

STN	Vysokonapäťové spínacie a riadiace zariadenia Časť 202 Prefabrikované rozvodne striedavého prúdu pre menovité napätie od 1 kV do 52 kV (vrátane)	STN EN IEC 62271-202 35 4220
------------	---	--

High-voltage switchgear and controlgear - Part 202: AC prefabricated substations for rated voltages above 1 kV and up to and including 52 kV

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 11/22

Obsahuje: EN IEC 62271-202:2022, IEC 62271-202:2022

Oznámením tejto normy sa od 27.07.2025 ruší
STN EN 62271-202 (35 4220) z januára 2017

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 62271-202

August 2022

ICS 29.130.10

Supersedes EN 62271-202:2014; EN 62271-202:2014/AC:2014; EN 62271-202:2014/AC:2015

English Version

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)

Appareillage à haute tension - Partie 202: Postes préfabriqués pour courant alternatif de tensions assignées supérieures à 1 kV et inférieures ou égales à 52 kV (IEC 62271-202:2022)

Hochspannungs-Schaltgeräte und -Schaltanlagen - Teil 202: Fabrikfertige Wechselstrom-Stationen für Bemessungsspannungen über 1 kV bis einschließlich 52 kV (IEC 62271-202:2022)

This European Standard was approved by CENELEC on 2022-07-27. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN IEC 62271-202:2022 (E)**European foreword**

The text of document 17C/843/FDIS, future edition 3 of IEC 62271-202, prepared by SC 17C "Assemblies" of IEC/TC 17 "High-voltage switchgear and controlgear" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62271-202:2022.

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) 2023-04-27
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-07-27

This document supersedes EN 62271-202:2014 and all of its amendments and corrigenda (if any).

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.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62271-202:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61936-1:2021	NOTE	Harmonized as EN IEC 61936-1:2021 (not modified)
IEC 60059:1999	NOTE	Harmonized as EN 60059:1999 (not modified)
IEC 60076 (series)	NOTE	Harmonized as EN 60076 (series)
IEC 62271-4:2013	NOTE	Harmonized as EN 62271-4:2013 (not modified)
IEC 60364-4-41:2005	NOTE	Harmonized as HD 60364-4-41:2017 + A11:2017
IEC 60721-3-2:2018	NOTE	Harmonized as EN IEC 60721-3-2:2018 (not modified)
IEC 60068 (series)	NOTE	Harmonized as EN 60068 (series)
IEC/TR 62271-208:2009	NOTE	Harmonized as CLC/TR 62271-208:2010 (not modified)
IEC 60243-1:2013	NOTE	Harmonized as EN 60243-1:2013 (not modified)
ISO 9223	NOTE	Harmonized as EN ISO 9223

EN IEC 62271-202:2022 (E)

ISO 9224	NOTE	Harmonized as EN ISO 9224
IEC 60721-2-6:1990	NOTE	Harmonized as HD 478.2.6 S1:1993 (not modified)
IEC/IEEE 82079-1:2019	NOTE	Harmonized as EN IEC/IEEE 82079-1:2020 (not modified)
ISO 13732-1:2006	NOTE	Harmonized as EN ISO 13732-1:2008 (not modified)
IEC 62430:2019	NOTE	Harmonized as EN IEC 62430:2019 (not modified)
ISO 1460	NOTE	Harmonized as EN ISO 1460
ISO 1461	NOTE	Harmonized as EN ISO 1461
ISO 2081	NOTE	Harmonized as EN ISO 2081
ISO 2409	NOTE	Harmonized as EN ISO 2409
ISO 9227	NOTE	Harmonized as EN ISO 9227
ISO 11997 (series)	NOTE	Harmonized as EN ISO 11997 (series)
ISO 7784 (series)	NOTE	Harmonized as EN ISO 7784 (series)
ISO 12944 (series)	NOTE	Harmonized as EN ISO 12944 (series)
IEC 60865-1:2011	NOTE	Harmonized as EN 60865-1:2012 (not modified)
IEC 60076-3	NOTE	Harmonized as EN 60076-3
IEC 61869 (series)	NOTE	Harmonized as EN IEC 61869 (series)

