

INTERNATIONAL STANDARD

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Surge arresters – **STANDARD PREVIEW**
Part 9: Metal-oxide surge arresters without gaps for HVDC converter stations
(standards.iteh.ai)

Parafoudres –
Partie 9: Parafoudres à oxyde métallique sans éclateur pour postes de
conversion CCHT

IEC 60099-9:2014
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Partie 9: Parafoudres à oxyde métallique sans éclateur pour postes de
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SURGE ARRESTERS –**Part 9: Metal-oxide surge arresters without
gaps for HVDC converter stations**

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FDIS	Report on voting
37/417/FDIS	37/422/RVD

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SURGE ARRESTERS –

Part 9: Metal-oxide surge arresters without gaps for HVDC converter stations

1 Scope

This part of IEC 60099 applies to non-linear metal-oxide resistor type surge arresters without spark gaps designed to limit overvoltages in HVDC converter stations of two terminal, multiterminal and back-to-back type up to and including an operating voltage of 1 100 kV. The standard applies in general to porcelain-housed and polymer-housed type arresters but also to gas-insulated metal enclosed arresters (GIS-arresters) solely used as d.c. bus and d.c. line/cable arresters. Arresters for voltage source converters are not covered. Arresters applied on the a.c. systems at the converter station and subjected to power-frequency voltage of 50 or 60 Hz principally without harmonics are tested as per IEC 60099-4. The arresters on a.c.-filters are tested according to this standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- IEC 60060-1, *High-voltage test techniques – Part 1: General definitions and test requirements*
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- IEC 60060-2, *High-voltage test techniques – Part 2: Measuring systems*
- IEC 60068-2-11:1981, *Environmental testing – Part 2: Tests. Test Ka: Salt mist*
- IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*
- IEC 60068-2-17, *Basic environmental testing procedures – Part 2-17: Tests – Test Q: Sealing*
- IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*
- IEC TS 60071-5:2002, *Insulation co-ordination – Part 5: Procedures for high-voltage direct current (HVDC) converter stations*
- IEC 60099-4:2004, *Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems*
- IEC 60143-2, *Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks*
- IEC 60270, *High-voltage test techniques – Partial discharge measurements*
- IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*
- IEC TS 60815-2, *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems*

IEC 62217, *Polymeric HV insulators for indoor and outdoor use – General definitions, test methods and acceptance criteria*

IEC 62271-200:2011, *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 62271-203:2011, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR/TR 18-2, *Radio interference characteristics of overhead power lines and high-voltage equipment – Part 2: Methods of measurement and procedure for determining limits*

3 Terms and definitions

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

3.1

acceptance tests

tests made on arresters or representative samples after agreement between manufacturer and user

3.2

bending moment

force perpendicular to the longitudinal axis of an arrester multiplied by the vertical distance between the mounting base (lower level of the flange) of the arrester and the point of application of the force

3.3

breaking load

force perpendicular to the longitudinal axis of a porcelain-housed arrester leading to mechanical failure of the arrester housing

3.4

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.

3.5

continuous operating voltage of an HVDC-arrester

U_{cHVDC}

maximum continuous voltage characterized by the voltages CCOV, PCOV and DCOV and the frequency DFCOV where applicable and that may be applied continuously between the arrester terminals

3.6

coordination current of an arrester

for a given system under study and for each class of overvoltage, the current through the arrester for which the representative overvoltage is determined

Note 1 to entry: Standard shapes of coordination currents for steep-front, lightning and switching current impulses are given in IEC 60099-4.

Note 2 to entry: The coordination currents are determined by system studies.

3.7 crest value of continuous operating voltage CCOV

highest continuously occurring crest value of the voltage across the arrester excluding commutation overshoots and commutation notches and calculated with a system model valid for up to approximately 5 kHz

Note 1 to entry: As an example, see Figure 10, given for valve arresters.

3.8 damage limit (mechanical)

lowest value of a force perpendicular to the longitudinal axis of a polymer-housed arrester leading to mechanical failure of the arrester housing

3.9 d.c. component of the continuous operating voltage DCOV

highest mean or average of the continuous operating voltage, U_{CHVDC} , across the arrester, excluding harmonics and commutation overshoots

Note 1 to entry: As an example, see Figure 11, given for bridge arrester.

3.10 d.c. system voltage

highest mean or average operating voltage to earth, excluding harmonics and commutation overshoots

3.11 designation of an impulse shape

combination of two numbers, the first representing the virtual front time (T_1) and the second the virtual time to half-value on the tail (T_2)

Note 1 to entry: It is written as T_1/T_2 , both in microseconds, the sign "/" having no mathematical meaning.

3.12 discharge current of an arrester

impulse current which flows through the arrester

3.13 disruptive discharge

phenomenon associated with the failure of insulation under electric stress, which includes 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.

3.14 dominant frequency of continuous operating voltage DFCOV

the frequency of the harmonic with highest rms-value in the voltage across d.c. and a.c. filter arresters

3.15
electrical unit

portion of an arrester in which each end of the unit is terminated with an electrode which is exposed to the external environment

Note 1 to entry: An electrical unit may have more than one mechanical unit (see Figure 4 of IEC 60099-4:2004/AMD1:2009).

3.16
equivalent continuous operating voltage of an arrester
ECOV

r.m.s. value of the sinusoidal power-frequency voltage or d.c. voltage at a metal-oxide surge arrester stressed by operating voltage of any wave shape that generates the same power losses in the metal-oxide material as the actual operating voltage

3.17
flashover

disruptive discharge over a solid surface

3.18
front of an impulse

part of an impulse which occurs prior to the peak

3.19
gas-insulated metal enclosed surge arrester
GIS-arrester

gas-insulated metal-enclosed metal-oxide surge arrester without any integrated series or parallel spark gaps, filled with gas other than air

Note 1 to entry: The gas pressure is normally higher than 1 bar = 10⁵Pa.

Note 2 to entry: A surge arrester used in gas-insulated switchgear.

3.20
grading ring of an arrester

metal part, usually circular in shape, mounted to modify electrostatically the voltage distribution along the arrester

3.21
high current impulse of an arrester

peak value of discharge current having a 4/10 impulse shape which is used to test the stability of the arrester on direct lightning strokes

3.22
housing

external insulating part of an arrester, which provides the necessary creepage distance and protects the internal parts from the environment

Note 1 to entry: Housing may consist of several parts providing mechanical strength and protection against the environment.

3.23
impulse

unidirectional wave of voltage or current which, without appreciable oscillations, rises rapidly to a maximum value and falls, usually less rapidly, to zero with small, if any, excursions of opposite polarity, with defining parameters being polarity, peak value, front time and time to half-value on the tail

3.24**insulating base**

a short insulator (or set of insulators) on which the arrester is mounted to provide a means of connecting a current monitoring device between the base of the arrester and earth

3.25**internal grading system of an arrester**

grading impedances, in particular grading capacitors connected in parallel to one single or to a group of non-linear metal-oxide resistors, to control the voltage distribution along the MO resistor stack

3.26**internal parts**

MO resistors with supporting structure and internal grading system, if equipped

3.27**lightning current impulse**

8/20 current impulse with limits on the adjustment of equipment such that the measured values are from 7 μs to 9 μs for the virtual front time and from 18 μs to 22 μs for the time to half-value on the tail

Note 1 to entry: The time to half-value on the tail is not critical and may have any tolerance during the residual voltage type tests (see 9.10).

3.28**lightning impulse coordination current**

I_{lco}

a coordination current with a shape equal to the lightning current impulse

3.29**long-duration current impulse**

rectangular current impulse which rises rapidly to maximum value, remains substantially constant for a specified period and then falls rapidly to zero, with defining parameters being polarity, peak value, virtual duration of the peak and virtual total duration

3.30**mean breaking load**

MBL

the average breaking load for porcelain -housed arresters determined from tests

3.31**mechanical unit**

portion of an arrester in which the MO resistors within the unit are mechanically restrained from moving in an axial direction

Note 1 to entry: An arrester may contain more than one mechanical units within an electrical unit (see Figure 13 of IEC 60099-4:2004/AMD1:2009).

Note 2 to entry: A mechanical unit may have more than one electrical unit (see Figure 13 of IEC 60099-4:2004/AMD1:2009).

3.32**metal-oxide surge arrester without gaps**

arrester having non-linear MO resistors connected in series and/or in parallel without any integrated series or parallel spark gaps, incorporated in a housing with terminals for electrical and mechanical connection

Note 1 to entry: Wherever the term “arrester” or “surge arrester” is used in this document, the term refers to a metal-oxide surge arrester without gaps.