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INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
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High-voltage switchgear and controlgear – Part 109: Alternating-current series capacitor by-pass switches

Appareillage à haute tension – Partie 109: Interrupteurs de contournement pour condensateurs série à courant alternatif

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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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.

The text of this amendment is based on the following documents:

FDIS	Report on voting
17A/1038/FDIS	17A/1043/RVD

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

3.7.106
peak value of transient by-pass current

Replace the existing term, definition and notes as follows:

by-pass making current
peak value of the by-pass current in a pole of a by-pass switch during the transient period following the initiation of current during a by-passing operation. This value is the maximum instantaneous value of the sum of the capacitor bank discharge current component and the power-frequency current component. In case of system faults, the power-frequency fault current is equal to the maximum varistor coordinating current or for schemes without varistor, the actual maximum power-frequency fault current at the particular location

NOTE 1 The peak value may differ from one pole to another and from one operation to another as it depends on the instantaneous capacitor voltage prior to by-passing.

NOTE 2 Where, for a three-phase circuit, a single value of peak value of by-pass making current is referred to, this is, unless otherwise stated, the highest value in any phase.

NOTE 3 The maximum power-frequency fault current at a particular location or the maximum varistor coordinating current is generally much lower than the rated peak withstand current of by-pass switch.

3.9 Index of definitions

*Add, under "*B*", the following new line:*

By-pass making current 3.7.106

*Delete, under "*P*", the existing line "*peak value of the transient by-pass current*".*

4.101 Rated operating sequence

Replace the existing Notes 1, 2 and 3 of this subclause by the following new text and notes:

where

C represents a closing operation;

OC represents an opening operation followed immediately (that is, without any intentional delay) by a closing operation;

t and t' are time intervals between successive operations;

t and t' should always be expressed in minutes or in seconds.

If the by-passing-insertion time is adjustable, the limits of adjustment should be specified.

NOTE 1 Instead of t = 0,3 s, other value: t = 0,2 s is also used for by-pass switches intended for rapid auto-reopening.

NOTE 2 Instead of t' = 3 min., other values: t' = 15 s and t' = 1 min are also used for by-pass switches intended for rapid auto-reopening.

NOTE 3 Other operating sequences may be specified depending upon system requirements.

4.102 Rated by-pass making current (I_{BP})

Replace the existing first paragraph of this subclause by the following new paragraph:

The rated by-pass making current is the maximum value of the by-pass making current that the by-pass switch shall be capable of making under line fault condition when the capacitor bank is pre-charged to the limiting voltage of the overvoltage protector (U_{PL}) and with a frequency of the by-pass discharge current corresponding to the actual capacitance of the capacitor bank with its associated inductance of the damping circuit. The effective damping of the by-pass discharge current can be taken into consideration.

Replace the existing note of this subclause by the following new note:

NOTE The rated by-pass making current should be determined by system studies as the maximum sum of the instantaneous capacitor bank discharge current and the instantaneous fault current component during the pre-arcing period (see also IEC 60143-2). A value of pre-arcing time of 5 ms is suggested in case no data is available.

Replace the existing third paragraph of this subclause by the following new paragraph:

The by-pass making performance is covered when the required peak value of the by-pass making current is equal to or lower than the peak current value used in the relevant type test. This rule is considered to be valid only when the frequency f_{BP} of the by-pass making current is equal to or lower than 130 % of the corresponding value used during type tests.

6.104.5 Number of making operations

Replace the existing text of the subclause, including the note, by the following new text and table:

The by-pass making current test can be performed using one of the two alternatives given in Table 7.

The by-pass switch conditions shall be in accordance with 6.102.3.1.

Table 7 – Test procedures for by-pass making current tests

Alternative	No. of making operations	Test current
Alternative 1	20	I_{BP}
Alternative 2	4 20	I_{BP} $I_{DISCHARGE}$

8 Guide to the selection of by-pass switches for service

Replace the existing text of this subclause by the following new text:

For more information refer to IEC 60143-1, IEC 60143-2 and Annexes E and F of this standard.

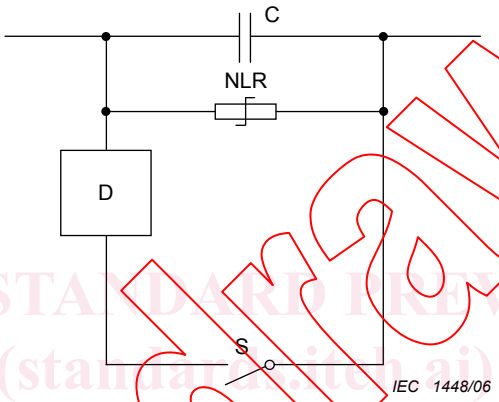
Annex E – By-pass switches used as the primary by-passing devices

Replace the existing annex by the following new annex:

Annex E
(normative)

By-pass switches used as the primary by-passing devices

By-pass switches are sometimes used as the primary protection of the overvoltage protector of the series capacitor bank (e.g. without the use of a fast by-passing device such as a spark-gap) for cases where the power-frequency fault current is relatively low (capacitor banks generally located in the middle of the line length) or where the use of a spark-gap could result in non-reliable operation of the spark-gap. For such series capacitor schemes, the varistor bank is designed to absorb the resulting energy produced by a line fault until the by-pass switch is closed. Figure E.1 illustrates the typical component layout.



Key

C	series capacitor
NLR	non linear resistor (varistor)
D	damping circuit
S	by-pass switch

Figure E.1 – Typical component layout for by-pass switches used as the primary by-passing device

For this particular application, the requirements stated in this standard also apply with the following addition.

The by-pass switch will be subjected, for all line faults, to the capacitor bank discharge current component ($I_{DISCHARGE}$) and to the power-frequency fault current. For schemes using fast by-passing devices (for example spark-gap), these types of stresses are not frequent since they are almost always seen by the fast by-passing device and not by the by-pass switch.

Test parameters of already performed by-pass making current tests can be used to qualify a by-pass switch for this specific application as follows:

– A by-pass switch has been tested following alternative 1 (see 6.104.5) at a by-pass making current I_{BP}. This by-pass switch can be used as a primary by-passing device in an installation having a by-pass making current of up to the tested I_{BP}.

– A by-pass switch has been tested following alternative 2 (see 6.104.5) at a by-pass making current I_{BP} and a discharge current $I_{DISCHARGE}$. The tested parameters result in an equivalent I_{BPE} for gapless application as follows:

$$(I_{BP})^2 \times 4 + (I_{DISCHARGE})^2 \times 20 = (I_{BPE})^2 \times 20 \rightarrow I_{BPE} = \sqrt{\frac{(I_{BP})^2}{5} + (I_{DISCHARGE})^2}$$

Example: A by-pass switch has been tested following alternative 2 (see 6.104.5) at a by-pass making current of 120 kA and a discharge current of 70 kA. The tested parameters give an equivalent I_{BPE} for gapless application as follows:

$(120)^2 \times 4 + (70)^2 \times 20 = (I_{BPE})^2 \times 20 \rightarrow I_{BPE} = 88{,}2$ kA.

This by-pass switch can be used as the primary by-passing device in an installation having a by-pass making current of up to 88,2 kA.

Annex F – Explanatory note regarding transient recovery voltage during reinsertion

Add, after the existing key for "I_N", the following new text:

X_C is the capacitive reactance in Ω of the series capacitor bank ($X_C = 1/\omega_1 C$);

X_L is the inductive reactance in Ω of the series compensated line ($X_L = \omega_1 L$);

C is the capacitance of the series capacitor bank;

L is the inductance of the series compensated line.

AVANT-PROPOS

Le présent amendement a été établi par le sous-comité 17A: Appareillage à haute tension, du comité d'études 17 de la CEI: Appareillage.

Le texte de cet amendement est issu des documents suivants:

FDIS	Rapport de vote
17A/1038/FDIS	17A/1043/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cet amendement.

Le comité a décidé que le contenu de cet amendement et de la publication de base ne sera pas modifié avant la date de stabilité indiquée sur le site web de la CEI sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

3.7.106

valeur de crête du courant de contournement transitoire

Remplacer le terme, la définition et les notes existants comme suit:

courant de contournement établi
valeur de crête du courant de contournement dans un pôle d'un interrupteur de contournement pendant la période transitoire qui suit l'établissement du courant pendant une manœuvre de contournement. Cette valeur est la valeur instantanée maximale de la somme des composantes du courant de décharge de la batterie de condensateurs et du courant à fréquence industrielle. Dans le cas de défaut sur le réseau, le courant de défaut à fréquence industrielle est égal au courant de coordination maximal de la varistance ou, dans les cas d'installation sans varistance, au courant de défaut à fréquence industrielle maximal réel à l'emplacement particulier

NOTE 1 La valeur de crête peut être différente d'un pôle à l'autre et d'une manœuvre à l'autre car elle dépend de la tension instantanée du condensateur avant le contournement.

NOTE 2 Lorsqu'une seule valeur de crête du courant de contournement établi est indiquée pour un circuit triphasé, il s'agit de la plus grande valeur dans n'importe quelle phase, sauf indication contraire.

NOTE 3 Le courant de défaut à fréquence industrielle maximal à un endroit particulier ou le courant de coordination maximal de la varistance est généralement nettement inférieur à la valeur de crête du courant admissible assigné de l'interrupteur de contournement.