

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



High-voltage switchgear and controlgear –  
Part 212: Compact Equipment Assembly for Distribution Substation (CEADS)

Appareillage à haute tension –  
Partie 212: Ensemble Compact d'Équipement pour Postes de Distribution  
(ECEPD)



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## CONTENTS

FOREWORD .....	7
INTRODUCTION .....	9
1 General .....	10
1.1 Scope .....	10
1.2 Normative references .....	10
2 Normal and special service conditions .....	12
2.1 Normal service conditions .....	12
2.2 Special service conditions .....	12
3 Terms and definitions .....	12
4 Ratings .....	14
4.1 Rated voltage .....	14
4.2 Rated insulation level .....	15
4.3 Rated frequency ( $f_r$ ) .....	15
4.4 Rated normal current and temperature rise .....	15
4.4.1 Rated normal current ( $I_r$ , $I_{nA}$ ) .....	15
4.4.2 Temperature rise .....	15
4.5 Rated short-time withstand currents ( $I_k$ , $I_{ke}$ , $I_{cw}$ ) .....	16
4.5.101 Rated short-time phase to phase and rated short-time phase to earth withstand currents of high-voltage functional unit and rated short-time withstand current of high-voltage interconnection ( $I_k$ , $I_{ke}$ ) .....	16
4.5.102 Rated short-time withstand currents of low-voltage functional unit and low-voltage interconnection ( $I_{cw}$ ) .....	16
4.5.103 Short-time withstand currents of high-voltage/low-voltage transformer functional unit .....	16
4.6 Rated peak withstand currents ( $I_p$ , $I_{pe}$ , $I_{pk}$ ) .....	16
4.6.101 Rated peak phase to phase and rated peak phase to earth withstand currents of high-voltage functional unit and rated peak withstand current of high-voltage interconnection ( $I_p$ , $I_{pe}$ ) .....	16
4.6.102 Rated peak withstand currents of low-voltage and low-voltage interconnection ( $I_{pk}$ ) .....	17
4.6.103 Peak withstand currents of high-voltage/low-voltage transformer functional unit .....	17
4.7 Rated durations of short circuit ( $t_k$ , $t_{ke}$ , $t_{cw}$ ) .....	17
4.7.101 Rated duration of phase to phase short circuit ( $t_k$ ) and rated duration of phase to earth short circuit ( $t_{ke}$ ) of high-voltage functional unit and rated duration of short-circuit of high-voltage interconnection .....	17
4.7.102 Rated duration of short circuit ( $t_{cw}$ ) for low-voltage functional unit and low-voltage interconnection .....	17
4.7.103 Duration of short circuit for high-voltage/low-voltage transformer functional unit .....	17
4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits .....	17
4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits .....	17
4.101 Rated power and total losses of CEADS .....	18
4.102 Ratings of the internal arc classification (IAC) .....	18
4.102.1 General .....	18
4.102.2 Types of accessibility (A, B, AB) .....	18
4.102.3 Classified sides .....	18

4.102.4	Rated arc fault currents ( $I_A$ , $I_{Ae}$ ) .....	18
4.102.5	Rated arc fault duration ( $t_A$ , $t_{Ae}$ ) .....	19
5	Design and construction .....	19
5.1	Requirements for liquids in switchgear and controlgear .....	19
5.2	Requirements for gases in switchgear and controlgear .....	20
5.3	Earthing of switchgear and controlgear .....	20
5.4	Auxiliary and control equipment .....	20
5.5	Dependent power operation .....	20
5.6	Stored energy operation .....	21
5.7	Independent manual or power operation (independent unlatched operation) .....	21
5.8	Operation of releases .....	21
5.9	Low- and high-pressure interlocking and monitoring devices .....	21
5.10	Nameplates .....	21
5.11	Interlocking devices .....	21
5.12	Position indication .....	21
5.13	Degrees of protection provided by enclosures .....	21
5.14	Creepage distances for outdoor insulators .....	22
5.15	Gas and vacuum tightness .....	22
5.16	Liquid tightness .....	22
5.17	Fire hazard (flammability) .....	22
5.18	Electromagnetic compatibility (EMC) .....	22
5.19	X-ray emission .....	22
5.20	Corrosion .....	23
5.101	Protection against mechanical stresses .....	23
5.102	Protection of the environment due to internal defects .....	23
5.103	Internal arc fault .....	23
5.104	Enclosures .....	24
5.105	Sound emission .....	24
5.106	Electromagnetic fields .....	24
6	Type tests .....	24
6.1	General .....	24
6.1.1	Grouping of tests .....	25
6.1.2	Information for identification of test objects .....	25
6.1.3	Information to be included in type-test reports .....	25
6.2	Dielectric tests .....	26
6.2.1	General .....	26
6.2.2	Dielectric tests on the high-voltage interconnection .....	26
6.2.3	Dielectric tests on the low-voltage interconnection .....	27
6.2.4	Dielectric tests on high-voltage functional unit .....	28
6.2.5	Dielectric tests on high-voltage/low-voltage transformer functional unit .....	28
6.2.6	Dielectric tests on low-voltage functional unit .....	28
6.2.7	Partial discharge test .....	29
6.3	Radio interference voltage (r.i.v) test .....	29
6.4	Measurement of the resistance of circuits .....	29
6.5	Temperature-rise tests .....	29
6.5.1	General .....	29
6.5.2	Test conditions .....	29
6.5.3	Test methods .....	30