EN IEC 62271-202:2022 (E)**Annex ZA**
(normative)**Normative references to international publications
with their corresponding European publications**

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-441	-	International Electrotechnical Vocabulary. Switchgear, controlgear and fuses	-	-
IEC 60050-461	2008	International Electrotechnical Vocabulary - Part 461: Electric cables	-	-
IEC 60068-2-5	2018	Environmental testing - Part 2-5: Tests - Test S: Simulated solar radiation at ground level and guidance for solar radiation testing and weathering	EN IEC 60068-2-5	2018
IEC 60071-1	2019	Insulation co-ordination - Part 1: Definitions, principles and rules	EN IEC 60071-1	2019
IEC 60076-1	2011	Power transformers - Part 1: General	EN 60076-1	2011
IEC 60076-2	2011	Power transformers - Part 2: Temperature rise for liquid-immersed transformers	EN 60076-2	2011
IEC 60076-5	2006	Power transformers - Part 5: Ability to withstand short circuit	EN 60076-5	2006
IEC 60076-7	2018	Power transformers - Part 7: Loading guide for mineral-oil-immersed power transformers	-	-
IEC 60076-10	2016	Power transformers - Part 10: Determination of sound levels	EN 60076-10	2016
IEC 60076-11	2018	Power transformers - Part 11: Dry-type transformers	EN IEC 60076-11	2018
IEC 60076-12	2008	Power transformers - Part 12: Loading guide for dry-type power transformers	-	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
-	-		+ corrigendum May	1993
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013

EN IEC 62271-202:2022 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60664-1	2020	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	2020
IEC 60721-1	1990	Classification of environmental conditions - Part 1: Environmental parameters and their severities	EN 60721-1	1995
+ A1	1992		-	-
+ A2	1995		+ A2	1995
IEC 60721-2-2	2012	Classification of environmental conditions - Part 2-2: Environmental conditions appearing in nature - Precipitation and wind	EN 60721-2-2	2013
IEC 60721-2-4	2018	Classification of environmental conditions - Part 2-4: Environmental conditions appearing in nature - Solar radiation and temperature	EN IEC 60721-2-4	2018
-	-		+ AC	2018-12
IEC 60721-3-4	-	Classification of environmental conditions - Part 3-4: Classification of groups of environmental parameters and their severities - Stationary use at non-weatherprotected locations	EN IEC 60721-3-4	-
IEC/TS 60815-1	2008	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles	-	-
IEC 60947-1	-	Low-voltage switchgear and controlgear - Part 1: General rules	EN IEC 60947-1	-
IEC 61180-1	1992 ¹	High-voltage test techniques for low-voltage equipment -- Part 1: Definitions, test and procedure requirements	-	-
IEC 61439	series	Low-voltage switchgear and controlgear assemblies	EN IEC 61439	series
IEC 61439-1	2020	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN IEC 61439-1	2021
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	2002
IEC 62271-1	2017	High-voltage switchgear and controlgear - Part 1: Common specifications for alternating current switchgear and controlgear	EN 62271-1	2017
IEC 62271-200	2021	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	EN IEC 62271-200	2021

¹ This publication has been partially replaced with IEC 61180:2016.

EN IEC 62271-202:2022 (E)

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 62271-201	2014	High-voltage switchgear and controlgear - Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV	EN 62271-201	2014
IEC 62271-212	2016	High-voltage switchgear and controlgear - Part 212: Compact Equipment Assembly for Distribution Substation (CEADS)	EN 62271-212	2017
ISO 1182	2010	Reaction to fire tests for products - Non-combustibility tests	-	-
ISO 1716	2018	Reaction to fire tests for products - Determination of the gross heat of combustion (calorific value)	EN ISO 1716	2018
ISO 6508-1	2016	Metallic materials - Rockwell hardness test - Part 1: Test method	EN ISO 6508-1	2016
-	-	Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels	EN 10025-2	2019



IEC 62271-202

Edition 3.0 2022-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**High-voltage switchgear and controlgear –
Part 202: AC prefabricated substations for rated voltages above 1 kV and up to
and including 52 kV**

**Appareillage à haute tension –
Partie 202: Postes préfabriqués pour courant alternatif de tensions assignées
supérieures à 1 kV et inférieures ou égales à 52 kV**

**THIS PUBLICATION IS COPYRIGHT PROTECTED****Copyright © 2022 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 62271-202

Edition 3.0 2022-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**High-voltage switchgear and controlgear –
Part 202: AC prefabricated substations for rated voltages above 1 kV and up to
and including 52 kV**

**Appareillage à haute tension –
Partie 202 : Postes préfabriqués pour courant alternatif de tensions assignées
supérieures à 1 kV et inférieures ou égales à 52 kV**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.130.10

ISBN 978-2-8322-1609-5

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	9
INTRODUCTION.....	11
1 Scope.....	12
2 Normative references	13
3 Terms and definitions	15
3.1 General terms and definitions	15
3.2 Assemblies of switchgear and controlgear	15
3.3 Parts of assemblies	15
3.4 Switching devices	16
3.5 Parts of switchgear and controlgear	17
3.6 Operational characteristics of switchgear and controlgear.....	17
3.7 Characteristic quantities	18
3.8 Index of definitions.....	18
4 Normal and special service conditions	18
4.1 Normal service conditions	18
4.1.1 General	18
4.1.2 Indoor switchgear and controlgear	19
4.1.3 Outdoor switchgear and controlgear	19
4.1.101 Low-voltage switchgear and controlgear	19
4.1.102 Power transformer	19
4.2 Special service conditions.....	20
4.2.1 General	20
4.2.2 Altitude	20
4.2.3 Exposure to pollution	20
4.2.4 Temperature and humidity	21
4.2.5 Exposure to abnormal vibrations, shock or tilting	21
4.2.6 Wind speed	21
4.2.7 Other parameters	21
5 Ratings.....	21
5.1 General.....	21
5.2 Rated voltage (U_r)	22
5.3 Rated insulation level (U_d , U_p , U_S)	22
5.4 Rated frequency (f_r).....	23
5.5 Rated continuous current (I_r).....	23
5.6 Rated short-time withstand current (I_k)	23
5.6.101 Rated short-time withstand current of high-voltage switchgear and controlgear and high-voltage interconnection (I_k)	23
5.6.102 Rated short-time phase to earth withstand current (I_{ke}).....	24
5.6.103 Rated short-time withstand currents of low-voltage switchgear and controlgear and low-voltage interconnection (I_{CW})	24
5.7 Rated peak withstand current (I_p)	24
5.7.101 Rated peak phase to earth withstand current (I_{pe}).....	24
5.7.102 Rated peak withstand currents of low-voltage switchgear and controlgear and low-voltage interconnection (I_{pk}).....	24
5.8 Rated duration of short-circuit (t_k).....	24

5.8.101	Rated duration of short-circuit (t_k)	25
5.8.102	Rated duration of phase to earth short-circuit (t_{ke})	25
5.8.103	Rated duration of short-circuits for low-voltage switchgear and controlgear and low-voltage interconnection	25
5.8.104	Rated duration of short-circuits for power transformers	25
5.9	Rated supply voltage of auxiliary and control circuits (U_a)	25
5.10	Rated supply frequency of auxiliary and control circuits	25
5.11	Rated pressure of compressed gas supply for controlled pressure systems	25
5.101	Rated power of prefabricated substation and class of enclosure	25
5.101.1	Rated power of the prefabricated substation	25
5.101.2	Rated class of enclosure	26
5.102	Ratings of the internal arc classification (IAC)	26
5.102.1	General	26
5.102.2	Types of accessibility (A, B, AB)	26
5.102.3	Rated arc fault currents (I_A , I_{Ae})	27
5.102.4	Rated arc fault duration (t_A , t_{Ae})	27
6	Design and construction	27
6.1	Requirements for liquids in switchgear and controlgear	28
6.2	Requirements for gases in switchgear and controlgear	28
6.3	Earthing of switchgear and controlgear	28
6.4	Auxiliary and control equipment and circuits	29
6.4.1	General	29
6.4.2	Protection against electric shock	29
6.4.3	Components installed in enclosures	30
6.5	Dependent power operation	30
6.6	Stored energy operation	30
6.7	Independent unlatched operation (independent manual or power operation)	31
6.8	Manually operated actuators	31
6.9	Operation of releases	31
6.10	Pressure/level indication	31
6.11	Nameplates	31
6.12	Locking devices	31
6.13	Position indication	31
6.14	Degrees of protection provided by enclosures	31
6.15	Creepage distances for outdoor insulators	32
6.16	Gas and vacuum tightness	32
6.17	Tightness for liquid systems	32
6.18	Fire hazard (flammability)	32
6.19	Electromagnetic compatibility (EMC)	32
6.20	X-ray emission	32
6.21	Corrosion	32
6.22	Filling levels for insulation, switching and/or operation	32
6.101	Protection of the prefabricated substation against mechanical stress	33
6.102	Protection of the environment due to internal defects	33
6.103	Internal arc fault	34
6.104	Enclosure	34
6.104.1	General	34
6.104.2	Fire behaviour	35

6.104.3	Environmental considerations	36
6.104.4	Covers and doors	36
6.104.5	Ventilation openings	37
6.104.6	Partitions	37
6.105	Other provisions.....	37
6.105.1	Provisions for dielectric tests on cables	37
6.105.2	Accessories	37
6.105.3	Operation aisle	38
6.105.4	Labels	38
6.105.5	Provisions for on-site assembly of prefabricated substation	38
6.106	Sound emission	38
6.107	Electromagnetic fields.....	38
6.108	Solar radiation	38
7	Type tests	39
7.1	General.....	39
7.1.1	Basics	39
7.1.2	Information for identification of test objects.....	40
7.1.3	Information to be included in type-test reports	40
7.2	Dielectric tests	40
7.2.1	General	40
7.2.2	Ambient air conditions during tests	41
7.2.3	Wet test procedure	41
7.2.4	Arrangement of the equipment.....	41
7.2.5	Criteria to pass the test	41
7.2.6	Application of the test voltage and test conditions.....	41
7.2.7	Tests of switchgear and controlgear of $U_r \leq 245$ kV	41
7.2.8	Tests of switchgear and controlgear of $U_r > 245$ kV	41
7.2.9	Artificial pollution tests for outdoor insulators.....	41
7.2.10	Partial discharge tests	41
7.2.11	Dielectric tests on auxiliary and control circuits.....	41
7.2.12	Voltage test as condition check	42
7.2.101	Tests on the high-voltage components.....	42
7.2.102	Tests on low-voltage interconnection	43
7.3	Radio interference voltage (RIV) test	44
7.4	Resistance measurement.....	44
7.4.1	Measurement of the resistance of auxiliary contacts class 1 and class 2.....	44
7.4.2	Measurement of the resistance of auxiliary contacts class 3	44
7.4.3	Electrical continuity of earthed metallic parts test	44
7.4.4	Resistance measurement of contacts and connections in the main circuit as a condition check.....	45
7.5	Continuous current tests	45
7.5.101	General	45
7.5.102	Test conditions	46
7.5.103	Test methods.....	47
7.5.104	Measurements.....	51
7.5.105	Acceptance criteria	53
7.5.106	Continuous current test under solar radiation.....	54
7.6	Short-time withstand current and peak withstand current tests	54
7.7	Verification of the protection	55

7.8	Tightness tests	55
7.9	Electromagnetic compatibility tests (EMC)	55
7.10	Additional tests on auxiliary and control circuits	55
7.10.1	General	55
7.10.2	Functional tests	55
7.10.3	Verification of the operational characteristics of auxiliary contacts	56
7.10.4	Environmental tests	56
7.10.5	Dielectric test	56
7.11	X-radiation test for vacuum interrupters	56
7.101	Calculations and mechanical tests	56
7.101.1	Wind pressure	56
7.101.2	Roof loads	56
7.101.3	Mechanical impacts	56
7.101.4	Handling	56
7.102	Internal arc test.....	57
7.102.1	General	57
7.102.2	Test conditions	57
7.102.3	Arrangement of the equipment.....	58
7.102.4	Test procedure	58
7.102.5	Criteria to pass the test	58
7.102.6	Test report.....	60
7.102.7	Transferability of tests results.....	60
7.103	Measurement or calculation of electromagnetic fields	61
8	Routine tests	61
8.1	General.....	61
8.2	Dielectric test on the main circuit	61
8.3	Test on auxiliary and control circuits	61
8.3.1	Inspection of auxiliary and control circuits, and verification of conformity to the circuit diagrams and wiring diagrams	61
8.3.2	Functional tests	61
8.3.3	Verification of protection against electric shock	61
8.3.4	Dielectric tests.....	62
8.4	Measurement of the resistance of the main circuit.....	62
8.5	Tightness test	62
8.6	Design and visual checks.....	62
8.101	Other functional tests.....	62
8.102	Tests after assembly on site	62
9	Guide to the selection of switchgear and controlgear (informative)	62
9.101	General.....	62
9.102	Selection of rated values.....	63
9.103	Selection of class of enclosure.....	63
9.104	Internal arc fault.....	64
9.104.1	General	64
9.104.2	Causes and preventive measures	64
9.104.3	Supplementary protective measures	64
9.104.4	Considerations for the selection and installation	66
9.104.5	IAC classification	66
9.105	Summary of technical requirements and ratings	67
10	Information to be given with enquiries, tenders and orders (informative).....	73

10.1	General.....	73
10.2	Information with enquiries and orders	73
10.3	Information with tenders.....	74
11	Transport, storage, installation, operating instructions and maintenance.....	74
11.1	General.....	74
11.2	Conditions during transport, storage and installation	75
11.3	Installation	75
11.3.1	General	75
11.3.2	Unpacking and lifting	75
11.3.3	Assembly.....	75
11.3.4	Mounting	75
11.3.5	Connections	76
11.3.6	Information about gas and gas mixtures for controlled and closed pressure systems	76
11.3.7	Final installation inspection.....	76
11.3.8	Basic input data by the user	76
11.3.9	Basic input data by the manufacturer	76
11.4	Operating instructions	76
11.5	Maintenance	76
12	Safety.....	77
12.101	General.....	77
12.102	Electrical aspects.....	77
12.103	Mechanical aspects	77
12.104	Thermal aspects	77
12.105	Internal arc aspects	77
13	Influence of the product on the environment	77
Annex A (normative) Internal arc fault – Method to verify the internal arc classification (IAC).....		78
A.1	General.....	78
A.2	Room simulation	78
A.3	Indicators (for assessing the thermal effects of the gases).....	78
A.3.1	General	78
A.3.2	Arrangement of indicators.....	80
A.4	Tolerances for geometrical dimensions of test arrangements	86
A.5	Test parameters.....	86
A.6	Test procedure.....	87
Annex B (normative) Test to verify the sound level of a high-voltage/low-voltage transformer prefabricated substation.....		92
B.1	Purpose	92
B.2	Test object.....	92
B.3	Test method.....	92
B.4	Measurements	92
B.5	Presentation and calculation of the results	92
Annex C (normative) Mechanical impact test.....		94
C.1	Test for the verification of the resistance to mechanical impact.....	94
C.2	Apparatus for the verification of the protection against mechanical damage	94
Annex D (informative) Rating of power transformers in an enclosure.....		96
D.1	General.....	96
D.2	Mineral-oil-immersed power transformer	96

D.3	Dry-type power transformer.....	97
D.4	Example.....	101
Annex E (informative)	Examples of earthing arrangements	104
Annex F (informative)	Characteristics of enclosure materials	107
F.1	Metals.....	107
F.1.1	Coatings	107
F.1.2	Paints	107
F.2	Concrete	107
Annex G (informative)	Evaluation of the impact of solar radiation – Simulated solar radiation continuous current test.....	109
G.1	General.....	109
G.2	Test method.....	109
G.2.1	General	109
G.2.2	Test parameters, equipment and preparation.....	109
G.2.3	Test procedure and application of test currents.....	111
G.2.4	Measurements	111
G.3	Evaluation of the solar radiation effects	112
G.3.1	Evaluation of solar radiation effects on the temperature rise of power transformer.....	112
G.3.2	Evaluation of solar radiation effects on the temperature rise of components other than the power transformer	112
G.4	Application considerations	112
Annex H (informative)	Installation conditions of electronic equipment	114
H.1	General.....	114
H.2	Accessibility.....	114
H.3	Application of air temperature measurements inside the prefabricated substation	115
Bibliography	116
Figure 1	– Measurement of power transformer temperature rise in ambient air: Δt_1	46
Figure 2	– Measurement of power transformer temperature rise in an enclosure: Δt_2	46
Figure 3	– Diagram of the preferred continuous current test method	48
Figure 4	– Diagram of the continuous current test alternative method	49
Figure 5	– Diagram for open-circuit test	50
Figure 6	– Example of air temperature measurement locations inside a non-walk-in type prefabricated substation	53
Figure A.1	– Mounting frame for vertical indicators	79
Figure A.2	– Horizontal indicators	79
Figure A.3	– Arrangement of indicators	86
Figure A.4	– Selection of tests on high-voltage switchgear and controlgear for class IAC-A.....	87
Figure A.5	– Selection of tests on high-voltage switchgear and controlgear for class IAC-B.....	88
Figure A.6	– Selection of tests on high-voltage interconnections for class IAC-A.....	89
Figure A.7	– Selection of tests on high-voltage interconnections for class IAC-B.....	90
Figure C.1	– Impact test apparatus	95

Figure D.1 – Mineral-oil-immersed power transformer load factor inside of the enclosure related to ambient air at the location and top-oil and winding temperature rise limits	97
Figure D.2 – Dry-type power transformer load factor outside of the enclosure	97
Figure D.3 – Insulation class 105 °C (A) dry-type power transformers load factor in an enclosure	98
Figure D.4 – Insulation class 120 °C (E) dry-type power transformers load factor in an enclosure	99
Figure D.5 – Insulation class 130 °C (B) dry-type power transformers load factor in an enclosure	99
Figure D.6 – Insulation class 155 °C (F) dry-type power transformers load factor in an enclosure	100
Figure D.7 – Insulation class 180 °C (H) dry-type power transformers load factor in an enclosure	100
Figure D.8 – Insulation class 200 °C (H) dry-type power transformers load factor in an enclosure	101
Figure D.9 – Insulation class 220 °C (H) dry-type power transformers load factor in an enclosure	101
Figure E.1 – Example of earthing arrangement	104
Figure E.2 – Example of earthing arrangement	105
Figure E.3 – Example with the framework serving as part of the main earthing conductor	106
Figure G.1 – Indicative arrangement of laboratory radiation sources (e.g. radiant heat lamps) for continuous current test with simulated solar radiation	110
Table 1 – Synthetic material characteristics	35
Table 2 – Type tests	40
Table 3 – Locations, causes and examples of measures decreasing the probability of internal arcs	65
Table 4 – Single phase-to-earth arc fault current depending on the network neutral earthing	67
Table 5 – Summary of technical requirements, characteristics and ratings relevant for prefabricated substations	68
Table F.1 – Treatment of coatings	107
Table F.2 – Tests of coatings	107
Table F.3 – Test of concrete	108

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 202: AC prefabricated substations for rated voltages above 1 kV and up to and including 52 kV

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62271-202 has been prepared by subcommittee 17C: Assemblies, of IEC technical committee 17: High-voltage switchgear and controlgear. It is an International Standard.

This third edition cancels and replaces the second edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) the whole document contents and structure are reviewed with due consideration of IEC 62271-1:2017;
- b) modification of the title and scope to include high-voltage switchgear prefabricated substations;
- c) inclusion of CEADS as a possible component of MV/LV prefabricated substation;
- d) in 7.2.101, the possible influence of surrounding elements on the dielectric performance of high-voltage components as high-voltage switchgear and controlgear and high-voltage interconnections non-metal-enclosed or without earthed screen are now considered;

- e) new informative Annex G with testing procedure to evaluate the impact of solar radiation in temperatures inside the enclosure and how to apply it;
- f) new informative Annex H for appropriate consideration of installation conditions of electronic equipment;
- g) the rated power of a prefabricated substation is now defined as a three-parameter rated value. See 5.101.1;
- h) minimum dimensions for access doors to the prefabricated substation in 6.104.4 and for free height of operation aisle in 6.105.3 have been introduced;
- i) continuous current (temperature rise) test methods have been revised/clarified where necessary;
- j) Figure D.1, which shows the mineral-oil-immersed power transformer load factor inside the enclosure, has been corrected.

The text of this document is based on the following documents:

Draft	Report on voting
17C/843/FDIS	17C/849/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

This document is to be read in conjunction with IEC 62271-1:2017, to which it refers and which is applicable, unless otherwise specified. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in IEC 62271-1:2017. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

A list of all parts of the IEC 62271 series can be found, under the general title *High-voltage switchgear and controlgear*, on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

A prefabricated substation is defined as a high-voltage type-tested assembly comprising an enclosure containing at least a power transformer and/or a high-voltage switchgear and controlgear, and, in general, all or some of the following main components: low-voltage switchgear and controlgear, electrical high-voltage interconnection and low-voltage interconnection. The prefabricated substation can include all necessary auxiliary and control equipment for its operation. The purpose being to supply low-voltage power from a high-voltage system and/or vice versa (high-voltage/low-voltage transformer substation) or distribute electric power in a high-voltage network (high-voltage switchgear substation).

These prefabricated 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. Use of type-tested components and suitable design and construction of the assembly contributes to this protection. The correct design and performance of the prefabricated substation is verified by means of relevant type and routine tests described in this document, including internal arc tests (if applicable).

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 202: AC prefabricated substations for rated voltages above 1 kV and up to and including 52 kV

1 Scope

This part of IEC 62271 specifies the service conditions, rated characteristics, general structural requirements and test methods of enclosed high-voltage prefabricated substations. These prefabricated substations are cable-connected to AC high-voltage networks with an operating voltage up to and including 52 kV and power frequencies up to and including 60 Hz. They can be manually operated from inside (walk-in type) or from outside (non-walk-in type). They are designed for outdoor installation at locations with public accessibility and where protection of personnel is provided.

These prefabricated substations can be situated at ground level or partially or completely below ground level. The last are also called "underground prefabricated substations".

In general, two types of prefabricated substations are considered in this document:

- high-voltage switchgear prefabricated substations;
- high-voltage/low-voltage transformer prefabricated substations (step-up and step-down).

A high-voltage switchgear prefabricated substation comprises an enclosure containing in general the following electrical components:

- high-voltage switchgear and controlgear;
- auxiliary equipment and circuits.

