

**High-voltage switchgear and controlgear - Part 105:  
Alternating current switch-fuse combinations for rated  
voltages above 1 kV up to and including 52 kV (IEC  
62271-105:2012)**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 62271-105:2012 sisaldab Euroopa standardi EN 62271-105:2012 ingliskeelset teksti.	This Estonian standard EVS-EN 62271-105:2012 consists of the English text of the European standard EN 62271-105:2012.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 14.12.2012.	Date of Availability of the European standard is 14.12.2012.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 29.130.10

### Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Aru 10, 10317 Tallinn, Eesti; [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

### The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:  
Aru 10, 10317 Tallinn, Estonia; [www.evs.ee](http://www.evs.ee); phone 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

**High-voltage switchgear and controlgear -  
Part 105: Alternating current switch-fuse combinations for rated voltages  
above 1 kV up to and including 52 kV  
(IEC 62271-105:2012)**

Appareillage à haute tension -  
Partie 105: Combinés interrupteurs-  
fusibles pour courant alternatif de tensions  
assignées supérieures à 1 kV et jusqu'à  
52 kV inclus  
(CEI 62271-105:2012)

Hochspannungs-Schaltgeräte und -  
Schaltanlagen -  
Teil 105: Wechselstrom-Lastschalter-  
Sicherungs-Kombinationen für  
Bemessungsspannungen über 1 kV bis  
einschließlich 52 kV  
(IEC 62271-105:2012)

This European Standard was approved by CENELEC on 2012-11-01. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**CENELEC**

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 17A/1013/FDIS, future edition 2 of IEC 62271-105, prepared by SC 17A, "High-voltage switchgear and controlgear", of IEC TC 17, "Switchgear and controlgear" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62271-105:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-08-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-11-01

This document supersedes EN 62271-105:2003.

EN 62271-105:2012 includes the following significant technical changes with respect to EN 62271-105:2003:

- implementation of figures at the place where they are cited first;
- renumbering of tables;
- addition of some of the proposals from IEC paper 17A/852/INF;
- addition of missing subclauses of EN 62271-1;
- implementation of 6.105 "Extension of validity of type tests" and consequently removing of the relevant parts in the different existing clauses;
- change of 7<sup>th</sup> paragraph of 6.101.4 as there is now a definition of NSDD given in 3.7.4 of EN 62271-1:2008. Harmonization with EN 62271-107;
- some referenced clauses in other standards like EN 60282-1 were changed and therefore changed the editions under 1.2 to the ones referred to;
- addition of a new Annex C defining tolerances.

This standard is to be read in conjunction with EN 62271-1:2008, to which it refers and which is applicable, unless otherwise specified in this standard. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in EN 62271-1. Amendments to these clauses and subclauses are given under the same numbering, whilst additional subclauses are numbered from 101.

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

### **Endorsement notice**

The text of the International Standard IEC 62271-105:2012 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 62271-107      NOTE   Harmonized as EN 62271-107.

IEC 62271-202      NOTE   Harmonized as EN 62271-202.

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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

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

*Annex ZA of EN 62271-1:2008 is applicable with the following additions:*

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60282-1	2009	High-voltage fuses - Part 1: Current-limiting fuses	EN 60282-1	2009
IEC/TR 60787	2007	Application guide for the selection of high-voltage current-limiting fuse-links for transformer circuits	-	-
IEC 62271-1	2007	High-voltage switchgear and controlgear - Part 1: Common specifications	EN 62271-1	2008
IEC 62271-100	2008	High-voltage switchgear and controlgear - Part 100: Alternating current circuit-breakers	EN 62271-100	2009
IEC 62271-102 + corr. April + corr. February + corr. May	2001 2002 2005 2003	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches	EN 62271-102 + corr. July + corr. March	2002 2008 2005
IEC 62271-103	2011	High-voltage switchgear and controlgear - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV	EN 62271-103	2011

# CONTENTS

FOREWORD .....	5
1 General .....	7
1.1 Scope .....	7
1.2 Normative references .....	8
2 Normal and special service conditions .....	8
3 Terms and definitions .....	8
3.1 General terms .....	8
3.2 Assemblies of switchgear and controlgear .....	8
3.3 Parts of assemblies .....	8
3.4 Switching devices .....	8
3.5 Parts of switchgear and controlgear .....	9
3.6 Operation .....	10
3.7 Characteristic quantities .....	10
3.101 Fuses .....	14
4 Ratings .....	15
4.1 Rated voltage ( $U_r$ ) .....	15
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 ( $I_r$ ) .....	15
4.4.2 Temperature rise .....	15
4.5 Rated short-time withstand current ( $I_k$ ) .....	15
4.6 Rated peak withstand current ( $I_p$ ) .....	15
4.7 Rated duration of short-circuit ( $t_k$ ) .....	15
4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits ( $U_a$ ) .....	16
4.9 Rated supply frequency of closing and opening devices and of auxiliary circuits .....	16
4.10 Rated pressure of compressed gas supply for controlled pressure systems .....	16
4.11 Rated filling levels for insulation and/or operation .....	16
4.101 Rated short-circuit breaking current .....	16
4.102 Rated transient recovery voltage .....	16
4.103 Rated short-circuit making current .....	16
4.104 Rated transfer current (striker operation) ( $I_{transfer}$ ) .....	17
4.105 Rated take-over current for release-operated combinations ( $I_{to}$ ) .....	17
5 Design and construction .....	17
5.1 Requirements for liquids in switch-fuse combinations .....	17
5.2 Requirements for gases in switch-fuse combinations .....	17
5.3 Earthing of switch-fuse combinations .....	17
5.4 Auxiliary and control equipment .....	17
5.5 Dependent power operation .....	17
5.6 Stored energy operation .....	17
5.7 Independent manual or power operation (independent unlatched operation) .....	17
5.8 Operation of releases .....	17
5.9 Low- and high-pressure interlocking and monitoring devices .....	17
5.10 Nameplates .....	17

5.11	Interlocking devices .....	18
5.12	Position indication .....	18
5.13	Degrees of protection provided by enclosures .....	18
5.14	Creepage distances for outdoor insulators .....	18
5.15	Gas and vacuum tightness .....	19
5.16	Liquid tightness .....	19
5.17	Fire hazard (flammability) .....	19
5.18	Electromagnetic compatibility (EMC) .....	19
5.19	X-ray emission .....	19
5.20	Corrosion .....	19
5.101	Linkages between the fuse striker(s) and the switch release .....	19
5.102	Low over-current conditions (long fuse-pre-arcing time conditions) .....	19
6	Type tests .....	20
6.1	General .....	20
6.1.1	Grouping of tests .....	20
6.1.2	Information for identification of specimens .....	21
6.1.3	Information to be included in the type-test reports .....	21
6.2	Dielectric tests .....	21
6.3	Radio interference voltage (r.i.v.) tests .....	21
6.4	Measurement of the resistance of circuits .....	21
6.5	Temperature-rise tests .....	21
6.6	Short-time withstand current and peak withstand current tests .....	21
6.7	Verification of the protection .....	21
6.8	Tightness tests .....	21
6.9	Electromagnetic compatibility tests (EMC) .....	21
6.10	Additional tests on auxiliary and control circuits .....	21
6.11	X-radiation test procedure for vacuum interrupters .....	22
6.101	Making and breaking tests .....	22
6.101.1	General .....	22
6.101.2	Conditions for performing the tests .....	22
6.101.3	Test-duty procedures .....	28
6.101.4	Behaviour of the combination during tests .....	33
6.101.5	Condition of the apparatus after testing .....	33
6.102	Mechanical operation tests .....	34
6.103	Mechanical shock tests on fuses .....	34
6.104	Thermal test with long pre-arcing time of fuse .....	35
6.105	Extension of validity of type tests .....	35
6.105.1	Dielectric .....	35
6.105.2	Temperature rise .....	35
6.105.3	Making and breaking .....	35
7	Routine tests .....	36
7.101	Mechanical operating tests .....	36
8	Guide for the selection of switch-fuse combinations .....	36
8.1	Selection of rated values .....	36
8.2	Continuous or temporary overload due to changed service conditions .....	37
8.101	Guide for the selection of switch-fuse combination for transformer protection .....	37
8.101.1	General .....	37
8.101.2	Rated short-circuit breaking current .....	37



8.101.3 Primary fault condition caused by a solid short-circuit on the transformer secondary terminals .....	37
8.102 Coordination of switch and fuses for extension of the reference list .....	38
8.102.1 General .....	38
8.102.2 Rated normal current .....	38
8.102.3 Low over-current performance .....	39
8.102.4 Transfer current .....	39
8.102.5 Take-over current .....	39
8.102.6 Extension of the validity of type tests .....	39
8.103 Operation .....	39
9 Information to be given with enquiries, tenders and orders .....	40
9.1 Information with enquiries and orders .....	40
9.2 Information with tenders .....	40
10 Transport, storage, installation, operation and maintenance .....	40
11 Safety .....	41
12 Influence of the product on the environment .....	41
Annex A (informative) Example of the coordination of fuses, switch and transformer .....	42
Annex B (normative) Procedure for determining transfer current .....	45
Annex C (normative) Tolerances on test quantities for type tests .....	50
Bibliography .....	51
Figure 1 – Arrangement of test circuits for test duties $TD_{I_{sc}}$ and $TD_{I_{Wmax}}$ .....	23
Figure 2 – Arrangement of test circuits for test-duty $TD_{I_{transfer}}$ .....	24
Figure 3 – Arrangement of test circuits for test-duty $TD_{I_{to}}$ .....	24
Figure 4 – Determination of power-frequency recovery voltage .....	26
Figure 5 – Representation of a specified TRV by a two-parameter reference line and a delay line .....	27
Figure 6 – Example of a two-parameter reference line for a TRV .....	28
Figure 7 – Characteristics for determining take-over current .....	32
Figure 8 – Transfer current in relation to the primary fault current $I_{sc}$ due to a solid short circuit in the transformer secondary terminal .....	38
Figure A.1 – Characteristics relating to the protection of an 11 kV – 400 kVA transformer .....	43
Figure A.2 – Discrimination between HV and LV fuses .....	44
Figure B.1 – Practical determination of the transfer current .....	46
Figure B.2 – Determination of the transfer current with the iterative method .....	48
Table 1 – Nameplate markings .....	18
Table 2 – Standard values of prospective TRV for test-duty $TD_{I_{transfer}}$ based on practice in Europe .....	30
Table 3 – Standard values of prospective TRV for test-duty $TD_{I_{transfer}}$ based on practice in the United States of America and Canada .....	31
Table 4 – Summary of test parameters for test duties .....	32
Table C.1 – Tolerances on test quantities for type tests .....	50

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 105: Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV

#### 1 General

##### 1.1 Scope

Subclause 1.1 of IEC 62271-1:2007 is not applicable, and is replaced as follows:

This part of IEC 62271 applies to three-pole units for public and industrial distribution systems which are functional assemblies of switches including switch-disconnectors and current-limiting fuses designed so as to be capable of

- breaking, at the rated recovery voltage, any current up to and including the rated short-circuit breaking current;
- making, at the rated voltage, circuits to which the rated short-circuit breaking current applies.

It does not apply to fuse-circuit-breakers, fuse-contactors, combinations for motor-circuits or to combinations incorporating single capacitor bank switches.

In this standard, the word “combination” is used for a combination in which the components constitute a functional assembly. Each association of a given type of switch and a given type of fuse defines one type of combination.

In practice, different types of fuses may be combined with one type of switch, which give several combinations with different characteristics, in particular concerning the rated currents. Moreover, for maintenance purposes, the user should know the types of fuses that can be combined to a given switch without impairing compliance to the standard, and the corresponding characteristics of the so-made combination.

A switch-fuse combination is then defined by its type designation and a list of selected fuses is defined by the manufacturer, the so-called “reference list of fuses”. Compliance with this standard of a given combination means that every combination using one of the selected fuses is proven to be in compliance with this standard.

The fuses are incorporated in order to extend the short-circuit breaking rating of the combination beyond that of the switch alone. They are fitted with strikers in order both to open automatically all three poles of the switch on the operation of a fuse and to achieve a correct operation at values of fault current above the minimum melting current but below the minimum breaking current of the fuses. In addition to the fuse strikers, the combination may be fitted with either an over-current release or a shunt release.

**NOTE** In this standard the term “fuse” is used to designate either the fuse or the fuse-link where the general meaning of the text does not result in ambiguity.

This standard applies to combinations designed with rated voltages above 1 kV up to and including 52 kV for use on three-phase alternating current systems of either 50 Hz or 60 Hz.

Fuses are covered by IEC 60282-1.

Devices that require dependent manual operation are not covered by this standard.

Switches, including their specific mechanism, shall be in accordance with IEC 62271-103 except for the short-time current and short-circuit making requirements where the current-limiting effects of the fuses are taken into account.

Earthing switches forming an integral part of a combination are covered by IEC 62271-102.

## 1.2 Normative references

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

Subclause 1.2 of IEC 62271-1:2007 is applicable with the following additions:

IEC 60282-1:2009, *High-voltage fuses – Part 1: Current-limiting fuses*

IEC/TR 60787:2007, *Application guide for the selection of high-voltage current-limiting fuse-links for transformer circuits*

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

IEC 62271-100:2008, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

IEC 62271-102:2001, *High-voltage switchgear and controlgear – Part 102: Alternating current disconnectors and earthing switches*

IEC 62271-103:2011, *High-voltage switchgear and controlgear – Part 103: Switches for rated voltages above 1 kV up to and including 52 kV*

## 2 Normal and special service conditions

Clause 2 of IEC 62271-1:2007 is applicable.

## 3 Terms and definitions

Clause 3 of IEC 62271-1:2007 is applicable with the the following additions.

### 3.1 General terms

Subclause 3.1 of IEC 62271-1:2007 is applicable.

### 3.2 Assemblies of switchgear and controlgear

Subclause 3.2 of IEC 62271-1:2007 is applicable.

### 3.3 Parts of assemblies

Subclause 3.3 of IEC 62271-1:2007 is applicable.

### 3.4 Switching devices

Subclause 3.4 of IEC 62271-1:2007 is applicable, with the following additions