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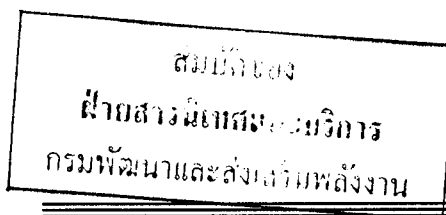
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AMENDEMENT 3
AMENDMENT 3

1996-09



Amendement 3

**Disjoncteurs à courant alternatif
à haute tension**

Amendment 3

**High-voltage alternating-current
circuit-breakers**

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FOREWORD

This amendment has been prepared by subcommittee 17A: High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This third amendment cancels and replaces the amendments 1 (1992) and 2 (1995).

The text of this amendment is based on Amendment 1 (1992), Amendment 2 (1995) and on the following documents:

DIS	Report on voting
17A/467/FDIS	17A/480/RVD

Full information on the voting for the approval of this third amendment can be found in the report on voting indicated in the above table.

Annexes JJ and KK are for information only.

Page 5

Add the following new subclause 8.104:

8.104 *Selection for electrical endurance in networks of rated voltage above 1 kV, and up to and including 52 kV*

Add the new appendices JJ and KK to the contents as follows:

Appendix JJ: Some remarks regarding multipliers for TRV values for second and third clearing poles, of Table IIF

Annex KK: Rationale behind introduction of circuit-breakers class B

Page 17

Add the following new subclauses:

3.102.13 *Circuit-breaker class A*

A circuit-breaker not falling into the category of class B as defined in 3.102.14.

3.102.14 *Circuit-breaker class B*

A circuit-breaker designed so as not to require maintenance of the interrupting parts of the main circuit during the expected operating life of the circuit-breaker, and only minimal maintenance of its other parts.

NOTES

- 1 Minimal maintenance may include lubrication, replenishment of gas and cleaning of external surfaces, where applicable.
- 2 This definition is restricted to circuit-breakers having a rated voltage up to and including 52 kV. See annex KK for rationale behind introduction of class B.

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4.101.2 D.C. component of the rated short-circuit breaking current

Replace the first line of the note on page 45 by the following:

NOTE – Depending on the characteristics of the system, for example if a circuit-breaker is close to a generator, the percentage d.c. component

Page 51

Introduce a new table IIF as follows:

Table IIF – Multipliers for transient recovery voltage values for second and third clearing poles for rated voltages above 72,5 kV, to be applied at three-phase testing

First-pole-to-clear factor	Multipliers			
	2nd clearing pole		3rd clearing pole	
	RRRV	u_c	RRRV	u_c
1,5	0,70	0,58	0,70	0,58
1,3	0,95	0,98	0,70	0,77
RRRV: Rate-of-rise of recovery voltage.				

In order to obtain the values of RRRV and u_c for the second and third clearing poles, the multiplier shall be applied to the values of RRRV and u_c of the first clearing pole at the relevant first-pole-to-clear factor.

The RRRV-multipliers are related to u_1/t_1 ; the times t_1 and t_2 are the same for the first, second and last clearing poles.

NOTES

- 1 For rated voltage for 72,5 kV and below, the values are under consideration.
- 2 See also appendix JJ.
- 3 This table is valid for test duty 1, 2, 3, 4 and 5. For test duty 5 the same reduction method shall be applied as indicated in IEC 427 for the first clearing pole. The figures are an approximation for test duties 1, 2 and 3 and are subject to further consideration.
- 4 The values are rounded values, depending on Z_0/Z_1 of the TRV-circuits, the time constant of the system and the rated voltages.
- 5 Values of table IIF for 1,5 first-pole-to-clear factor are only valid to breakers having less than one-quarter of a cycle difference in pole simultaneity.

6 Type tests

Amend the text of the second dash as follows:

- short-circuit current making and breaking tests including, where applicable, terminal fault tests, short-line fault tests, electrical endurance tests, and also out-of-phase tests (see 6.102 to 6.110.5).

6.1.7 Power-frequency voltage tests

The two notes of 6.1.7 shall be numbered:

NOTE 1 – In the case of dead tank circuit-breakers, ...

NOTE 2 – For special applications, ...

6.101.1.3 Condition of the circuit-breaker during and after the tests

Add a sixth indent on page 117:

- after the tests the insulating properties of the circuit-breaker in the open position shall be in essentially the same condition as before the tests. Visual inspection of the circuit-breaker after the tests is usually sufficient for verification of the insulating properties. In case of doubt, the condition checking test according to 6.1.11 of IEC 694 is deemed sufficient to prove the insulating properties. For circuit-breakers with sealed-for-life interrupters the condition checking test is mandatory.

6.101.2.1 General

Delete, on page 119, the last paragraph.

Add, after subclause 6.101.2.3, the following new subclause 6.101.2.4:

6.101.2.4 Extended mechanical endurance tests on circuit-breakers for special service requirements

For special service requirements in the case of frequently operated circuit-breakers, extended mechanical endurance tests may be carried out, as follows:

- a) The tests shall consist of 10 000 operating cycles comprising five times the relevant test series specified in table XII.

Between the test series, some maintenance, such as lubrication and mechanical adjustment, is allowed, and shall be performed in accordance with the manufacturer's instructions. Change of contacts is not permitted.

The programme of maintenance during the tests shall be defined by the manufacturer before the tests and recorded in the test report.

b) Before and after the total test programme, the following operations shall be performed:

- five close-open operating cycles at the rated supply voltage and/or pressure;
- five close-open operating cycles at the minimum supply voltage and/or pressure;
- five close-open operating cycles at the maximum supply voltage and/or pressure;
- five close-open manual operations.

During these operating cycles, operating characteristics (see 6.101.1.2) shall be recorded or evaluated, if applicable. It is not necessary to publish all the oscillogrammes recorded.

In addition, the following checks and measurements shall be performed (see appendix HH):

- measurements of characteristic operating fluid pressures and of consumption during operations, if applicable;
- verification of the rated operating sequence;
- checks of certain specific operations, if applicable.

The variation between the mean values of each parameter measured before and after the extended mechanical endurance tests shall be within the tolerance given by the manufacturer.

c) After each series of 2 000 operating cycles or at maintenance intervals, some significant operating characteristics selected in subclause 6.101.1.2 should be recorded or evaluated.

d) After the total test programme the condition of the circuit-breaker shall be in accordance with subclause 6.101.1.3.

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6.101.3.3 Low temperature test

Amend Item b), on page 123, as follows:

b) Characteristics and settings of the circuit-breaker shall be recorded in accordance with 6.101.1.2 and at an ambient air temperature of $(20 \pm 5) ^\circ\text{C}$ (T_A). The tightness test (if applicable) shall be performed according to EE1.4 of appendix EE.

Amend Item f) as follows:

f) The low temperature behaviour of the circuit-breaker and its alarms and lock-out systems shall be verified by disconnecting the supply of heating devices for a duration t_x . During this interval, occurrence of the alarm is acceptable but lock-out is not. At the end of the interval t_x , an opening order, at rated values of supply voltage and operating pressure, shall be given. The circuit-breaker shall then open. The opening time shall be recorded (and the contact velocity measured, if feasible) to allow assessment of the interrupting capability.

The manufacturer shall state the value of t_x up to which the circuit-breaker is still operable without auxiliary power to the heaters. In the absence of such a statement, this value shall be equal to 2 h.

Add after Item k), on page 125, a new paragraph as follows:

The accumulated leakage during the complete low temperature test sequence from Item *b)* to Item *k)* shall not be such that lock-out pressure is reached without gas-replenishment (whereas reaching alarm pressure is allowed).

Page 125

6.101.3.4 *High temperature test*

Amend Item m) as follows:

m) Characteristics and settings of the circuit-breaker shall be recorded in accordance with 6.101.1.2 and at an ambient air temperature of $(20 \pm 5) ^\circ\text{C}$ (T_A). The tightness test (if applicable) shall be performed according to EE1.4 of Appendix EE.

Add after Item u), on page 127, a new paragraph as follows:

The accumulated leakage during the complete high temperature test sequence from Item *m)* to Item *u)* shall not be such that lock-out pressure is reached without gas-replenishment (whereas reaching alarm pressure is allowed).

Page 133

6.102.2 *Arrangement of circuit-breaker for tests*

Replace the text of 6.102.2 a) by:

a) Single-enclosure type

A three-pole circuit-breaker having all its arcing contacts supported within a common enclosure shall be tested in line with IEC 1633.

Page 135

6.102.2 *b) Multi-enclosure type*

Add after "rigidity of structure" a new paragraph as follows:

Metal enclosed and dead tank circuit-breakers shall be tested in accordance with IEC 1633.

Page 141

6.102.4 *Synthetic tests*

Replace the existing text by the following:

Synthetic testing methods can be applied for making and breaking tests as required in 6.106 to 6.111. Synthetic testing techniques and methods are described in IEC 427.

Page 145

6.102.8.1 *General**Replace the text by the following:*

The circuit-breaker may be inspected after any test duty. Its mechanical parts and insulators shall be in essentially the same condition as before the test duty. Visual inspection is usually sufficient for verification of the insulating properties. In case of doubt, the condition checking test according to 6.1.11 of IEC 694 is deemed sufficient to prove the insulating properties. For circuit-breakers with sealed-for-life interrupters and when the demounting affects the inspection result, as may be the case for certain GIS breakers, the condition checking test is mandatory.

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6.102.8.5 *Reconditioning after a short-circuit test duty and other test series**Replace the text of this subclause by the following new text:*

It may be necessary to carry out maintenance work on the circuit-breaker after performing a short-circuit test duty or other test series in order to restore it to the original condition specified by the manufacturer. For example, the following may be necessary:

- a) repair or replacement of the arcing contacts and any other renewable parts recommended by the manufacturer;
- b) renewal or filtration of the oil, or of any other extinguishing medium, and the addition of any quantity of the medium necessary to restore its normal level or density;
- c) removal of deposit, caused by the decomposition of the extinguishing medium, from internal insulation.

A class B circuit-breaker shall not be reconditioned during the basic short-circuit test duties, given in 6.106.

6.102.9 *Circuit-breakers with short arcing times**Amend the first two paragraphs as follows:*

It is recognized that, when breaking tests are made on circuit-breakers having short arcing times, there may be great variation in actual severity of tests with the same circuit setting due to the point on the current wave at which contact separation occurs. For this reason, the testing procedure for circuit-breakers with arcing times (to the extinction of the main arc for circuit-breakers with switching resistors) not exceeding one cycle for the first pole to clear is given below under Items (A) and (B).

The tests under Items (A)2) and (B)2) consist of three valid breaking operations independent of the rated operating sequence. After the number of operations provided for in accordance with the rated operating sequence the circuit-breaker may be reconditioned in accordance with 6.102.8.5.

NOTE – The same test procedure may be applied also for circuit-breakers having longer arcing times than one cycle.