BRITISH STANDARD

BS EN
62271-108:2006

High-voltage switchgear and controlgear —

Part 108: High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72,5 kV and above

The European Standard EN 62271-108:2006 has the status of a British Standard

ICS 29.130.10

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 62271-108:2006. It is identical with IEC 62271-108:2005.

The UK participation in its preparation was entrusted to Technical Committee 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 committee can be obtained on request to its secretary.

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Summary of pages

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EN 62271-108

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English version

High-voltage switchgear and controlgear Part 108: High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72,5 kV and above

(IEC 62271-108:2005)

Appareillage à haute tension
Partie 108: Disjoncteurs-sectionneurs
à courant alternatif à haute tension
de tensions assignées supérieures
ou égales à 72,5 kV
(CEI 62271-108:2005)

Hochspannungs-Schaltgeräte
und -Schaltanlagen
Teil 108: Hochspannungs-Wechselstrom-
Leistungsschalter mit Trennfunktion
für Bemessungsspannungen
größer oder gleich 72,5 kV
(IEC 62271-108:2005)

This European Standard was approved by CENELEC on 2005-12-01. 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, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the 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

Ref. No. EN 62271-108:2006 E

Foreword

The text of document 17A/742/FDIS, future edition 1 of IEC 62271-108, 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 62271-108 on 2005-12-01.

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)	2006-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-12-01

This European Standard should be read in conjunction with EN 62271-100:2001, EN 62271-102:2002 and EN 60694:1996, 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 EN 60694. Additional subclauses are numbered from 101.

This European Standard makes reference to International Standards. Where the International Standard referred to has been endorsed as a European Standard or a home-grown European Standard exists, this European Standard shall be applied instead. Pertinent information can be found on the CENELEC web site.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62271-108:2005 was approved by CENELEC as a European Standard without any modification.

INTERNATIONAL STANDARD

IEC 62271-108

First edition
2005-10

High-voltage switchgear and controlgear –

Part 108:
High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72,5 kV and above

Reference number
CEI/IEC 62271-108:2005

CONTENTS

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 108: High-voltage alternating current disconnecting circuit-breakers for rated voltages of 72,5 kV and above

1 General

1.1 Scope and object

This part of IEC 62271 applies to high-voltage alternating current disconnecting circuit-breakers for operation at frequencies of 50 Hz and 60 Hz on systems having voltages of 72,5 kV and above.

This standard identifies which requirements of IEC 60694, IEC 62271-100 and IEC 62271-102 standards are applicable. It also gives the additional requirements specific to these devices.

This standard covers a circuit-breaker which, when in the open position, satisfies the requirements of both a circuit-breaker and a disconnector.

As there is interaction between the requirements of the separate functions it is necessary to consider the standardisation of requirements. This standard details the requirements for a disconnecting circuit-breaker, identifying where these differ from the separate requirements of a discrete circuit-breaker and a disconnector.

NOTE For design examples of disconnecting circuit-breakers, refer to Annex A.

1.2 Normative references

The following referenced documents are indispensable for the application 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 60694:1996, *Common specifications for high-voltage switchgear and controlgear standards*

IEC 62271-100:2001, *High-voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers*

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

IEC 62271-310:2004, *High-voltage switchgear and controlgear – Part 310: Electrical endurance testing for circuit-breakers of rated voltage 72,5 kV and above*

2 Normal and special service conditions

Clause 2 of IEC 60694 is applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE 1 Certain definitions taken from IEC 60050(441), IEC 60050(604) and IEC 60694 are recalled here for ease of reference.

NOTE 2 Additional definitions given here are classified in a manner that aligns with the classification used in IEC 60050(441).

3.1 General terms

3.1.1
switchgear and controlgear
general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures

[IEV 441-11-01]

3.2 Assemblies of switchgear and controlgear

No particular definitions.

3.3 Parts of assemblies

No particular definitions.

3.4 Switching devices

3.4.101
circuit-breaker
mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit

[IEV 441-14-20]

3.4.102
disconnector
mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements

[IEV 441-14-05]

3.4.103
disconnecting circuit-breaker
circuit-breaker satisfying the requirements of a disconnector, when the contacts are in open position

3.5 Parts of switchgear and controlgear

No particular definitions.

3.6 Operation

3.6.101
closed position (of a mechanical switching device)
position in which the predetermined continuity of the main circuit of the device is secured

[IEV 441-16-22]

3.6.102
open position (of a mechanical switching device)
position in which the predetermined clearance between open contacts in the main circuit of the device is secured

[IEV 441-16-23]

3.6.103
interlocking device
device which makes the operation of a switching device dependent upon the position of operation of one or more other pieces of equipment

[IEV 441-16-49]

3.7 Characteristic quantities

3.7.101
insulation level
for a disconnecting circuit-breaker, a characteristic defined by one or two values indicating the insulation withstand voltages

[IEV 604-03-47, modified]

3.7.102
external insulation
distances in atmospheric air, and surfaces of solid insulation of disconnectors and earthing switches in contact with the air, which are subject to dielectric stresses and to the effect of atmospheric and other external conditions such as pollution, humidity, vermin, etc.

[IEV 604-03-02, modified]

NOTE External insulation is either weather-protected or non-weather-protected, designed to operate outside or inside closed shelters, respectively

3.7.103
internal insulation
internal solid, liquid or gaseous parts of the insulation of equipment which are protected from the effects of atmospheric and other external conditions

[IEV 604-03-03]

3.7.104
isolating distance (of a pole of a mechanical switching device)
clearance between open poles meeting the safety requirements specified for disconnectors

[IEV 441-17-35, modified]

4 Ratings

Clause 4 of IEC 62271-100 is applicable, unless stated otherwise.

The characteristics of a disconnecting circuit-breaker, including its operating devices, and auxiliary equipment, that shall be used to determine the rating are the following:

Rated characteristics to be given for all disconnecting circuit-breakers

a) rated voltage;
b) rated insulation level;
c) rated frequency;
d) rated normal current;
e) rated short-time withstand current;
f) rated peak withstand current;
g) rated duration of short-circuit;
h) rated supply voltage of closing and opening devices and of auxiliary circuits;
i) rated supply frequency of closing and opening devices and of auxiliary circuits;
j) rated pressures of compressed gas supply and/or of hydraulic supply for operation, interruption and insulation, as applicable;
k) rated short-circuit breaking current;
l) transient recovery voltage related to the rated short-circuit breaking current;
m) rated short-circuit making current;
n) rated operating sequence;
o) rated time quantities;
p) rated static terminal load;
q) rated line-charging breaking current;

Rated characteristics to be given in the specific cases indicated below

r) characteristics for short-line faults related to the rated short-circuit breaking current, for disconnecting circuit-breakers designed for direct connection to overhead transmission lines at more than 12,5 kA rated short-circuit breaking current;
s) rated cable-charging breaking current, for three-pole disconnecting circuit-breakers intended for switching cables.

Rated characteristics to be given on request

t) rated out-of-phase making and breaking current;
u) rated single capacitor bank breaking current;
v) rated back-to-back capacitor bank breaking current;
w) rated capacitor bank inrush making current;
x) rated back-to-back capacitor bank inrush making current.

The rated characteristics of the disconnecting circuit-breaker are referred to the rated operating sequence.

NOTE 1 Disconnecting circuit-breakers need not be assigned ratings with respect to bus-transfer current switching. The bus-transfer current switching capability is covered by the making and breaking tests in IEC 62271-100.

NOTE 2 Rated contact zone is not applicable for disconnecting circuit-breakers.

4.2 Rated insulation level

Subclause 4.2 of IEC 62271-100 is applicable with the following exception:

The standard values of rated withstand voltages across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b and columns 3, 6 and 8 of Tables 2a-2b in IEC 60694.

4.112 Rated static terminal load

The rated static terminal load is the maximum resulting terminal forces (simultaneous action of ice, wind and connected conductors) to which the terminal of a disconnecting circuit-breaker is allowed to be subjected to.

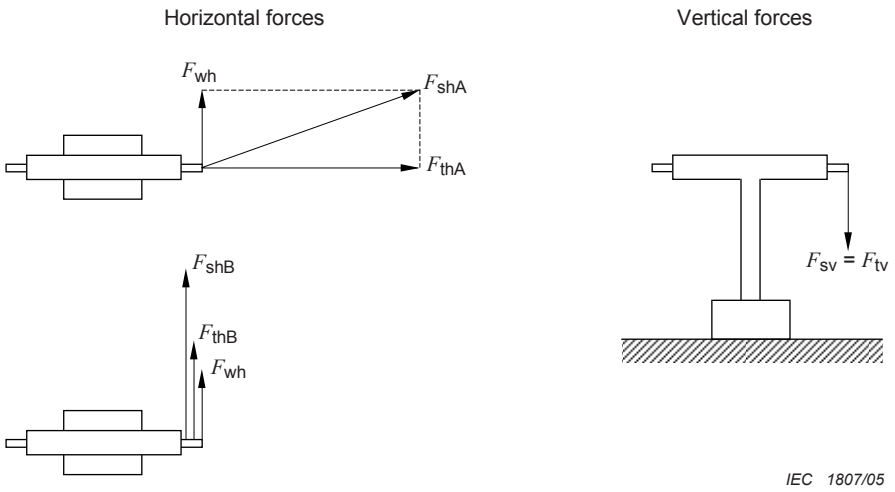
Recommended values of forces due to flexible and tubular connected conductors (not including wind or ice load or the dynamic loads on the disconnecting circuit-breaker itself) are given in Table 1.

Table 1 – Recommended static terminal loads

Rated voltage range U_r	Rated current range I_r	Static horizontal force F_{th}		Static vertical force (vertical axis-upward and downward) F_{tv}
		Longitudinal F_{thA}	Transversal F_{thB}	
kV	A	N	N	N
72,5	800 – 1 250	500	400	500
72,5	1 600 – 2 500	750	500	750
100 – 170	1 250 – 2 000	1 000	750	1 000
100 – 170	2 500 – 4 000	1 250	750	1 000
245	1 600 – 4 000	1 250	1 000	1 250
300 – 362	1 600 – 2 000	1 250	1 000	1 250
300 – 362	3 150 – 4 000	1 500	1 000	1 500
420 – 800	2 000	1 750	1 250	1 500
420 – 800	3 150 – 4 000	2 000	1 250	1 500

Forces due to wind and ice are applicable for outdoor disconnecting circuit-breakers only and shall be taken into account by the manufacturer. Ice coating and wind pressure on the disconnecting circuit-breaker shall be in accordance with 2.1.2 of IEC 60694.

The rated static terminal load shall be expressed in the resultant horizontal (F_{shA} and F_{shB}) and vertical (F_{sv}) forces (refer to Figure 1 and 2).



F_{thA} tensile horizontal force due to connected conductors (direction A)

F_{thB} tensile horizontal force due to connected conductors (direction B)

F_{tv} tensile vertical force due to connected conductors (direction C)

F_{wh} horizontal force on disconnecting circuit-breaker due to wind pressure on ice-coated disconnecting circuit-breaker

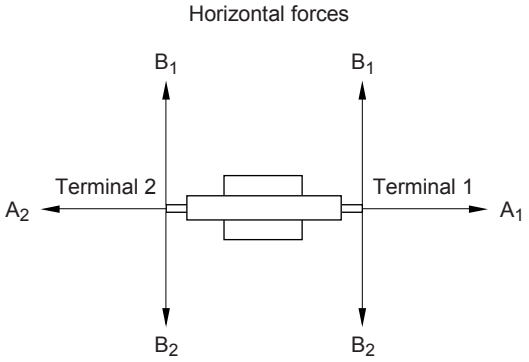
F_{shA}, F_{shB}, F_{sv} rated static terminal load (resultant forces)

NOTE Refer to Figure 2 for directions A, B and C.

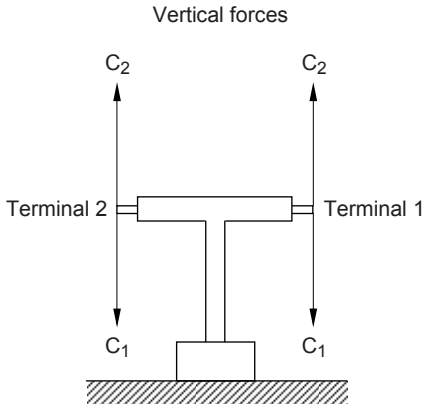
	Horizontal	Vertical	Remark
Forces due to dead weight, wind and ice on connected conductor	F_{thA}, F_{thB}	F_{tv}	According to Table 1
Forces due to wind and ice on disconnecting circuit-breaker if applicable [a]	F_{wh}	O	Taken into account by the manufacturer
Resultant force	F_{shA}, F_{shB}	F_{sv}	

[a] The horizontal force on the disconnecting circuit-breaker, due to wind, may be moved from the centre of pressure to the terminal and reduced in magnitude in proportion to the longer lever arm. (The bending moment at the lowest part of the disconnecting circuit-breaker should be the same.)

Figure 1 – Static terminal load forces



Force directions: A_1, B_1, B_2 for terminal 1
Force directions: A_2, B_1, B_2 for terminal 2
Horizontal test forces: F_{shA} and F_{shB} (see Figure 1)



Force directions: C_1, C_2 for terminal 1
Force directions: C_1, C_2 for terminal 2
Vertical test forces (both directions): F_{sv} (see Figure 1)

IEC 1808/05

NOTE For disconnecting circuit-breakers which are symmetrical about the pole unit vertical centreline, only one terminal needs to be tested.

Figure 2 – Directions for static terminal load tests

5 Design and construction

Clause 5 of IEC 60694 and 62271-100 and IEC 62271-102 are applicable, unless stated otherwise.

The design of the disconnecting circuit-breaker shall take into account the mechanical, electrical and other requirements of a circuit-breaker and a disconnector as a single device.

5.10 Nameplates

Subclause 5.10 of IEC 62271-100 is applicable with the following addition:

The nameplate shall state that the device is a disconnecting circuit-breaker and the data shall be applicable to both a circuit-breaker and a disconnector of the declared ratings.

5.11 Interlocking devices

Subclause 5.11 of IEC 60694 is applicable.

5.12 Position indication

Subclauses 5.12 of IEC 60694 and IEC 62271-102, and 5.104.3.1 of IEC 62271-102 are applicable.

5.102 Requirements in respect of the isolating distance of disconnecting circuit-breakers

Subclause 5.102 of IEC 62271-102 is applicable with the following addition:

When the insulation across the isolating distance may be subjected to pollution in service, care should be taken to the suitability of insulator design (e.g. creepage distance, hydrophobicity, orientation of insulator, etc.). Where necessary, satisfactory performance under polluted conditions should be verified.

The design has to take into account the long term effects of contamination caused by wear and arcing by-products. The effectiveness of the design to withstand these effects in service shall be verified by testing according to 6.114.

5.104.1 Securing of position

Disconnecting circuit-breakers shall be designed in such a way that they cannot come out of their open or closed position by gravity, wind pressure, vibrations, reasonable shocks or accidental touching of the operating system.

Disconnecting circuit-breakers shall have provisions for temporary mechanical locking in the open position. Provisions for temporary mechanically locking in the closed position are required only if specified by the user.

NOTE 1 Temporary mechanical securing the disconnecting circuit-breaker in the closed position prevents the short circuit protection function and should be used only when alternative protection is provided.

NOTE 2 Temporary mechanical locking in the closed position is typically required when the disconnecting circuit-breaker is intended to be used for earthing purposes.

5.104.2 Additional requirements for power operated mechanisms

Subclause 5.104.2 of IEC 62271-102 is not applicable because manual operating facilities for such a device when in service are not required.

6 Type tests

Clause 6 of IEC 62271-100 is applicable as appropriate to the rating of the device. Additional tests are required to demonstrate that the device complies with the relevant requirements of a disconnector.

In particular, the combined function tests are required to demonstrate that the dielectric withstand across the isolating distance remains without undue deterioration after the type-tests specified in IEC 62271-100.

6.1 General

Subclause 6.1 of IEC 62271-100 and IEC 62271-102 are applicable, unless stated otherwise.

If a circuit-breaker already has been type-tested according to IEC 62271-100, only the additional tests indicated below need to be performed.

For convenience of testing, the additional combined function tests may be combined with those for the circuit-breaker.

6.2 Dielectric tests

Subclause 6.2 of IEC 62271-100 is applicable with the following addition:

The test values across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b and columns 3, 6 and 8 of Tables 2a-2b in IEC 60694.

6.3 Radio interference (r.i.v.) tests

Subclause 6.3 of IEC 62271-100 is applicable.

6.4 Measurement of the resistance of the main circuit

Subclause 6.4 of IEC 62271-100 is applicable.

6.5 Temperature-rise tests

Subclause 6.5 of IEC 62271-100 is applicable.

6.6 Short-time withstand current and peak withstand current tests

Subclause 6.6 of IEC 62271-100 is applicable.

6.7 Verification of the degree of protection

Subclause 6.7 of IEC 62271-100 is applicable.

6.8 Tightness tests

Subclause 6.8 of IEC 62271-100 is applicable.

6.9 Electromagnetic compatibility tests

Subclause 6.9 of IEC 62271-100 is applicable.

6.101 Mechanical and environmental tests

Subclause 6.101 of IEC 62271-100 is applicable unless stated otherwise.

6.101.6 Static terminal load tests

Subclause 6.101.6 of IEC 62271-100 is applicable with the following addition:

Recommended values of static forces are given in Table 1.

6.102 Miscellaneous provisions for making and breaking tests

Subclause 6.102 of IEC 62271-100 is applicable unless stated otherwise.

6.102.9.4 Condition after a capacitive current switching test series

Subclause 6.102.9.4 of IEC 62271-100 is applicable with the following addition:

If, during the capacitive current switching tests, restrike(s) occurred, the dielectric requirements confined to the isolating distance of IEC 62271-102 shall be demonstrated. The test values across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b and columns 3, 6 and 8 of Tables 2a-2b in IEC 60694.

The test arrangement should be such that no interference with the disconnecting circuit-breaker between the tests is necessary.

However, if this is not possible due to limitation of test facilities, transportation of the test object between different test plants is allowed. If local safety rules require depressurising to enter the test cell or to transport the test object between different test plants, it is allowed to decrease the pressure in the disconnecting circuit-breaker provided that the gas is reused when refilling the disconnecting circuit-breaker.

NOTE All the used gas may not be available for refilling of the test object. In this case, it is permitted to top up the test object with new SF_6 gas to the specified pressure. Proper gas handling should be used to avoid unnecessary refilling with new SF_6 gas.

6.103 Test circuits for short-circuit making and breaking tests

Subclause 6.103 of IEC 62271-100 is applicable.

6.104 Short-circuit test quantities

Subclause 6.104 of IEC 62271-100 is applicable.

6.105 Short-circuit test procedure

Subclause 6.105 of IEC 62271-100 is applicable.

6.106 Basic short-circuit test-duties

Subclause 6.106 of IEC 62271-100 is applicable.

6.107 Critical current tests

Subclause 6.107 of IEC 62271-100 is applicable.

6.108 Single-phase and double-earth fault tests

Subclause 6.108 of IEC 62271-100 is applicable.

6.109 Short-line fault tests

Subclause 6.109 of IEC 62271-100 is applicable.

6.110 Out-of-phase making and breaking tests

Subclause 6.110 of IEC 62271-100 is applicable.

6.111 Capacitive current switching tests

Subclause 6.111 of IEC 62271-100 is applicable.

6.112 Special requirements for making and breaking tests on class E2 disconnecting circuit-breakers

Subclause 6.112 of IEC 62271-100 is applicable.

6.113 Tests to verify the proper function of the position indicating device

Annex A of IEC 62271-102 is applicable unless specified otherwise.

A.6.105 Tests to verify the proper function of the position indicating device

Subclause A.6.105 of IEC 62271-102 is applicable with the following addition:

In the case of a disconnecting circuit-breaker with several making (or breaking) units connected in series, only the moving contacts in one unit of the pole shall be locked.

A.6.105.1 Tests on the power kinematic chain

Subclause A.6.105.1.1 or A.6.105.1.4 is applicable for disconnecting circuit-breakers.

If the position indicating device is part of the operating mechanism the opening point is defined to be on the power kinematic chain as close as possible to the operating mechanism.

NOTE If the position indicating device is part of the operating mechanism, no connecting point is defined.

A.6.105.1.1 Disconnecting circuit-breakers with dependent power operation

Subclause A.6.105.1.1 is applicable with the following addition:

As an alternative to measurement, the resulting force (F_{m}) or torque (T_{m}) may be calculated.

A.6.105.1.4 Disconnecting circuit-breakers with independent power operation being actuated by the release of latching devices

Subclause A.6.105.1.4 of IEC 62271-102 is applicable with the following addition:

As an alternative to measurement, the resulting force (F_m) or torque (T_m) may be calculated. In this case, the resulting force (F_m) or torque (T_m) is obtained from the static force on the opening latch when the disconnecting circuit-breaker is in closed position.

NOTE If the design is such that the opening latch is located on the power kinematic chain between the opening point and the contacts, the latch must be released before the test.

A.6.105.3 Test results

Subclause A.6.105.3 of IEC 62271-102 is applicable with the following addition:

If the position indicating device is part of the operating mechanism, the test on the power kinematic chain is passed if

– there is no permanent distortion on the power kinematic chain that would cause the position indicating device on the operating mechanism to indicate an incorrect position.

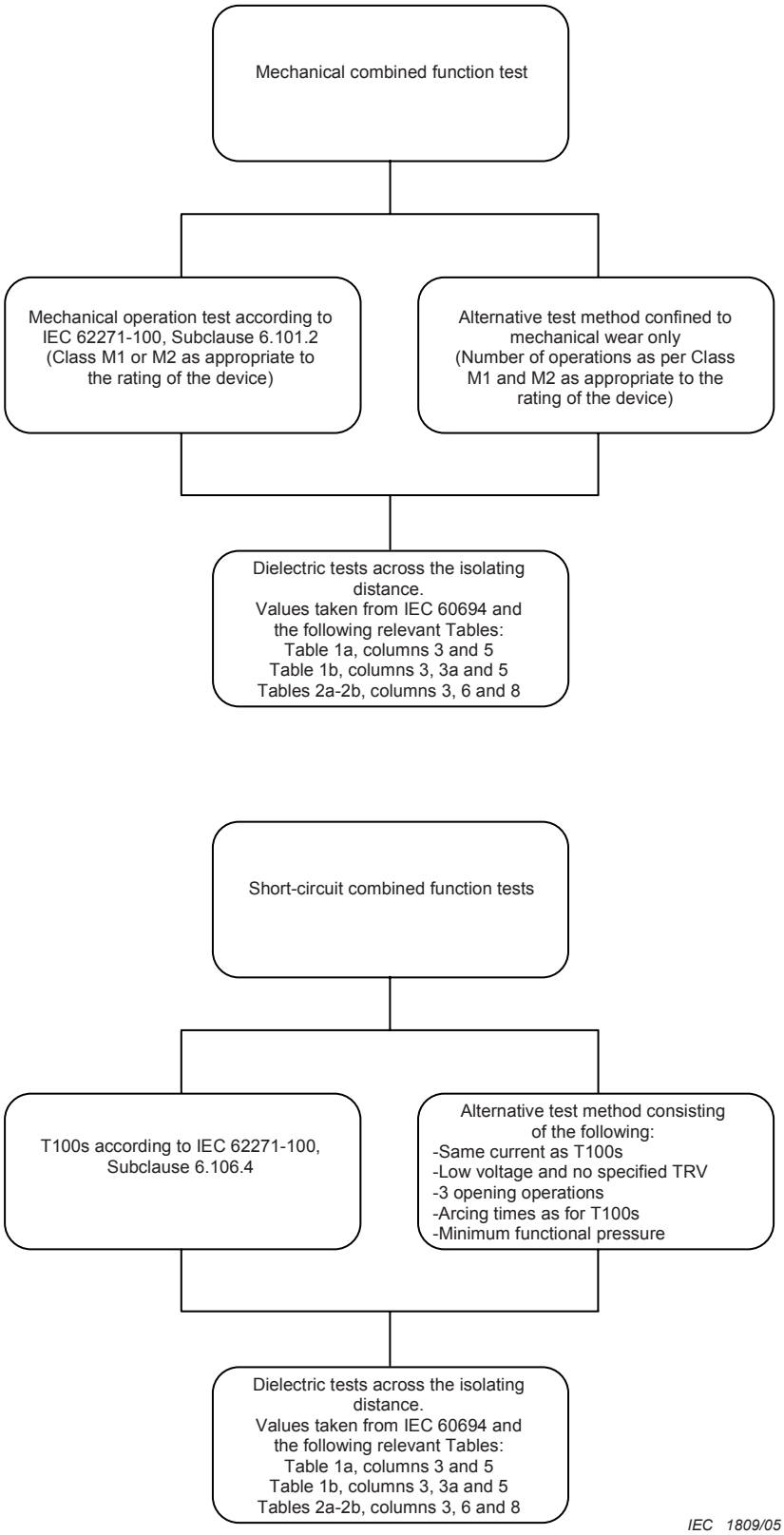
6.114 Combined function test

The disconnecting circuit-breaker shall fulfil the dielectric requirements for the isolating distance not only in new condition but also in service. Therefore the dielectric withstand across the isolating distance shall be demonstrated after a mechanical operation test as well as after the specified short-circuit test-duty.

These additional combined function tests are specific type test requirements for the device; they are not the condition check tests detailed in 6.2.11 of IEC 62271-100 and IEC 62271-102.

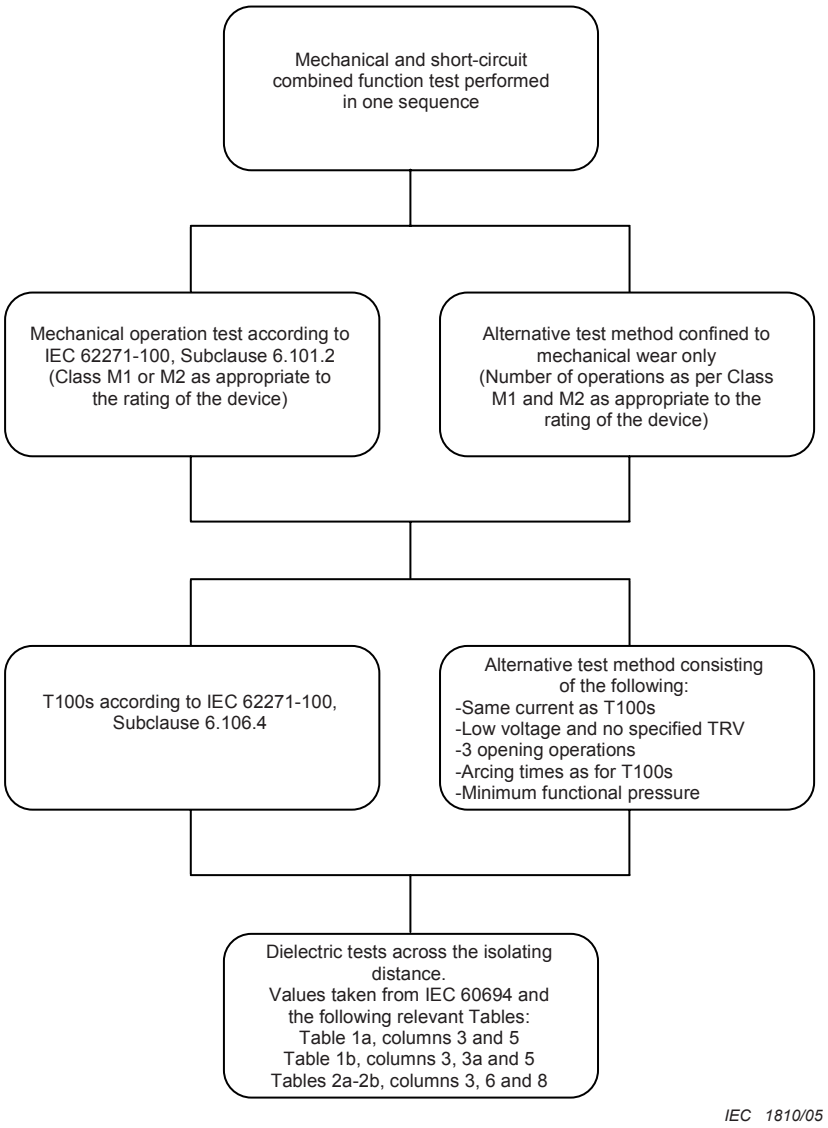
These tests verify that the apparatus fully maintains its insulating characteristics between open contacts after the given mechanical and short-circuit breaking tests. The disconnecting circuit-breakers that pass successfully these combined function tests are considered to withstand internal contamination that can occur in service due to contact wear and any decomposition by-product generated by the arc interruption, thus complying with the design criterion given in 5.102.

These separate test requirements shall be as detailed in 6.114.1 and 6.114.2. For convenience the mechanical operations and short-circuit combined function tests may be performed in one sequence. For the choice of test sequence, see the flow chart diagrams in Figures 3 and 4.



NOTE For disconnecting circuit-breakers assigned to Class E2 test-duty T100s is replaced by the wear phase as described in IEC 62271-310.

Figure 3 – Test sequence for mechanical operations and short-circuit combined function tests when performed as separate tests



NOTE For disconnecting circuit-breakers assigned to Class E2 test-duty T100s is replaced by the wear phase as described in IEC 62271-310.

Figure 4 – Test sequence for mechanical operations and short-circuit combined function tests when performed in one sequence

6.114.1 Mechanical operations combined function test

Following a mechanical operation test as detailed in 6.101, the rated insulating level across the isolating distance of IEC 62271-102 shall be demonstrated. The test values across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b and columns 3, 6 and 8 of Tables 2a-2b in IEC 60694.

As an alternative, a mechanical operation test confined to the mechanical wear of the contacts only before the above mentioned dielectric tests may be performed with recording of the operating characteristics (reference mechanical travel curve) at the beginning and at the end of the tests only.

The test arrangement should be such that no interference with the disconnecting circuit-breaker between the tests is necessary.

However, if this is not possible due to limitation of test facilities, transportation of the test object between different test plants is allowed. If local safety rules require depressurising to enter the test cell or to transport the test object between different test plants, it is allowed to decrease the pressure in the disconnecting circuit-breaker. In this case, it is possible to refill the disconnecting circuit-breaker either with the gas used at the previous mechanical operation test or with new gas.

NOTE All the used gas may not be available for refilling of the test object. In this case, it is permitted to top up the test object with new SF_6 gas to the specified pressure.

6.114.2 Short-circuit combined function test

6.114.2.1 Disconnecting circuit-breakers of class E1

Following a circuit-breaker short-circuit test sequence T100s as detailed in 6.106, the rated insulating level across the isolating distance of IEC 62271-102 shall be demonstrated. This requirement can be demonstrated after the short-circuit type testing of IEC 62271-100.

The test values across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b, and columns 3, 6 and 8 of Tables 2a-2b, in IEC 60694.

NOTE 1 As there are various short-circuit currents in service, currents most probably in the range of 10% to 60%, it is assumed that a test series T100s will be sufficient as pre-stress for the dielectric withstand test across the isolating distance.

As an alternative, a short-circuit test sequence consisting of the following may be performed before the above mentioned dielectric tests:

– same current as test-duty T100s;
– low voltage and no specified TRV;
– three opening operations;
– arcing time: as for T100s or expected T100s arcing time values given by the manufacturer;
– minimum functional pressure for operation.

For convenience, tests with different arc extinguishing windows may be combined (e.g. different frequencies or different earthing systems). In this case the arc extinguishing window during tests shall be equal to or longer than required.

The test arrangement should be such that no interference with the disconnecting circuit-breaker between the tests is necessary.

However, if this is not possible due to limitation of test facilities, transportation of the test object between different test plants is allowed. If local safety rules require depressurising to enter the test cell or to transport the test object between different test plants it is allowed to decrease the pressure in the disconnecting circuit-breaker provided that the gas is reused when refilling the disconnecting circuit-breaker.

By agreement between manufacturer and user tests additional to the T100s may be performed on the disconnecting circuit-breaker before the dielectric tests.

NOTE 2 All the used gas may not be available for refilling of the test object. In this case, it is permitted to top up the test object with new SF_6 gas to the specified pressure. Proper gas handling should be used to avoid unnecessary refilling with new SF_6 gas.

6.114.2.2 Disconnecting circuit-breakers of class E2

Following a circuit-breaker short-circuit test sequence consisting of the wear phase as detailed in Clause 4 of IEC 62271-310, the rated insulating level across the isolating distance of IEC 62271-102 shall be demonstrated.

The test values across the isolating distance of the disconnecting circuit-breaker are given in columns 3 and 5 of Table 1a, columns 3, 3a and 5 of Table 1b and columns 3, 6 and 8 of Tables 2a-2b in IEC 60694.

The wear tests may be performed with or without TRV according to the relevant test programme as described in 4.1 or 4.2 of IEC 62271-310.

The test arrangement should be such that no interference with the disconnecting circuit-breaker between the tests is necessary.

However, if this is not possible due to limitation of test facilities, transportation of the test object between different test plants is allowed. If local safety rules require depressurising to enter the test cell or to transport the test object between different test plants, it is allowed to decrease the pressure in the disconnecting circuit-breaker provided that the gas is reused when refilling the disconnecting circuit-breaker.

By agreement between manufacturer and user, tests additional to the wear phase may be performed on the disconnecting circuit-breaker before the dielectric tests.

NOTE All the used gas may not be available for refilling of the test object. In this case, it is permitted to top up the test object with new SF_6 gas to the specified pressure. Proper gas handling should be used to avoid unnecessary refilling with new SF_6 gas.

6.114.3 Condition of disconnecting circuit-breaker during the dielectric test part of the combined function test

Subclause 6.2.3 of IEC 60694 is applicable with the following addition. The dielectric test shall be conducted after finishing the mechanical operation combined function test and the short-circuit combined function test and before conducting other tests or disassembling so that the condition at the start of the dielectric tests is the same as at the end of the first part of this combined function test.

7 Routine tests

Clauses 7 of IEC 60694, IEC 62271-100 and IEC 62271-102 are applicable, unless stated otherwise.

Where the procedure for a circuit-breaker routine test covers that for a disconnector, then it can be considered valid for the disconnecting circuit-breaker.

8 Guide to the selection of disconnecting circuit-breakers for service

Clause 8 of IEC 62271-100 is applicable.

9 Information to be given with enquires, tenders and orders

Clause 9 of IEC 62271-100 is applicable.

10 Rules for transport, storage, installation, operation and maintenance

Clause 10 of IEC 62271-100 is applicable.

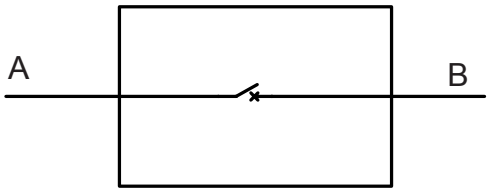
11 Safety

Clause 11 of IEC 60694 and 62271-100 and -102 are applicable.

Annex A
(informative)

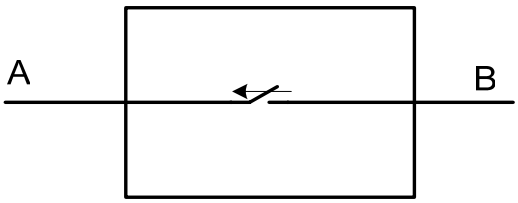
Explanatory notes and examples of disconnecting circuit-breakers

The following figures illustrate in diagrammatic form examples of the types of switching device considered to be a disconnecting circuit-breaker. In these figures the terminals of the complete device are labelled A and B and the isolating distance of the device is located between these terminals.



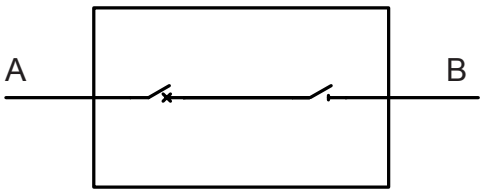
The making (breaking) unit(s) satisfies the dielectric requirements of a disconnector in open position.

Figure A.1 – A making (breaking) unit (or several identical units connected in series) which satisfies the dielectric requirements of a disconnector



Uses the same contact parts (contact pins or similar movable parts) of the making (breaking) unit to achieve the isolating distance but with a different length of contact gap.

Figure A.2 – Device with a single gap which is divided into a making (breaking) section and an isolating section



The criteria which define this device into as a disconnecting circuit-breakers is that all serial gaps are needed to fulfil the dielectric requirements of a disconnector. Hence, the isolating capability of the making (breaking) gap is essential for the disconnecting function. It does not matter whether a single or separate drives are used to move the contacts through the different gaps.

Figure A.3 – Circuit-breaker which, together with a series connected disconnector, commonly satisfies the dielectric requirements of a disconnector in open position

Bibliography

IEC 60050(441):1984, *International Electrotechnical Vocabulary – Part 441: Switchgear, controlgear and fuses*

IEC 60050(604):1987, *International Electrotechnical vocabulary – Part 604: Generation, transmission and distribution of electricity – Operation*

Annex ZA
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CENELEC member.

A-deviations in an EFTA-country are valid instead of the relevant provisions of the European Standard in that country until they have been removed.

Clause	Deviation
1.1	**Italy** (I.S.P.E.S.L.[1)] Rules, 95 revision: VSR.8.B.1; VSR.8.B.2; M.15.D.2) Italian laws apply to gas pressurized enclosures made of both insulating and metallic materials with a capacity of 25 litres or above, a design pressure higher than 0,05 kg/cm² and a temperature range: -25 °C/+100 °C (only for insulating materials). Moreover the manufacturer of any electrical equipment which comprehends gas pressurized enclosures must submit the design of the pressurized enclosures itself to a proper legal Authority indicating the stresses and the loads which have any influence on the design itself. For each of the stresses the manufacturer must indicate the design values and the relevant computations. – For metal-enclosed switchgear and controlgear containing gas-filled compartments, the design pressure is limited to a maximum of 0,5 bar (gauge) and the volume is limited to a maximum of 2 m^3. – Gas filled compartments having a design pressure exceeding 0,5 bar (gauge) or a volume exceeding 2 m^3 shall be designed according to Italian pressure vessel code for electrical switchgear (DM 1 December 1980 and DM 10 September 1981 published on Gazzetta Ufficiale n° 285 dated 16.10.1981).
5	**Italy** (I.S.P.E.S.L. [1)] Rules, 95 revision: VSR.8.B.1 and M.15.D.3. Tab I for porcelain) Only the use of porcelain type A or S. (Aluminous or Siliceous) is permitted.
6	**Italy** (I.S.P.E.S.L. [1)] Rules, 95 revision: VSR.8.B.1 Clause 2) The type test shall be performed in the presence of the Authority Supervisor. (I.S.P.E.S.L. [1)] Rules, 95 revision: VSR.8.B.2 Clause 2; M.15.D.4) An additional pressure test shall be performed on a complete pressurized enclosure. This has to withstand 1,5 times the design pressure without failure for five minutes. Temperature cycles test and electrical test shall be made; after these tests shall be carried out consecutively the pressure test at pressure p ≥ 4,25 times the design pressure.
7	**Italy** (I.S.P.E.S.L. [1)] Rules, 95 revision: VSR.8.B.1 subclause 4.1.2) For a homogeneous batch of 100 pieces max., one hollow insulator shall be subjected to the failure test with a pressure 4,25 times the design pressure.

[1)] I.S.P.E.S.L.: Istituto Superiore per la Prevenzione e la Sicurezza del Lavoro

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