A high-voltage/low-voltage transformer prefabricated substation comprises an enclosure containing in general the following electrical components:

- power transformer(s);
- high-voltage and low-voltage switchgear and controlgear;
- high-voltage and low-voltage interconnections;
- auxiliary equipment and circuits.

However, relevant provisions of this document are applicable to designs where not all these electrical components exist (for example, a prefabricated substation consisting of power transformer and low-voltage switchgear and controlgear).

The listed electrical components of a high-voltage/low-voltage transformer prefabricated substation can be incorporated in the prefabricated substation either as separate components or as an assembly type CEADS according to IEC 62271-212.

This document covers only designs using natural ventilation. However, relevant provisions of this document are applicable to designs using other means of ventilation except the rated power of the prefabricated substation and associated class of enclosure (see 5.101), the continuous current tests (see 7.5) and all temperature rise related requirements, which would need an agreement between manufacturer and user.

NOTE 1 IEC 61936-1 [1]¹ 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 substations compliant with IEC 62271-202, which are regarded as a component of such installation. Non-prefabricated high-voltage substations, are generally covered by IEC 61936-1 [1].

NOTE 2 High-voltage switchgear prefabricated substations can include instrument transformers, according to IEC 61869 (all parts). These substations are not high-voltage/low-voltage transformer prefabricated substations.

2 Normative references

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.

IEC 60050-441, *International Electrotechnical Vocabulary (IEV) – Part 441: Switchgear, controlgear and fuses* (available at www.electropedia.org)

IEC 60050-461:2008, *International Electrotechnical Vocabulary (IEV) – Part 461: Electric cables*

IEC 60068-2-5:2018, *Environmental testing – Part 2-5: Tests – Test S: Simulated solar radiation at ground level and guidance for solar radiation testing and weathering*

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60076-1:2011, *Power transformers – Part 1: General*

IEC 60076-2:2011, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

IEC 60076-5:2006, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-7:2018, *Power transformers – Part 7: Loading guide for mineral-oil-immersed power transformers*

IEC 60076-10:2016, *Power transformers – Part 10: Determination of sound levels*

IEC 60076-11:2018, *Power transformers – Part 11: Dry-type transformers*

IEC 60076-12:2008, *Power transformers – Part 12: Loading guide for dry-type power transformers*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

¹ Numbers in square brackets refer to the Bibliography.

IEC 60721-1:1990, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*
IEC 60721-1:1990/AMD1:1992
IEC 60721-1:1990/AMD2:1995

IEC 60721-2-2:2012, *Classification of environmental conditions – Part 2-2: Environmental conditions appearing in nature – Precipitation and wind*

IEC 60721-2-4:2018, *Classification of environmental conditions – Part 2-4: Environmental conditions appearing in nature – Solar radiation and temperature*

IEC 60721-3-4, *Classification of environmental conditions – Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weather protected locations*

IEC TS 60815-1:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 61180-1:1992, *High-voltage test techniques for low voltage equipment – Part 1: Definitions, test and procedure requirements²*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 62262:2002, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62271-1:2017, *High-voltage switchgear and controlgear – Part 1: Common specifications for alternating current switchgear and controlgear*

IEC 62271-200:2021, *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 62271-201:2014, *High-voltage switchgear and controlgear – Part 201: AC solid-insulation enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-212:2016, *High-voltage switchgear and controlgear – Part 212: Compact Equipment Assembly for Distribution Substation (CEADS)*

ISO 1182:2010, *Reaction to fire tests for products – Non-combustibility tests*

ISO 1716:2018, *Reaction to fire tests for products – Determination of the gross heat of combustion (calorific value)*

ISO 6508-1:2016, *Metallic materials – Rockwell hardness test – Part 1: Test method*

EN 10025-2:2019, *Hot rolled products of structural steels – Part 2: Technical delivery conditions for non-alloy structural steels*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN