (of the ASSEMBLY)

Replacement of the NOTE:

NOTE Unless otherwise specified, the rated impulse withstand voltage is selected according to overvoltage category IV (origin of installation level) or III (distribution circuit level) as given in Table G.1 of Part 1.

5.3.1 Rated current of the ASSEMBLY (I_{nA})

Addition:

NOTE 4 Where the BTS is not equipped with a single incoming unit at one end of the BT run, (e.g. incoming unit not installed at one end of the BTS, or more than one incoming unit), the rated currents will be subject to agreement between the user and the manufacturer.

The rated current shall apply for a specified mounting orientation (see 5.3.2). However the influence of the mounting orientation may be ignored for short (e.g. less than 3 m long) vertical sections in a horizontal BTS.

The BTS manufacturer may state the rated currents of the BTS for different ambient temperatures for example by means of the following formula:

$$I'_{nA} = k_{1A} I_{nA}$$

where k_{1A} is a temperature factor, equal to 1 at an ambient air temperature of 35 °C.

In case of significant harmonic currents, special agreement shall be made for a reduction factor, if necessary.

5.3.2 Rated current of a circuit (I_{nc})

Addition:

The rated current (I_{nc}) of each circuit (i.e. incoming unit, BTU, tap-off unit, outgoing circuit) shall be equal to or higher than its assumed loading. For tap-off units provided with more than one main outgoing circuit, see also 5.4.

The rated current shall apply for specified mounting conditions. Mounting conditions may include orientation and position, as follows:

a) orientation

Orientation may be horizontal or vertical.

Unless otherwise specified, the reference orientation is horizontal.

b) position

Position may be for example edgewise or flatwise for a BT run, and/or below or on top of the BTU for a tap-off unit.

The BTS manufacturer may state different rated currents for different ambient temperatures and/or mounting conditions, where applicable, for example by means of the following formula:

$$I'_{nc} = k_{1c} k_{2c} I_{nc}$$

where

k_{1c} is a temperature factor, equal to 1 at an ambient air temperature of 35 °C;

k_{2c} is a mounting factor, equal to 1 in the reference mounting conditions.

In case of significant harmonic currents, special agreement shall be made for a reduction factor, if necessary.

5.4 Rated diversity factor (RDF)

Replacement:

For the whole BTS, unless otherwise specified, the RDF (see 3.8.11 of Part 1) shall be equal to 1, i.e. all tap-off units can be continuously and simultaneously loaded with their full rated current, within the limit of the rated current of the BT run(s) and feeder BTU(s)

NOTE 1 This is because thermal influence between tap-off units is considered negligible.

For tap-off units provided with more than one main outgoing circuit, these circuits shall be able to be continuously and simultaneously loaded at their rated current multiplied by the RDF, within the limit of the rated current of the tap-off unit. Unless otherwise specified, the RDF of such tap-off units shall be equal to the values given in Table 101.

Table 101 – Rated diversity factor for a tap-off unit

Number of main outgoing circuits	Rated diversity factor
2 and 3	0,9
4 and 5	0,8
6 to 9 inclusive	0,7
10 (and above)	0,6

The RDF is applicable with the BTS operating at rated current (I_{nA})

NOTE 2 The RDF recognizes that multiple functional units are in practice not fully loaded simultaneously or are intermittently loaded.

NOTE 3 The assumed loading of the outgoing circuits can be a steady continuous current or the thermal equivalent of a varying current.

NOTE 4 In Norway, the overload protection of conductors is not solely based on the use of diversity factors of the downstream circuits.

5.6 Other characteristics

Modification of item e):

e) stationary BTS ;

Modification of item j):

j) enclosed BTS;

Addition:

aa) ability to withstand mechanical loads, either normal or heavy (see 8.1.101);

bb) resistance to flame propagation, if applicable (see 9.101);

cc) fire resistance in building penetration, if applicable (see 9.102).

Additional subclauses:

5.101 Phase conductor and fault-loop characteristics

NOTE 1 For BTS rated below 100 A, the reactances are deemed negligible.

R and X according to Table 102 are intended to be used to calculate voltage drops (see informative Annex AA).

Table 102 – Phase conductor characteristics

Mean phase conductor characteristics at rated current I_{nc} , and rated frequency f_n Ω per-metre length	
Resistance, - at an ambient air temperature of 35 °C - at a conductor temperature of 20 °C	R R_{20}
Reactance (independent from temperature)	X
Positive-sequence and negative-sequence impedances - at an ambient air temperature of 35 °C - at a conductor temperature of 20 °C	$Z = Z_{(1)} = Z_{(2)}$ $Z_{20} = Z_{(1)20} = Z_{(2)20}$
All phase conductor characteristics may be determined according to Annex BB.	

R_{20} and X according to Table 102, and fault-loop resistances and reactances according to Table 103, i.e. the total resistances and reactances of the phase conductor(s) and return path, are intended to be used to calculate fault currents according to the method of impedances (see Table 104).

Z and Z_{20} according to Table 102, and fault-loop zero-sequence impedances according to Table 103, i.e. the total zero-sequence impedances of the phase conductor(s) and return path, are intended to be used to calculate fault currents according to the method of symmetrical components (see Table 104).

NOTE 2 Fault currents reach their lowest value for the highest impedance values; this is deemed to happen when the BTUs are operating at I_{nc} at the maximum normal ambient air temperature i.e. 35 °C, resulting in a conductor temperature of $(35 + \Delta\theta)$ °C, where $\Delta\theta$ is the mean stabilized temperature rise measured according to 10.10.

Conversely fault currents reach their highest value for the lowest impedance values; this is deemed to happen when the BTUs are not operating, resulting in a conductor temperature of 20 °C, and the circuit is closed while a short-circuit is present.

Table 103 – Fault-loop characteristics

Mean fault-loop characteristics at rated frequency f_n Ω per-metre length	Phase-to-phase	Phase-to-neutral	Phase-to-PEN	Phase-to-PE
Zero-sequence impedances - at an ambient air temperature of 35 °C - at a conductor temperature of 20 °C		$Z_{(0)bphN}$ $Z_{(0)b20phN}$	$Z_{(0)bphPEN}$ $Z_{(0)b20phPEN}$	$Z_{(0)bphPE}$ $Z_{(0)b20phPE}$
Resistances - at an ambient air temperature of 35 °C - at a conductor temperature of 20 °C	R_{bphph} $R_{b20phph}$	R_{bphN} R_{b20phN}	R_{bphPEN} $R_{b20phPEN}$	R_{bphPE} $R_{b20phPE}$
Reactances (independent from temperature)	X_{bphph}	X_{bphN}	X_{bphPEN}	X_{bphPE}
Fault-loop zero-sequence impedances may be determined according to Annex CC.				
Fault-loop resistances and impedances may be determined according to Annex DD.				

Table 104 – Characteristics to be used for fault currents calculations

Fault currents	Method of impedances	Method of symmetrical components
Maximum short-circuit current		
- 3-phase	R_{20}, X	Z_{20}
- phase-to-phase	$R_{b20phph}, X_{bphph}$	Z_{20}
- phase-to-neutral	R_{b20phN}, X_{bphN}	Z_{20} and $Z_{(0)20phN}$
Minimum short-circuit current		
- phase-to-phase	R_{bphph}, X_{bphph}	Z
- phase-to-neutral	R_{bphN}, X_{bphN}	Z and $Z_{(0)phN}$
Earth fault current (phase-to-PE(N))	$R_{bphPE(N)}, X_{bphPE(N)}$	Z and $Z_{(0)phPE(N)}$

NOTE 3 The method of symmetrical components is based on respectively summing the modulus of the fault-loop positive-, negative- and zero-sequence impedances (see IEC 60909-0). Similarly the method of impedance is based on respectively summing the modulus of the fault-loop resistances and reactances.

5.102 Electromagnetic field

The strength of the power frequency magnetic field in the vicinity of the BT run may be stated by the BTS manufacturer.

NOTE The magnetic field is a fast-decreasing function of the distance.

A method for measurement and calculation of the modulus of the magnetic field around the BTS is given in Annex EE.

6 Information

This clause of Part 1 is applicable except as follows.

6.1 ASSEMBLY designation marking

Addition after the first paragraph:

One nameplate shall be located near one end of each BTU and one on each tap-off unit.

Replacement:

d) IEC 61439-6.

7 Service conditions

This clause of Part 1 is applicable except as follows.

7.2 Special service conditions

Addition:

- aa) exposure to special mechanical loads, such as lighting apparatus, additional cables, ladder supports, etc.;
- bb) applications with high repetitive overcurrent, for example resistance welding;
- cc) installation near highly sensitive IT equipment, such as high-speed data networks, radiology apparatus, workstation monitors, etc.;