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INTERNATIONAL STANDARD

colour inside

Surge arresters –
Part 5: Selection and application recommendations

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FOREWORD

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International Standard IEC 60099-5 has been prepared by IEC technical committee 37: Surge arresters.

This third edition cancels and replaces the second edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition regarding the new surge arrester classification introduced in IEC 60099-4:2014:

a) Expanded discussion of comparison between the old and new classification and how to calculate or estimate the corresponding charge for different stresses.
b) New annexes dealing with:
   – Comparison between line discharge classes and charge classification
   – Estimation of arrester cumulative charges and energies during line switching

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

FDIS	Report on voting
37/437/FDIS	37/439/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60099 series, published under the general title *Surge arresters*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SURGE ARRESTERS –

Part 5: Selection and application recommendations

1 Scope

This part of IEC 60099 provides information, guidance, and recommendations for the selection and application of surge arresters to be used in three-phase systems with nominal voltages above 1 kV. It applies to gapless metal-oxide surge arresters as defined in IEC 60099-4, to surge arresters containing both series and parallel gapped structure – rated 52 kV and less as defined in IEC 60099-6 and metal-oxide surge arresters with external series gap for overhead transmission and distribution lines (EGLA) as defined in IEC 60099-8. In Annex J, some aspects regarding the old type of SiC gapped arresters are discussed.

Surge arrester residual voltage is a major parameter to which most users have paid a lot of attention to when selecting the type and rating. Typical maximum residual voltages are given in Annex F. It is likely, however, that for some systems, or in some countries, the requirements on system reliability and design are sufficiently uniform, so that the recommendations of the present standard may lead to the definition of narrow ranges of arresters. The user of surge arresters will, in that case, not be required to apply the whole process introduced here to any new installation and the selection of characteristics resulting from prior practice may be continued.

Annexes H and I present comparisons and calculations between old line discharge classification and new charge classification.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60071-1:2006, *Insulation co-ordination – Part 1: Definitions, principles and rules*
IEC 60071-1:2006/AMD1:2010

IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*

IEC TR 60071-4, *Insulation co-ordination – Part 4: Computational guide to insulation co-ordination and modelling of electrical networks*

IEC 60099-4:2009, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60099-4:2014, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*

IEC 60099-6:2002, *Surge arresters – Part 6: Surge arresters containing both series and parallel gapped structures – Rated 52 kV and less*

IEC 60099-8:2011, *Surge arresters – Part 8: Metal-oxide surge arresters with external series gap (EGLA) for overhead transmission and distribution lines of a.c. systems above 1 kV*

IEC 60507, *Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems*

IEC TS 60815-1:2008, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-203, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

NOTE These terms follow standard definitions as close as possible, but are not in all cases exact citations of definitions in other IEC standards.

3.1
arrester – dead-front type, dead-front arrester
arrester assembled in a shielded housing providing system insulation and conductive earth shield, intended to be installed in an enclosure for the protection of underground and pad mounted distribution equipment and circuits

Note 1 to entry: Most dead-front arresters are load-break arresters.

Note 2 to entry: The use of dead-front arresters is common in the USA.

3.2
arrester disconnector
device for disconnecting an arrester from the system in the event of arrester failure, to prevent a persistent fault on the system and to give visible indication of the failed arrester

Note 1 to entry: Clearing of the fault current through the arrester during disconnection generally is not a function of the device.

3.3
arrester – liquid-immersed type
arrester designed to be immersed in an insulating liquid

3.4
arrester – separable type, separable arrester
arrester assembled in an insulated or screened housing providing system insulation, intended to be installed in an enclosure for the protection of distribution equipment and systems

Note 1 to entry: Electrical connection may be made by sliding contact or by bolted devices; however, all separable arresters are dead-break arresters.

Note 2 to entry: The use of separable arresters is common in Europe.

3.5
back flashover rate
BFOR
characteristics of an overhead line or system with respect to the number of back flashovers typically given per 100 km and year

3.6
bending moment
horizontal force acting on the arrester housing multiplied by the vertical distance between the mounting base (lower level of the flange) of the arrester housing and the point of application of the force

3.7
continuous current of an arrester
current flowing through the arrester when energized at the continuous operating voltage

Note 1 to entry: The continuous current, which consists of a resistive and a capacitive component, may vary with temperature, stray capacitance and external pollution effects. The continuous current of a test sample may, therefore, not be the same as the continuous current of a complete arrester.

Note 2 to entry: The continuous current is, for comparison purposes, expressed either by its r.m.s. or peak value.

3.8
continuous operating voltage of an arrester
U_c
designated permissible r.m.s. value of power-frequency voltage that may be applied continuously between the arrester terminals in accordance with IEC 60099-4 and 60099-6

3.9
dead-break arrester
arrester which can be connected and disconnected from the circuit only when the circuit is de-energized

3.10
discharge current of an arrester
impulse current which flows through the arrester

3.11
disruptive discharge
phenomenon associated with the failure of insulation under electric stress, which include a collapse of voltage and the passage of current

Note 1 to entry: The term applies to electrical breakdowns in solid, liquid and gaseous dielectric, and combinations of these.

Note 2 to entry: A disruptive discharge in a solid dielectric produces permanent loss of electric strength. In a liquid or gaseous dielectric, the loss may be only temporary.

3.12
externally gapped line arresters
EGLA
a line surge arrester designed with an external spark gap in series with a SVU part, defined in 3.57, to protect the insulator assembly from lightning caused fast-front overvoltages only

Note 1 to entry: This is accomplished by raising the sparkover level of the external series gap to a level that isolates the arrester from power frequency overvoltages and from the worst case slow-front overvoltages due to switching and fault events expected on the line to which it is applied.