
Železniške naprave - Fiksni postroji - Visokonapetostne/nizkonapetostne predizdelane napajalne postaje v sistemih izmeničnih in enosmernih električnih vlek

Railway applications - Fixed installations - High-voltage/low-voltage prefabricated substations in AC and DC electric traction systems

Bahnanwendungen - Ortsfeste Anlagen - Fabrikfertige Stationen für Hochspannung/Niederspannung in AC und DC Bahnenergieversorgungssystemen

Applications ferroviaires - Installations fixes - Postes préfabriqués haute tension/basse tension dans AC et DC réseau de traction électrique

Ta slovenski standard je istoveten z: CLC/TS 50711:2026

ICS:

29.280	Električna vlečna oprema	Electric traction equipment
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CLC/TS 50711

May 2026

ICS 29.280

English Version

Railway applications - Fixed installations - High-voltage/low-voltage prefabricated substations in AC and DC electric traction systems

Applications ferroviaires - Installations fixes - Postes
préfabriqués haute tension/basse tension dans AC et DC
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Stationen für Hochspannung/Niederspannung in AC und
DC Bahnenergieversorgungssystemen

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European foreword

This document (CLC/TS 50711:2026) has been prepared by CLC/SC 9XC “Electric supply and earthing systems for public transport equipment and ancillary apparatus (Fixed installations)”.

CLC/TS 50711:2026 has been elaborated to set out requirements for prefabricated traction substations which include switchgear operated at traction system voltages as specified in EN 50163.

It is based on EN IEC 62271-202:2022 “High-voltage switchgear and controlgear - Part 202: High-voltage/low-voltage prefabricated traction substation” and contains detailed requirements specific for prefabricated traction substations operated in a railway environment.

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

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Introduction

A prefabricated traction substation is defined as a type-tested assembly comprising an enclosure containing AC and/or DC traction switchgears and in general also all or some of the following main components: power transformers, high-voltage and/or low-voltage switchgear, electronic power converters, electrical high-voltage and/or low-voltage interconnections. The prefabricated traction substation can include all necessary auxiliary and control equipment for its operation. The purpose being to supply traction power from a high-voltage system and/or vice versa (high-voltage/low-voltage traction substation) or distribute electric power in an electric traction system (traction switching station).

These prefabricated traction substations can be in locations accessible to the public and should ensure protection not only to authorized persons but also to general public under the specified service conditions.

Therefore, in addition to the specified characteristics, ratings and relevant test procedures, particular attention has been paid to the specification concerning the protection of persons, both operators and general public with respect to the railway environment. Use of type-tested main components and suitable design and construction of the assembly ensure this protection. The correct design and performance of the prefabricated traction substation is verified by means of relevant type tests and routine tests described in this document, including internal arc verification (if applicable).

This document needs to be read in conjunction with EN 62271-1:2017 and EN IEC 62271-202:2022.

Where a particular clause of EN IEC 62271-202:2022 is not mentioned in this document, that clause applies as far as reasonable. Where this document states "addition" or "replacement", the relevant text of EN IEC 62271-202:2022 needs to be adapted accordingly.

The numbering of clauses in EN 62271 series is not used in this European Document. For easier understanding the numbering of clauses in EN IEC 62271-202:2022 is given in square brackets.

Where terms defined in EN 62271-1:2017 and EN IEC 62271-202:2022 conflict with definitions of the same terms as given in IEC 60050-811:2017 or of the other railway application documents listed in the normative references, the definitions in EN 62271-1:2017 and EN IEC 62271-202:2022 need to be used.

NOTE 1 The suffix N which appears in this document for rated values is not present in EN 62271-1 and EN IEC 62271-202.

References in subclauses of EN 62271-1:2017 and EN IEC 62271-202:2022 need to be replaced by references to applicable subclauses in this document as far as reasonably possible. Also the term "prefabricated substation" needs to be read "prefabricated traction substation" for use in this document.

The term "switchgear and controlgear" is used in the EN 62271 series. It will be kept for the headlines even when the text of the clause or subclause addresses other kinds of main components.

NOTE 2 Expressions in single quotes indicate a technical requirement which can be available in the specific product standard under a different title.

NOTE 3 Expressions in double quotes indicate terms consisting of several words.

1 Scope

[1]

This document specifies

- the service conditions;
- rated characteristics;
- general structural requirements; and
- test methods

of prefabricated traction substations for use in AC and DC electric traction systems, which as a minimum contain an enclosure and a traction switchgear designed and manufactured according to

- EN 50123-6 in DC electric traction systems;
- CLC/TS 50152-4 in AC electric traction systems.

Traction substations using non-type tested traction switchgear are covered by EN IEC 61936-1:2021.

NOTE 1 Due to the type testing requirements on the prefabricated traction substations only type tested traction switchgear is considered.

The enclosures of the prefabricated traction substations for use in AC and DC electric traction systems are

- designed for outdoor installation at locations with or without public accessibility;
- connected by insulated cable;
- operated from inside (walk-in type) or outside (non-walk-in type).

NOTE 2 Prefabricated traction substations for railway applications are typically of the walk-in type due to the rating and resulting dimensions of the AC or DC traction switchgear.

Prefabricated traction substations can be situated at ground level or partially or completely below ground level.

In general a prefabricated traction substation comprises an enclosure, a traction switchgear and can include the following additional main components:

- power transformers;
- electronic power converters;
- high-voltage and/or low-voltage switchgear and controlgear;
- high-voltage and/or low-voltage interconnections;
- auxiliary equipment and circuits.

However, relevant provisions of this document are applicable to designs where not all these main components exist.

NOTE 3 The term “main component” is defined in 3.3.103 of EN IEC 62271-202:2022.

NOTE 4 For example, a switching station in an AC electric traction system consisting of an AC metal-enclosed traction switchgear and auxiliary circuits only.

NOTE 5 EN IEC 61936-1:2021 provides general rules for the design and erection of high-voltage power installations. As well, it specifies additional requirements for the external connections, erection and operation at the place of installation of high-voltage prefabricated traction substations compliant with EN IEC 62271-202:2022, which are regarded as a main component of such installation. Non-prefabricated traction substations, are generally covered by EN IEC 61936-1:2021.

This document covers designs using natural ventilation and/or any other kind of cooling system.

Due to the large number of different main components being addressed in this document the expression “main components shall comply with (the applicable subclause of) their specific product standard” is used in this document. This means that reference is to

- EN 50123-6:2003¹ for DC traction switchgear;
- to other parts of the EN 50123 series for switching devices also measurement, control and protection devices for DC traction applications;
- CLC/TS 50152-4:2021 for AC traction switchgear;
- other parts of the EN 50152 series for switching devices and also measurement, control and protection devices for AC traction applications;
- EN 50328:2003² for electronic power converters;
- EN 50329:2003³ for traction power transformers;
- EN IEC 61439-1:2021⁴ for low-voltage non-traction switchgear; and
- EN IEC 62271-200:2021⁵ for high-voltage non-traction switchgear.

2 Normative references

[2]

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1990 (all parts), *Eurocode - Basis of structural and geotechnical design*

EN 1991 (all parts), *Eurocode 1 - Actions on structures*

EN 1992 (all parts), *Eurocode 2 - Design of concrete structures*

EN 1993 (all parts), *Eurocode 3 - Design of steel structures*

EN 1994 (all parts), *Eurocode 4 - Design of composite steel and concrete structures*

EN 1995 (all parts), *Eurocode 5 - Design of timber structure*

EN 1996 (all parts), *Eurocode 6 - Design of masonry structures*

EN 1997 (all parts), *Eurocode 7 - Geotechnical design*

EN 1998 (all parts), *Eurocode 8 - Design of structures for earthquake resistance*

¹ As impacted by EN 50123-6:2003/A1:2014.

² As impacted by EN 50328:2003/corrigendum Dec. 2006.

³ As impacted by EN 50329:2003/corrigendum Dec. 2006 and EN 50329:2003/A1:2010.

⁴ As impacted by EN IEC 61439-1:2021/AC2022-01 and EN IEC 61439-1:2021/AC2023-11.

⁵ As impacted by EN IEC 62271-200:2021/A1:2024.

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EN 1999 (all parts), *Eurocode 9 - Design of aluminium structures*

EN 50121-5:2017,⁶ *Railway applications - Electromagnetic compatibility - Part 5: Emission and immunity of fixed power supply installations and apparatus*

EN 50122-1:2022,⁷ *Railway applications - Fixed installations - Electrical safety, earthing and the return circuit - Part 1: Protective provisions against electric shock*

EN 50123-1:2003, *Railway applications - Fixed installations - D.C. switchgear - Part 1: General*

EN 50123-6:2003,⁸ *Railway applications - Fixed installations - D.C. switchgear - Part 6: D.C. switchgear assemblies*

EN 50124-1:2017,⁹ *Railway applications - Insulation coordination - Part 1: Basic requirements - Clearances and creepage distances for all electrical and electronic equipment*

EN 50125-2:2002,¹⁰ *Railway applications - Environmental conditions for equipment - Part 2: Fixed electrical installations*

CLC/TS 50152-4:2021, *Railway applications - Fixed installations - Particular requirements for AC switchgear - Part 4: AC metal-enclosed traction switchgear*

EN 50163:2004,¹¹ *Railway applications - Supply voltages of traction systems*

EN 50329:2003,¹² *Railway applications - Fixed installations - Traction transformers*

EN 50500:2008,¹³ *Measurement procedures of magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure*

EN 50522:2022,¹⁴ *Earthing of power installations exceeding 1 kV a.c*

EN ISO 52016-1:2017, *Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 1: Calculation procedures (ISO 52016-1:2017)*

EN 60529:1991,¹⁵ *Degrees of protection provided by enclosures (IP Code)*

EN IEC 61936-1:2021, *Power installations exceeding 1 kV AC and 1,5 kV DC - Part 1: AC (IEC 61936-1:2021)*

⁶ As impacted by EN 50121-5:2017/A1:2019.

⁷ As impacted by EN 50122-1:2022/A1:2025.

⁸ As impacted by EN 50123-6:2003/A1:2014.

⁹ As impacted by EN 50124-1:2017/prA1:2024.

¹⁰ As impacted by EN 50125-2:2002/corrigendum Jun.2010.

¹¹ As impacted by EN 50163:2004/A1:2007, EN 50163:2004/corrigendum May 2010, EN 50163:2004/AC:2013, EN 50163:2004/A2:2020 and EN 50163:2004//A3:2022.

¹² As impacted by EN 50329:2003/corrigendum Dec. 20026 and EN 50329:2003/A1:2010.

¹³ As impacted by EN 50500:2008/A1:2015.

¹⁴ As impacted by EN 50522:2022/A1:2024.

¹⁵ As impacted by EN 60529:1991/corrigendum May 1993, EN 60529:1991/A1:2000, EN 60529:1991/A2:2013, EN 60529:1991/A2:2013/AC2019-02 and EN 60529:1991/AC2016-12.

EN 62271-1:2017,¹⁶ *High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear (IEC 62271-1:2017)*

EN IEC 62271-200:2021,¹⁷ *High-voltage switchgear and controlgear - Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-200:2021)*

EN IEC 62271-202:2022,¹⁸ *High-voltage switchgear and controlgear - Part 202: AC prefabricated substations for rated voltages above 1 kV and up to and including 52 kV (IEC 62271-202:2022)*

IEC/TR 62271-312:2021, *High-voltage switchgear and controlgear - Part 312: Guidance for the transferability of type tests of high-voltage/low-voltage prefabricated substations*

3 Terms and definitions

[3]

For the purposes of this document, the terms and definitions given in EN IEC 62271-202:2022 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

NOTE 1 The terms “enclosure (of a prefabricated substation)”, “compartment (of a prefabricated substation)” and “main component (of a prefabricated substation)”, definitions 3.3.101, 3.3.102 and 3.3.103 of EN IEC 62271-202:2022 are essential for the understanding of this document.

NOTE 2 The term “enclosure (of a prefabricated substation)” as defined in 3.3.101 of EN IEC 62271-202:2022 does not constitute that a prefabricated traction substation consists of a single enclosure only.

NOTE 3 In this document the terms

- assembly relates to the enclosure of the substation with the main components installed inside and
- compartment relates to a subsection of the substation enclosure.

This is different to EN IEC 62271-200:2021 where both terms are related to the switchgear and controlgear only.

3.1

nominal voltage

U_n

suitable approximate voltage value used to designate or identify a given supply system

Note 1 to entry: This value is also assigned to the voltage of a power transformer to show its usability in the supply system.

Note 2 to entry: An electric traction system that is supplied by use of auto-transformers with 2 phases, having a phase shift of 180° between them, is commonly named 2 x U_n according to the U_n supplied to the contact line system.

[SOURCE: EN 50124-1:2017, 3.4.1, modified - Notes to entry added]

¹⁶ As impacted by EN 62271-1:2017/A1:2021.

¹⁷ As impacted by EN IEC 62271-200:2021/A1:2024.

¹⁸ As impacted by EN IEC 62271-202:2022/AC:2023-09.

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3.2**AC traction switchgear**

high-voltage switchgear designed according to CLC/TS 50152-4:2021 and operated at an AC supply voltage of traction systems according to 4.1 of EN 50163:2004

3.3**DC traction switchgear**

high-voltage or low-voltage switchgear designed according to EN 50123-6:2003 and operated at a DC supply voltage of traction systems according to 4.1 of EN 50163:2004

3.4**non-traction switchgear**

high-voltage or low-voltage switchgear operated at a supply voltage other than AC or DC supply voltages of traction systems according to 4.1 of EN 50163:2004

Note 1 to entry: Non-traction switchgears are high-voltage or low-voltage switchgears used in general power supply applications e.g. low-voltage AC or DC distribution boards or high-voltage switchgear and controlgear providing a three-phase AC supply to power transformer rectifiers.

Note 2 to entry: This term is defined to easily distinguish AC from DC traction switchgear in this document.

3.5**converter**

<electronic power> operative unit for electronic power conversion, comprising one or more electronic valve devices, power transformers and filters if necessary and auxiliaries if any

Note 1 to entry, In English, the two spellings “convertor” and “converter” are in use, and both are correct. In this document, the spelling “converter” is used in order to avoid duplications.

[SOURCE: IEC 60050-551:1998 551-12-01, modified - the term with the spelling convertor has been removed and “transformers” has been replaced with “power transformers”]

3.6**structure**

<mechanical> building or other object constructed to form a rigid support and/or to house several other objects

Note 1 to entry: E.g. supporting structure, enclosure or similar.

3.7**traction substation****substation**

<electric traction> substation the main function of which is to supply an electric traction system and which includes a traction switchgear as a minimum

Note 1 to entry: The synonym substation is used only when the context is clear.

Note 2 to entry: It includes equipment for protection and switching-off.

[SOURCE: IEC 60050-811:2017, 811-36-02, modified - “and which includes a traction switchgear as a minimum” added to the definition, –Note 2 to entry added]

3.8**prefabricated**

practice of assembling all the main components on or into a structure in a factory or other manufacturing sites including all power, control and auxiliary interconnections also testing of the assemblies which are then transported as a complete unit or in sub-assemblies to the construction site where the structure is to be located

Note 1 to entry: The place of final use is a construction site and not seen as factory or manufacturing site.

Note 2 to entry: All power, control and auxiliary interconnections include that all internal connections are present and established. All external interfaces are prepared ready for connection.

Note 3 to entry: Subassemblies are only separated for transport and reconnected on site at predefined and fully prepared interfaces. Subassemblies are a means to cope with transport restrictions.

3.9

prefabricated traction substation

[3.2.101]

traction substation which is prefabricated and comprising an enclosure containing as a minimum an AC traction switchgear or a DC traction switchgear

Note 1 to entry: Prefabricated enclosures themselves are not to be considered as prefabricated traction substations if transported to the site of use without main components.

3.10

prefabricated AC traction substation

prefabricated traction substation containing an AC traction switchgear and in general complemented by high-voltage and low-voltage interconnections as well as auxiliary equipment and circuits

3.11

prefabricated DC traction substation

prefabricated traction substation containing a DC traction switchgear and in general complemented by power transformers, electronic power converters, high-voltage switchgear and controlgear, high-voltage and low-voltage interconnections, auxiliary equipment and circuits

3.12

prefabricated switching station

prefabricated traction substation containing a traction switchgear and other main components except power transformers and electronic power converters

3.13

standard size compartment

compartment of a prefabricated traction substation having a total internal volume of 15 m³ or higher and a total internal volume excluding the main components of 10 m³ or higher

4 Normal and special service conditions

[4]

4.1 Normal service conditions

[4.1]

Subclause 4.1 of EN IEC 62271-202:2022 is applicable, except as follows:

- main components shall comply with the requirements for 'normal service conditions' of the specific product standard.

NOTE 1 The altitude reference condition is 1 000 m as per EN 62271-1:2017. The altitude reference of EN 50124-1:2017 (up to 2 000 m) applies to insulation coordination only and is not considered as reference condition in this document.

Subclause 4.1.3 of EN 62271-1:2017 does not apply.

NOTE 2 Subclause 4.1.3 of EN 62271-1:2017 addresses service conditions for outdoor electrical equipment.

4.2 Special service conditions

[4.2]

Subclause 4.2 of EN IEC 62271-202:2022 is replaced by the following:

For special service conditions, agreement shall be made between purchaser and supplier. EN 50125-2:2002 shall be taken as guidance for the selection of appropriate classifications.

5 Ratings

[5]

5.1 General

[5.1]

Subclause 5.1 of EN IEC 62271-202:2022 is replaced by the following: