

# High-voltage switchgear and controlgear —

## Part 110: Inductive load switching

The European Standard EN 62271-110:2005 has the status of a British Standard

ICS 33.100.10; 33.100.20

# National foreword

This British Standard is the official English language version of EN 62271-110:2005. It is identical with IEC 62271-110:2005.

The UK participation in its preparation was entrusted by Technical Committee PEL/17, Switchgear, controlgear and HV-LV co-ordination, to Subcommittee PEL/17/1, High-voltage switchgear and controlgear, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

## Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

## Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 27 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2006

© BSI

ISBN 0 580 47970 6

## Amendments issued since publication

| Amd. No. | Date | Comments |
|----------|------|----------|
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |
|          |      |          |

EUROPEAN STANDARD

**EN 62271-110**

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 2005

ICS 33.100.10; 33.100.20

English version

**High-voltage switchgear and controlgear**  
**Part 110: Inductive load switching**  
(IEC 62271-110:2005)

Appareillage à haute tension  
Partie 110: Manoeuvre de charges  
inductives  
(CEI 62271-110:2005)

Hochspannungs-Schaltgeräte und  
-Schaltanlagen  
Teil 110: Schalten induktiver Lasten  
(IEC 62271-110:2005)

This European Standard was approved by CENELEC on 2005-10-01. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

**CENELEC**

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

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

© 2005 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 62271-110:2005 E

**AVA** Documents  
Document Sharing Hub

## Foreword

The text of document 17A/729/FDIS, future edition 1 of IEC 62271-110, 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 was approved by CENELEC as EN 62271-110 on 2005-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented  
at national level by publication of an identical  
national standard or by endorsement (dop) 2006-07-01
- latest date by which the national standards conflicting  
with the EN have to be withdrawn (dow) 2008-10-01

This European Standard should be read in conjunction with EN 62271-100:2001 and EN 60694:1996, to which it refers and which are applicable, unless otherwise specified. In order to simplify the indication of corresponding requirements, the same numbering of clauses and subclauses is used as in EN 62271-100 and EN 60694. Additional subclauses are numbered from 101.

Annex ZA has been added by CENELEC.

---

## Endorsement notice

The text of the International Standard IEC 62271-110:2005 was approved by CENELEC as a European Standard without any modification.

---

## CONTENTS

|       |                                                                                                           |    |
|-------|-----------------------------------------------------------------------------------------------------------|----|
| 1     | General .....                                                                                             | 5  |
| 1.1   | Scope .....                                                                                               | 5  |
| 1.2   | Normative references .....                                                                                | 5  |
| 2     | Normal and special service conditions .....                                                               | 6  |
| 3     | Definitions .....                                                                                         | 6  |
| 4     | Ratings .....                                                                                             | 6  |
| 4.1   | Rated voltage ( $U_r$ ) .....                                                                             | 6  |
| 4.2   | Rated insulation level .....                                                                              | 6  |
| 4.3   | Rated frequency ( $f_r$ ) .....                                                                           | 6  |
| 4.4   | Rated normal current ( $I_r$ ) and temperature rise .....                                                 | 6  |
| 4.5   | Rated short-time withstand current ( $I_k$ ) .....                                                        | 6  |
| 4.6   | Rated peak withstand current ( $I_p$ ) .....                                                              | 6  |
| 4.7   | Rated duration of short-circuit ( $t_k$ ) .....                                                           | 6  |
| 4.8   | Rated supply voltage of closing and opening devices and of auxiliary and control circuits ( $U_a$ ) ..... | 7  |
| 4.9   | Rated supply frequency of closing and opening devices and auxiliary circuits .....                        | 7  |
| 4.10  | Rated pressure of compressed gas supply for insulation, operation and/or interruption .....               | 7  |
| 5     | Design and construction .....                                                                             | 7  |
| 6     | Type tests .....                                                                                          | 7  |
| 6.1   | General .....                                                                                             | 7  |
| 6.2   | Dielectric test .....                                                                                     | 8  |
| 6.3   | Radio interference voltage (r.i.v.) tests .....                                                           | 8  |
| 6.4   | Measurement of the resistance of the main circuit .....                                                   | 8  |
| 6.5   | Temperature-rise tests .....                                                                              | 8  |
| 6.6   | Short-time withstand current and peak withstand current tests .....                                       | 8  |
| 6.7   | Verification of protection .....                                                                          | 8  |
| 6.8   | Tightness tests .....                                                                                     | 8  |
| 6.9   | Electromagnetic compatibility (EMC) tests .....                                                           | 8  |
| 6.101 | Mechanical and environmental tests .....                                                                  | 8  |
| 6.102 | Miscellaneous provisions for making and breaking tests .....                                              | 8  |
| 6.103 | Test circuits for short-circuit making and breaking tests .....                                           | 9  |
| 6.104 | Short-circuit test quantities .....                                                                       | 9  |
| 6.105 | Short-circuit test procedures .....                                                                       | 9  |
| 6.106 | Basic short-circuit test duties .....                                                                     | 9  |
| 6.107 | Critical current tests .....                                                                              | 9  |
| 6.108 | Single-phase and double-earth fault tests .....                                                           | 9  |
| 6.114 | High-voltage motor current switching tests .....                                                          | 9  |
| 6.115 | Shunt reactor current switching tests .....                                                               | 14 |
| 7     | Routine tests .....                                                                                       | 19 |
| 8     | Guide to selection of circuit-breakers for service .....                                                  | 19 |

|                                                                                                                                                                   |                                                                             |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|----|
| 9                                                                                                                                                                 | Information to be given with enquiries, tenders and orders .....            | 20 |
| 10                                                                                                                                                                | Rules for transport, storage, installation, operation and maintenance ..... | 20 |
| 11                                                                                                                                                                | Safety .....                                                                | 20 |
| Bibliography .....                                                                                                                                                |                                                                             | 26 |
| Annex ZA (normative) Normative references to international publications with their<br>corresponding European publications .....                                   |                                                                             | 27 |
| Figure 1 – Motor switching test circuit and summary of parameters .....                                                                                           |                                                                             | 21 |
| Figure 2 – Illustration of transient voltages at interruption of inductive current for first<br>phase clearing in a three-phase non-solidly earthed circuit ..... |                                                                             | 22 |
| Figure 3 – Reactor switching test – Basic layout of three-phase test circuit .....                                                                                |                                                                             | 23 |
| Figure 4 – Reactor switching test – Basic layout of single-phase test circuit .....                                                                               |                                                                             | 24 |
| Figure 5 – Illustration of transient voltages at interruption of inductive current for a<br>single-phase test .....                                               |                                                                             | 25 |
| Table 1 – Test duties at motor current switching tests .....                                                                                                      |                                                                             | 12 |
| Table 2 – Prospective transient voltage of load circuit including connection to the<br>circuit-breaker .....                                                      |                                                                             | 16 |
| Table 3 – Load circuit 1 test currents .....                                                                                                                      |                                                                             | 16 |
| Table 4 – Load circuit 2 test currents .....                                                                                                                      |                                                                             | 17 |
| Table 5 – Test duties for reactor current switching tests .....                                                                                                   |                                                                             | 18 |

## HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

### Part 110: Inductive load switching

#### 1 General

##### 1.1 Scope

This International Standard is applicable to a.c. circuit-breakers designed for indoor or outdoor installation, for operation at frequencies of 50 Hz and 60 Hz on systems having voltages above 1000 V and applied for inductive current switching with or without additional short-circuit current breaking duties. The standard is applicable to circuit-breakers in accordance with IEC 62271-100 that are used to switch high-voltage motor currents and shunt reactor currents and also to high-voltage contactors used to switch high-voltage motor currents [1] <sup>1</sup>.

Switching unloaded transformers, i.e. breaking transformer magnetizing current, is not considered in this standard. The reasons for this are as follows:

- a) due to the non-linearity of the transformer core, it is not possible to correctly model the switching of transformer magnetizing current using linear components in a test laboratory. Tests conducted using an available transformer, such as a test transformer, will only be valid for the transformer tested and cannot be representative for other transformers;
- b) as detailed in the guide for application of IEC 62271-100 and IEC 60694 (hereafter referred to as the guide [2]), the characteristics of this duty are usually less severe than any other inductive current switching duty. It should be noted that such a duty may produce severe overvoltages within the transformer winding(s) depending on the circuit-breaker re-ignition behaviour and transformer winding resonance frequencies.

Short-line faults, out-of-phase current making and breaking and capacitive current switching are not applicable to circuit-breakers applied to switch shunt reactors or motors. These duties are therefore not included in this standard.

Subclause 1.1 of IEC 62271-100 is otherwise applicable.

##### 1.2 Normative references

Subclause 1.2 of IEC 62271-100 is applicable with the following addition:

IEC 62271-100:2001, *High-voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers* <sup>2</sup>

<sup>1</sup> Figures in square brackets refer to the bibliography.

<sup>2</sup> A consolidated edition is available (2003).

## 2 Normal and special service conditions

Clause 2 of IEC 60694 is applicable.

## 3 Definitions

For the purposes of this document, the definitions of IEC 60050(441) and IEC 60694 apply.

## 4 Ratings

Clause 4 of IEC 62271-100 is applicable except for the references to short-line faults, out-of-phase making and breaking, capacitive current switching and as noted in specific subclauses below.

### 4.1 Rated voltage ( $U_r$ )

Subclause 4.1 of IEC 60694 is applicable.

### 4.2 Rated insulation level

Subclause 4.2 of IEC 60694 is applicable with the following addition:

The rated values stated in Tables 1a and 1b and Tables 2a and 2b of IEC 60694 are applicable with the exception of column (8) in the latter two tables.

NOTE 1 The reason for this exception is the passive nature of the shunt reactor load circuit.

NOTE 2 In some cases (high chopping overvoltage levels, or where a neutral reactor is present or in cases of shunt reactors with isolated neutral), it may be necessary to specify an appropriate insulation level which is higher than the rated values given in Tables 1a, 1b, 2a and 2b.

### 4.3 Rated frequency ( $f_r$ )

Subclause 4.3 of IEC 60694 is applicable with the following addition:

The standard values for the rated frequency of high voltage circuit-breakers are 50 Hz and 60 Hz.

### 4.4 Rated normal current ( $I_r$ ) and temperature rise

Subclause 4.4 of IEC 60694 is applicable.

### 4.5 Rated short-time withstand current ( $I_k$ )

Subclause 4.5 of IEC 62271-100 is applicable.

### 4.6 Rated peak withstand current ( $I_p$ )

Subclause 4.6 of IEC 62271-100 is applicable.

### 4.7 Rated duration of short-circuit ( $t_k$ )

Subclause 4.7 of IEC 62271-100 is applicable.

#### **4.8 Rated supply voltage of closing and opening devices and of auxiliary and control circuits ( $U_a$ )**

Subclause 4.8 of IEC 60694 is applicable.

#### **4.9 Rated supply frequency of closing and opening devices and auxiliary circuits**

Subclause 4.9 of IEC 60694 is applicable.

#### **4.10 Rated pressure of compressed gas supply for insulation, operation and/or interruption**

Subclause 4.10 of IEC 60694 is applicable.

#### **4.101 Rated short-circuit breaking current ( $I_{sc}$ )**

Subclause 4.101 of IEC 62271-100 is applicable.

#### **4.102 Transient recovery voltage related to the rated short-circuit breaking current**

Subclause 4.102 of IEC 62271-100 is applicable.

#### **4.103 Rated short-circuit making current**

Subclause 4.103 of IEC 62271-100 is applicable.

#### **4.104 Rated operating sequence**

Subclause 4.104 of IEC 62271-100 is applicable.

#### **4.108 Inductive load switching**

This standard is applicable thereby replacing IEC 61233.

#### **4.109 Rated time quantities**

Subclause 4.109 of IEC 62271-100 is applicable.

#### **4.110 Number of mechanical operations**

Subclause 4.110 of IEC 62271-100 is applicable.

### **5 Design and construction**

Clause 5 of IEC 62271-100 is applicable.

### **6 Type tests**

#### **6.1 General**

Subclause 6.1 of IEC 62271-100 is applicable with the following addition:

Inductive current switching tests performed for a given current rating and type of application may be considered valid for another current rating and same type of application as detailed below: