

# INTERNATIONAL STANDARD

# IEC 60099-4

Second edition  
2004-05

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## Surge arresters –

### Part 4: Metal-oxide surge arresters without gaps for a.c. systems

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number  
IEC 60099-4:2004(E)

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PRICE CODE **XG**

*For price, see current catalogue*

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SURGE ARRESTERS –****Part 4: Metal-oxide surge arresters without gaps  
for a.c. systems**

## FOREWORD

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International Standard 60099-4 has been prepared by IEC technical committee 37: Surge arresters.

This second edition cancels and replaces the first edition, published in 1991, amendment 1 (1998) and amendment 2 (2001).

This edition includes the following significant technical changes with respect to the previous edition.

- Clauses 1, 2 and 3 contain common subclauses that cover all arrester types. Clauses 4 to 9 contain subclauses that apply to porcelain-housed arresters. To a great extent, the content of Clauses 4 to 9 also applies to arrester types other than porcelain-housed. Any exceptions that apply to polymer-housed, GIS, separable and dead-front, and liquid-immersed arresters are included in Clauses 10 to 13 as entire subclauses, not as parts of subclauses. That is, if any subclause of Clauses 4 to 9 does not apply in its entirety to a particular type of arrester, then a replacement subclause is given in its entirety in the appropriate Clauses 10, 11, 12, or 13. This avoids the necessity for the user of the document to judgewhich part of a clause has been amended.
- Table 1 has been modified. The previous Table 1 included references to subclauses for type testing. Such references are really not appropriate in Clause 4 and have been transferred to a new table in Clause 8.
- Clauses 6, 8, 11, 12 and 13: modifications have been made to short-circuit requirements.
- Requirements of Clause 13 (mechanical considerations) have been incorporated into Clauses 5, 6, 8, 10, 11, 12 and 13, and Annex A of this new edition.

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

FDIS	Report on voting
37/298/FDIS	37/300/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.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

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

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## INTRODUCTION

This part of IEC 60099 presents the minimum criteria for the requirements and testing of gapless metal-oxide surge arresters that are applied to a.c. power systems.

Arresters covered by this standard are commonly applied to live/front overhead installations in place of the non-linear resistor-type gapped arresters covered in IEC 60099-1.

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## SURGE ARRESTERS –

### Part 4: Metal-oxide surge arresters without gaps for a.c. systems

#### 1 Scope

This part of IEC 60099 applies to non-linear metal-oxide resistor type surge arresters without spark gaps designed to limit voltage surges on a.c. power circuits.

#### 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 60060-1:1989, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2:1994, *High-voltage test techniques – Part 2: Measuring systems*

IEC 60068-2-11:1981, *Environmental testing – Part 2: Tests – Test Ka: Salt mist*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-42:2003, *Environmental testing – Part 2-42: Tests – Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60071-1:1993, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

IEC 60270:2000, *High-voltage test techniques – Partial discharge measurements*

IEC 60507:1991, *Artificial pollution tests on high-voltage insulators to be used on a.c. systems*

IEC 60815:1986, *Guide for the selection of insulators in respect of polluted conditions*

IEC 61109:1992, *Composite insulators for a.c. overhead lines with a nominal voltage greater than 1 000 V – Definitions, test methods and acceptance criteria*

IEC 61166:1993, *High-voltage alternating current circuit-breakers – Guide for seismic qualification of high-voltage alternating current circuit-breakers*

IEC 61330:1995, *High-voltage/low-voltage prefabricated substations*

IEC 62271-200:2003, *High-voltage switchgear and controlgear – Part 200: A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62271-203:2003, *High-voltage switchgear and controlgear – Part 203: Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV*

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

CISPR 18-2:1986, *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 purposes of this document, the following definitions apply.

#### 3.1

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

arrester having non-linear metal-oxide resistors connected in series and/or in parallel without any integrated series or parallel spark gaps

#### 3.2

##### **non-linear metal-oxide resistor**

part of the surge arrester which, by its non-linear voltage versus current characteristics, acts as a low resistance to overvoltages, thus limiting the voltage across the arrester terminals, and as a high resistance at normal power-frequency voltage

#### 3.3

##### **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 metal-oxide resistor stack

#### 3.4

##### **grading ring of an arrester**

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

#### 3.5

##### **section of an arrester**

complete, suitably assembled part of an arrester necessary to represent the behaviour of a complete arrester with respect to a particular test

NOTE A section of an arrester is not necessarily a unit of an arrester.

#### 3.6

##### **unit of an arrester**

completely housed part of an arrester which may be connected in series and/or in parallel with other units to construct an arrester of higher voltage and/or current rating

NOTE A unit of an arrester is not necessarily a section of an arrester.

**3.7****pressure-relief device of an arrester**

means for relieving internal pressure in an arrester and preventing violent shattering of the housing following prolonged passage of fault current or internal flashover of the arrester

**3.8****rated voltage of an arrester** $U_r$ 

maximum permissible r.m.s. value of power-frequency voltage between its terminals at which it is designed to operate correctly under temporary overvoltage conditions as established in the operating duty tests (see 8.5)

NOTE 1 The rated voltage is used as a reference parameter for the specification of operating characteristics.

NOTE 2 The rated voltage as defined in this standard is the 10 s power-frequency voltage used in the operating duty test after high-current or long-duration impulses. Tests used to establish the voltage rating in IEC 60099-1, as well as some national standards, involve the application of repetitive impulses at nominal current with power-frequency voltage applied. Attention is drawn to the fact that these two methods used to establish rating do not necessarily produce equivalent values (a resolution to this discrepancy is under consideration).

**3.9****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 8.5

**3.10****rated frequency of an arrester**

frequency of the power system on which the arrester is designed to be used

**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 The term applies to electrical breakdowns in solid, liquid and gaseous dielectric, and combinations of these.

NOTE 2 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****puncture  
breakdown**

disruptive discharge through a solid

**3.13****flashover**

disruptive discharge over a solid surface

**3.14****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

NOTE The parameters which define a voltage or current impulse are polarity, peak value, front time and time to half-value on the tail.