

High-voltage/ low-voltage prefabricated substations

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ICS 29.240.10

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National foreword

This British Standard has been prepared by Subcommittee PEL/17/1 and is the English language version of EN 61330:1996 *High-voltage/low-voltage prefabricated substations*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1330:1995 published by the International Electrotechnical Commission IEC.

Cross-references

Publication referred to	Corresponding British Standard
	BS 4727 <i>Glossary of electrotechnical power, telecommunication, electronics, lighting and colour terms</i>
IEC 50(151) 1978	Part 1 <i>Terms common to power, telecommunications and electronics</i> Group 02:1980 <i>Electrical and magnetic devices terminology</i>
IEC 50(441) 1984	Part 2 <i>Terms particular to power engineering</i> Group 06:1985 <i>Switchgear and controlgear terminology (including fuse terminology)</i> BS 923 <i>Guide on high-voltage testing techniques</i>
HD 5881.1 S1:1991 (IEC 60-1:1989)	Part 1:1990 <i>General</i> BS EN 60068 <i>Environmental testing</i> BS EN 60068-2 <i>Test methods</i>
EN 60068-2-62:1995 (IEC 68-2-62:1991)	BS EN 60068-2-62:1996 <i>Test Ef. Impact, pendulum hammer</i> BS 5622 <i>Guide for insulation co-ordination</i>
HD 540.2 S1:1991 (IEC 71-2:1976)	Part 2:1979 <i>Application guide</i> BS 171 <i>Power transformers</i>
IEC 76-1:1976 ^a	Part 1:1978 <i>General</i>
IEC 76-2:1976 ^b	Part 2:1978 <i>Specification for temperature rise requirements</i>
HD 398.5 S1:1983 (IEC 76-5:1976)	Part 5:1978 <i>Specification for ability to withstand short circuit</i> BS 2918 <i>Methods of test for electric strength of solid insulating materials</i>
HD 559.1 S1:1991 (IEC 243-1)	Part 1:1994 <i>Tests at power frequencies</i>
IEC 354:1991	BS 7735:1994 <i>Guide to loading of oil-immersed power transformers</i> BS EN 60439 <i>Specification for low-voltage switchgear and controlgear assemblies</i>
EN 60439-1:1994 (IEC 439-1:1992)	BS EN 60439-1:1994 <i>Specification for type-tested and partially type-tested assemblies</i>
EN 60529:1991 (IEC 529:1989)	BS EN 60529:1992 <i>Specification for degrees of protection provided by enclosures (IP code)</i>
EN 60551:1992 (IEC 551:1987)	BS EN 60551:1993 <i>Determination of transformer and reactor sound levels</i> BS EN 60947 <i>Specification for low-voltage switchgear and controlgear</i>
EN 60947-1:1991 (IEC 947-1:1988)	BS EN 60947-1:1992 <i>General rules</i> BS EN 61180 <i>High-voltage test techniques for low-voltage equipment</i>

Publication referred to	Corresponding British Standard
EN 61180-1:1994 (IEC 1180-1:1992)	BS EN 61180-1:1991 <i>Definitions, test and procedure requirements</i>
ISO 1210:1992	BS 2782 <i>Methods of testing plastics</i> Part 1 <i>Thermal properties</i> Method 140A:1992 <i>Determination of the burning behaviour of horizontal and vertical specimens in contact with a small flame ignition source</i>

^a Harmonized as HD 398.1 S1:1980.

^b Harmonized as HD 398.2 S1:1980.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, the EN title page, pages 2 to 34, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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Descriptors: High-voltage, preabricated substations, earthing, auxiliary equipment

English version

High-voltage/low-voltage prefabricated substations

(IEC 1330:1995)

Postes préfabriqués haute tension/basse
tension
(CEI 1330:1995)

Fabrikfertige Stationen für
Hochspannung/Niederspannung
(IEC 1330:1995)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

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Foreword

The text of document 17C/168 + 168A/FDIS, future edition 1 of IEC 1330, prepared by SC 17C, High-voltage enclosed switchgear and controlgear, of IEC TC 17, Switchgear and controlgear, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61330 on 1995-11-28.

The following dates were fixed:

- latest date by which the EN has to implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-09-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1996-09-01

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given for information only. In this standard, Annex A, Annex B, Annex C and Annex ZA are normative and Annex D is informative. Annex ZA has been added by CENELEC.

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Introduction

Prefabricated substations are defined as type-tested equipment comprising transformer, low-voltage and high-voltage switchgear, connections and auxiliary equipment in an enclosure to supply low-voltage energy from a high-voltage system. These substations are in locations accessible to the public and should ensure safety for persons according to the specified service conditions.

This means that in addition to specified characteristics, ratings and relevant test procedures, particular attention has been paid to specifications concerning the protection of persons. This protection is ensured by use of type-tested components and suitable design and construction of the enclosure.

1 General

1.1 Scope

This International Standard specifies the service conditions, rated characteristics, general structural requirements and test methods of prefabricated substations, which are cable connected, to be operated from inside or outside for alternating current of primary rated voltages above 1 kV and up to and including 52 kV¹⁾, and for a transformer of maximum power 1 600 kVA, for service frequencies up to and including 60 Hz for outdoor installation in locations with public accessibility.

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

As no basic generally accepted IEC or ISO standards are available concerning ageing or corrosion, requirements covering these aspects are not included in this standard.

1.2 Normative references

The following normative documents contain provisions which, through reference in the text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(151):1978, *International Electrotechnical Vocabulary (IEV) — Chapter 151: Electrical and magnetic devices*.

IEC 50 (441):1984, *International Electrotechnical Vocabulary (IEV) — Chapter 441: Switchgear, controlgear and fuses*.

IEC 60-1:1989, *High-voltage test techniques — Part 1: General definitions and test requirements*.

IEC 68-2-62:1991, *Environmental testing — Part 2: Tests — Test Ef: Impact, pendulum hammer Amendment 1 (1993)*.

IEC 71-2:1976, *Insulation co-ordination — Part 2: Application guide*.

IEC 76, *Power transformers*.

IEC 76-1:1993, *Power transformers — Part 1: General*.

IEC 76-2:1993, *Power transformers — Part 2: Temperature rise*.

IEC 76-5:1976, *Power transformers — Part 5: Ability to withstand short circuit*.

IEC 243-1:1988, *Methods of test for electric strength of solid insulating materials — Part 1: Tests at power frequencies*.

IEC 298:1990, *AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*.

IEC 354:1991, *Loading guide for oil-immersed power transformers*.

IEC 364-4-41:1992, *Electrical installations of buildings — Part 4: Protection for safety — Chapter 41: Protection against electric shock*.

IEC 439-1:1992, *Low-voltage switchgear and controlgear assemblies — Part 1: Type-tested and partially type-tested assemblies*.

IEC 466:1987, *AC insulation-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 38 kV*.

IEC 529:1989, *Degrees of protection provided by enclosures (IP Code)*.

IEC 551:1987, *Determination of transformer and reactor sound levels*.

IEC 664-1:1992, *Insulation co-ordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*.

IEC 694:1980, *Common clauses for high-voltage switchgear and controlgear standards*.

IEC 726:1982, *Dry-type power transformers*.

IEC 905:1987, *Loading guide for dry-type power transformers*.

IEC 947-1:1988, *Low-voltage switchgear and controlgear — Part 1: General rules*.

¹⁾ The rated voltage on the secondary side should not exceed 1 kV.

IEC 1180-1:1992, *High-voltage test techniques for low-voltage equipment — Part 1: Definitions, test and procedure requirements*.

ISO 1052:1982, *Steels for general engineering purposes*.

ISO 1210:1992, *Plastics — Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source*.

1.3 Definitions

For the purpose of this International Standard, the following definitions apply. For the definitions of general terms used in this International Standard, reference is made to IEC 50(441).

1.3.1 prefabricated substation

prefabricated and type-tested assembly comprising components described in 1.1 and clause 3 of this standard

1.3.2 transport unit

part of a prefabricated substation suitable for shipment without being dismantled

1.3.3 enclosure

part of a prefabricated substation providing protection against external influences to the substation and a specified degree of protection against approach to or contact with live parts and against contact with moving parts

1.3.4 compartment

part of a prefabricated substation enclosed except for openings necessary for interconnection, control or ventilation

NOTE A compartment may be designated by the main component contained therein, e.g. transformer, high-voltage switchgear and controlgear, low-voltage switchgear and controlgear respectively.

1.3.5 component

essential part of the prefabricated substation which serves a specific function (e.g. transformer, high-voltage switchgear and controlgear, low-voltage switchgear and controlgear, etc.)

1.3.6 partition

part of a prefabricated substation separating one compartment from other compartments

1.3.7 main circuit

all conductive parts of a prefabricated substation included in a circuit intended to transmit electrical energy

1.3.8 auxiliary circuit

all conductive parts of a prefabricated substation included in a circuit (other than the main circuit) intended to control, measure, signal, regulate, illuminate, etc

1.3.9 rated value

quantity value assigned, generally by the manufacturer, for a specified operating condition of a prefabricated substation [IEV 151-04-03, modified]

1.3.10 degree of protection

extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods

1.3.11 ambient air temperature

temperature, determined under prescribed conditions, of the air surrounding the enclosure of the prefabricated substation

1.3.12 class of enclosure

difference of temperature rise between the transformer in the enclosure and the same transformer outside the enclosure at normal service conditions as defined in 2.1 of this standard. The transformer rated values (power and losses) correspond to the maximum rated values of the prefabricated substation

1.3.13 transformer load factor

the per unit value of constant current that can be taken from the transformer at constant rated voltage. The basis for the load factor value is not to exceed the maximum hot spot temperature and top fluid temperature as given in IEC 76 or the maximum hot spot temperature of the insulation class used as given in IEC 726

2 Service conditions

2.1 Normal service conditions

2.1.1 Enclosure

Unless otherwise specified in this standard, the enclosure of the prefabricated substation is designed to be used under normal outdoor service conditions according to IEC 694.

NOTE The ambient temperature inside the enclosure of the prefabricated substation will be different from the ambient temperature outside the enclosure of the prefabricated substation.

2.1.2 High-voltage switchgear and controlgear

Inside the enclosure it can be assumed that normal indoor service conditions prevail according to IEC 694.

2.1.3 Low-voltage switchgear and controlgear

Inside the enclosure it can be assumed that normal indoor service conditions prevail according to IEC 439-1.

2.1.4 Transformer

A transformer loaded with rated normal current inside an enclosure has a temperature rise which is higher than in normal conditions and the temperature limits as defined in IEC 76-2 or IEC 726 can be exceeded.

The service conditions of the transformer will be determined according to the local outside service conditions and the class of the enclosure.

The results will enable the transformer manufacturer or user to calculate its possible derating.

2.2 Special service conditions

When a prefabricated substation is used under conditions different from the normal service conditions given in 2.1, the following applies.

2.2.1 Altitude

Precaution should be taken for the following equipment.

2.2.1.1 High-voltage switchgear and controlgear

For installation at an altitude higher than 1 000 m, refer to IEC 694.

2.2.1.2 Low-voltage switchgear and controlgear

For installation at an altitude higher than 2 000 m, refer to IEC 439-1.

2.2.1.3 Transformer

For installation at an altitude higher than 1 000 m, refer to IEC 76-2 or IEC 726.

2.2.2 Pollution

For installation in polluted ambient air, the degree of pollution should be specified according to the relevant standards for the following equipment:

2.2.2.1 High-voltage switchgear and controlgear

Refer to IEC 694.

2.2.2.2 Low-voltage switchgear and controlgear

Refer to IEC 664-1.

2.2.2.3 Transformer

No standard is available.

2.2.3 Temperature

For a prefabricated substation situated where the ambient temperature can be significantly outside the normal service condition range for the enclosure stated in 2.1, the preferred ranges of temperature to be specified should be:

- 50 °C and + 40 °C for very cold climates.
- 5 °C and + 50 °C for very hot climates.

3 Requirements for components

The main components of a prefabricated substation are transformer, high-voltage switchgear and controlgear, low-voltage switchgear and controlgear, corresponding interconnections (cable, busbar or other) and auxiliary equipment.

The components shall be enclosed, by either a common enclosure or by an assembly of enclosures.

All the components shall comply with their relevant IEC standards:

- transformers according to IEC 76-1 or IEC 726;
- high-voltage switchgear and controlgear according to IEC 298 or IEC 466;
- low-voltage switchgear and controlgear according to IEC 947-1 and IEC 439-1.

4 Ratings

The ratings of a prefabricated substation are the following:

- a) rated voltages;
- b) rated insulation levels;
- c) rated frequency and number of phases;
- d) rated normal currents for main circuits;
- e) rated short-time withstand currents for main and earthing circuits;
- f) rated peak withstand currents, if applicable, for main and earthing circuits;