6.5.4	Special case of dry-type high-voltage/low-voltage transformer functional unit .....	33
6.5.5	Measurements .....	33
6.6	Short-time withstand current and peak withstand current tests .....	35
6.6.1	Short-time and peak withstand current tests on main circuit of high-voltage and low-voltage functional units .....	35
6.6.2	Short-time and peak withstand current tests on high-voltage and low-voltage interconnections .....	35
6.6.3	Short-time and peak withstand current tests on earthing circuits .....	35
6.6.4	Short-time and peak withstand current tests on high-voltage/low-voltage transformer functional unit .....	36
6.7	Verification of the protection, .....	36
6.7.1	Verification of degree of protection (IP coding) .....	36
6.7.2	Verification of resistance to mechanical impacts (IK coding) .....	36
6.8	Tightness tests .....	36
6.9	Electromagnetic compatibility tests (EMC) .....	36
6.10	Additional tests on auxiliary and control circuits .....	36
6.10.1	General .....	36
6.10.2	Functional tests .....	37
6.10.3	Electrical continuity of earthed metallic parts test .....	37
6.10.4	Verification of the operational characteristics of auxiliary contacts .....	37
6.10.5	Environmental tests .....	37
6.10.6	Dielectric test .....	37
6.11	X-radiation test procedure for vacuum interrupters .....	37
6.101	Internal arc test .....	37
6.101.1	General .....	37
6.101.2	Test conditions .....	38
6.101.3	Arrangement of the equipment .....	38
6.101.4	Test procedure .....	39
6.101.5	Criteria to pass the test .....	39
6.101.6	Test report .....	39
6.101.7	Extension of validity of test results .....	40
6.102	Verification of making and breaking capacities .....	40
6.103	Mechanical operation tests .....	40
6.104	Mechanical stability test .....	40
6.105	Pressure withstand test for gas-filled compartments .....	40
6.106	Measurements of leakage currents of non-metallic enclosures .....	41
6.107	Weatherproofing test .....	41
6.108	Tightness and mechanical strength for liquid filled compartments .....	41
6.109	Measurement or calculation of electromagnetic fields .....	41
7	Routine tests .....	42
7.1	Dielectric tests on the main circuit .....	42
7.1.1	General .....	42
7.1.2	Dielectric tests on high-voltage functional unit .....	42
7.1.3	Dielectric tests on high-voltage/low-voltage transformer functional unit and high-voltage interconnection .....	43
7.1.4	Dielectric tests on low-voltage functional unit and low-voltage interconnection .....	43
7.2	Tests on auxiliary and control circuits .....	43
7.3	Measurement of the resistance of the main circuit .....	43

7.4	Tightness test .....	43
7.5	Design and visual checks .....	43
7.101	Mechanical operation tests on high-voltage functional unit .....	43
7.102	Pressure tests of gas-filled compartments .....	43
7.103	Tests of auxiliary electrical, pneumatic and hydraulic devices .....	44
7.104	Measurement of the resistance of the windings .....	44
7.105	Measurement of the voltage ratio .....	44
7.106	Measurement of the short circuit impedance and load losses .....	44
7.107	Measurement of no-load losses and current .....	44
7.108	Inspection of the low-voltage functional unit, including inspection of wiring and, if necessary, electrical operation test .....	44
7.109	Checking of protective measures and of the electrical continuity of the protective circuits of the low-voltage functional unit .....	44
7.110	Tests after assembly on site .....	44
8	Guide to the selection of CEADS .....	44
8.1	Selection of rated values .....	45
8.2	Continuous or temporary overload due to changed service conditions .....	45
8.101	Selection of internal arc classification .....	45
8.102	Information .....	47
9	Information to be given with enquiries, tenders and orders .....	51
9.1	Information with enquiries and orders .....	51
9.2	Information with tenders .....	52
10	Rules for transport, installation, operation and maintenance .....	52
10.1	Conditions during transport, storage and installation .....	53
10.2	Installation .....	53
10.2.1	Unpacking and lifting .....	53
10.2.2	Assembly .....	53
10.2.3	Mounting .....	53
10.2.4	Final installation inspection .....	53
10.3	Operation .....	53
10.4	Maintenance .....	54
10.5	Dismantling, recycling and disposal at the end of service life .....	54
11	Safety .....	54
11.101	Electrical aspects .....	54
11.102	Mechanical aspects .....	54
11.103	Thermal aspects .....	54
11.104	Internal arc aspects .....	54
12	Influence of the product on the environment .....	54
Annex AA	(normative) Method for testing CEADS under conditions of arcing due to an internal arc fault .....	56
AA.1	General .....	56
AA.2	Room simulation .....	56
AA.3	Indicators (for assessing the thermal effects of the gases) .....	56
AA.3.1	General .....	56
AA.3.2	Arrangement of indicators .....	57
AA.4	Tolerances for geometrical dimensions of test arrangements .....	58
AA.5	Test parameters .....	58
AA.6	Test procedure .....	58
AA.7	Designation of the internal arc classification .....	59



Annex BB (normative) Test to verify the sound level of a CEADS.....	68
BB.1 Purpose .....	68
BB.2 Test object.....	68
BB.3 Test method.....	68
BB.4 Measurements .....	68
BB.5 Presentation and calculation of the results .....	68
Annex CC (informative) Types and application of CEADS .....	69
CC.1 Type of CEADS.....	69
CC.1.1 General .....	69
CC.1.2 CEADS-G .....	69
CC.1.3 CEADS-A .....	69
CC.1.4 CEADS-I.....	69
CC.2 Application of CEADS .....	69
Bibliography.....	73

Figure 1 – Test diagram in case of type tested high-voltage functional unit .....	31
Figure 2 – Test diagram in case of non-type tested high-voltage functional unit .....	31
Figure 3 – Alternative diagram in case of type tested high-voltage functional unit .....	32
Figure 4 – Diagram for the open-circuit test .....	33
Figure AA.1 – Mounting frame for vertical indicators.....	60
Figure AA.2 – Horizontal indicators.....	60
Figure AA.3 – Protection of operators in front of classified side(s) of CEADS.....	61
Figure AA.4 – Protection of general public around the CEADS.....	61
Figure AA.5 – Protection of operators in front of classified side(s) of CEADS having a pressure relief volume below the floor.....	62
Figure AA.6 – Protection of general public around the CEADS having a pressure relief volume below the floor .....	63
Figure AA.7 – Selection of tests on high-voltage switchgear for class IAC-A .....	64
Figure AA.8 – Selection of tests on high-voltage switchgear for class IAC-B .....	65
Figure AA.9 – Selection of tests on high-voltage interconnection for class IAC-A .....	66
Figure AA.10 – Selection of tests on high-voltage interconnection for class IAC-B .....	67
Figure CC.1 – Application of CEADS .....	70
Figure CC.2 – CEADS Type G .....	71
Figure CC.3 – CEADS Type A.....	71
Figure CC.4 – CEADS Type I.....	72

Table 1 – Locations, causes and examples of measures decreasing the probability of internal arc faults .....	45
Table 2 – Examples of measures limiting the consequences of internal arc faults .....	46
Table 3 – Summary of technical requirements, ratings for CEADS – Service conditions .....	47
Table 4 – Summary of technical requirements, ratings for CEADS – Ratings of the CEADS .....	48
Table 5 – Summary of technical requirements, ratings for CEADS – Design and construction of the CEADS .....	50



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## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

**Part 212: Compact Equipment Assembly  
for Distribution Substation (CEADS)**

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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## INTRODUCTION

Traditionally a high-voltage/low-voltage distribution substation has been constructed by installing the main electrical components –high-voltage switchgear, distribution transformer(s) and the corresponding low-voltage distribution panel(s)- within a closed electrical operating area. It can be a room within a building intended for other (non electrical uses) or a separated housing (prefabricated or not) designed specifically to contain the electrical equipment of the substation or an open area limited by fences.

Some years ago in the search for a more standardized and compact substation, the concept of prefabricated substation was developed. IEC 62271-202 covers this type of substation. According to this document, the main electrical components (high-voltage switchgear, transformer and low-voltage switchgear) are fully in compliance with their respective product standard, and the whole substation, including interconnections and enclosure is designed and type tested and later manufactured and routine tested in the factory. Correspondingly the quality of the substation is assured by the manufacturer.

Moreover, also other types of assemblies have been introduced in the market. These are assemblies comprising the main electrical active components of the substation and their interconnections, delivered as a single product. The product can therefore be type tested, manufactured, routine tested in the factory, transported and then installed in a closed electrical operating area.

This type of factory assembled and type-tested product is covered by this document receiving the generic name CEADS from Compact Equipment Assembly for Distribution Substation. Numerous arrangements are possible and this document provides guidance on basic types of assemblies, which might be envisaged.

A CEADS is not covered by IEC 61936-1. However CEADS is intended to become part of a distribution substation.

<https://standards.iteh.ai/catalog/standards/sist/9db58d65-e038-4908-b631-17f1c4c2ef63/iec-62271-212-2016>

Taking into account the closer proximity of the components that even can share some parts (enclosure, solid or fluid insulation...) it is very relevant to pay attention to the potential interaction between them. Therefore to cover CEADS is neither sufficient nor always applicable to refer to the relevant product standards. This document covers any additional design and construction requirements and test methods applicable to the different types of CEADS. In addition to the specified characteristics, particular attention has been paid to the specification concerning the protection of persons, both operators and general public.

The CEADS is also for the interest of committee TC 14: Power transformers, and committee TC 121: Switchgear and controlgear and their assemblies for low voltage.

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 212: Compact Equipment Assembly for Distribution Substation (CEADS)

#### 1 General

##### 1.1 Scope

This part of IEC 62271 specifies the service conditions, rated characteristics, general structural requirements and test methods of the assemblies of the main electrical functional units of a high-voltage/low-voltage distribution substation, duly interconnected, for alternating current of rated operating voltages above 1 kV and up to and including 52 kV on the high-voltage side, service frequency 50 Hz or 60 Hz. This assembly is to be cable-connected to the network, and intended for installation within an indoor or outdoor closed electrical operating area.

A Compact Equipment Assembly for Distribution Substation (CEADS) as defined in this document is designed and tested to be a single product with a single serial number and one set of documentation.

The functions of a CEADS are:

- switching and control for the operation of the high-voltage circuit(s);
- protection of the high-voltage/low-voltage transformer functional unit;
- high-voltage/low-voltage transformation;
- switching and control for the operation and protection of the low-voltage feeders.

However relevant provisions of this document are also applicable to designs where not all of these functions exist (e.g. equipment comprising only high-voltage/low-voltage transformation and switching and control for the operation and protection of the low-voltage feeder functions or equipment without switching and control for the operation of the high-voltage circuit(s)).

NOTE For the purpose of this document a self-protected transformer is considered not as a CEADS, but as a functional unit, designed and type tested to its own product standard IEC 60076-13:2006.

##### 1.2 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 60050-441:1984, *International Electrotechnical Vocabulary – Switchgear, controlgear and fuses*

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

IEC 60076 (all parts), *Power transformers*

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

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

IEC 60076-3:2013, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

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

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

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

IEC 60076-11:2004, *Power transformers – Part 11: Dry-type transformers*

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

IEC 60076-15:2015, *Power transformers – Part 15: Gas-filled power transformers*

IEC 60243-1:2013, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

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

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60721-1:1990, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

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

IEC 60721-2-4:1987, *Classification of environmental conditions – Part 2-4: Environmental conditions appearing in nature – Solar radiation and temperature*

IEC TS 60815 (all parts), *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions*

IEC 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 61439 (all parts)<sup>1</sup>, *Low-voltage switchgear and controlgear assemblies*

IEC 61439-1:2011, *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 62271-1:2007, *High-voltage switchgear and controlgear – Part 1: Common specifications*  
IEC 62271-1:2007/AMD1:2011

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<sup>1</sup> This series will supersede some parts of IEC 60439 series.

IEC 62271-200:2011, *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 62271-202:2014, *High voltage switchgear and controlgear – Part 202: High-voltage/low-voltage prefabricated substation*

ISO/IEC Guide 51:2014, *Safety aspects – Guidelines for their inclusion in standards*

## 2 Normal and special service conditions

### 2.1 Normal service conditions

Subclause 2.1 of IEC 62271-1:2007 is applicable with the following additions.

Wave shape and symmetry of supply voltage are in accordance with 4.2 of IEC 60076-1:2011.

For high-voltage/low-voltage transformer functional unit, average ambient air temperature limits of 4.2 of IEC 60076-1:2011 for liquid immersed type and 4.2.3 of IEC 60076-11:2004 shall also apply.

For indoor CEADS

- the minimum air ambient temperature is -5 °C;
- equipment shall also be suitable for conditions of humidity in accordance with 7.1.2.1 of IEC 61439-1:2011.

For outdoor CEADS

- the preferred values of minimum air ambient temperature are -10 °C, -25 °C.

NOTE 1 For air ambient below -25 °C, CEADS can be designed or used according to the relevant product standards, where applicable, or according to agreement between manufacturer and user.

NOTE 2 For higher ambient temperatures inside a room, the user has to specify to the manufacturer the specific operating conditions.

When two or more functional units share a common surrounding medium and in some cases even the same enclosure, the real operating service conditions, in particular temperature, of those functional units can differ largely from the normal service conditions (ambient air) due to the interaction between them. This has to be considered where relevant during type test (see e.g. 6.5.2).

### 2.2 Special service conditions

Subclause 2.2 of IEC 62271-1:2007 is applicable with the following additions.

Refer to the relevant standards for the different functional units.

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-441, IEC 62271-1:2007 and in the standards mentioned in 1.2, and the following apply.

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

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

### 3.101

#### **Compact Equipment Assembly for Distribution Substation**

##### **CEADS**

factory assembled and type-tested equipment comprising functional units, described in 1.1, duly interconnected

Note 1 to entry: Three types of CEADS are considered: grouped, associated and integrated (see Annex CC for details).

### 3.101.1

#### **grouped type CEADS**

##### **CEADS-G**

CEADS which functional units are stand alone equipment fully complying with their respective product standards, where these functional units are placed close to each other in a specified layout

### 3.101.2

#### **associated type CEADS**

##### **CEADS-A**

CEADS which functional units may deviate from existing product standard but not in any aspect that could affect negatively safety and/or operation and where these functional units can either be independent or share part of their frames or enclosures

### 3.101.3

#### **integrated type CEADS**

##### **CEADS-I**

CEADS where all or part of high-voltage functional units and the high-voltage/low-voltage transformation functional unit are contained in a single enclosure, sharing the insulating medium

### 3.102

#### **functional unit**

assembly of devices and components performing a given main function of the CEADS

Note 1 to entry: For the purpose of this document functional unit has a different meaning than the meaning in other standards. For example in this document high-voltage functional unit (see the definition below) may comprise several functional units as per IEC 62271-200:2011.

### 3.102.1

#### **high-voltage functional unit**

assembly of the switching devices and other components performing the function of switching and control for the operation of the high-voltage side of the CEADS

Note 1 to entry: It may include switching and control of the high-voltage main circuit of the network and the protection of the high-voltage/low-voltage transformation function.

### 3.102.2

#### **high-voltage/low-voltage transformer functional unit**

assembly of elements that perform the function of high-voltage/low-voltage transformation of the CEADS

### 3.102.3

#### **low-voltage functional unit**

assembly of the switching devices and other components performing the function of switching and control for the operation and protection of the low-voltage feeders of the CEADS