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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Parafoudres –
Partie 8: Parafoudres à oxyde métallique avec éclateur extérieur en série (EGLA) pour lignes aériennes de transmission et de distribution de réseaux à courant alternatif de plus de 1 kV

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FOREWORD

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International Standard IEC 60099-8 has been prepared by IEC technical committee 37: Surge arresters.

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

FDIS	Report on voting
37/370/FDIS	37/377/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 of IEC 60098 series, 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 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- withdrawn,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.

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INTRODUCTION

This part of IEC 60099 applies to the externally gapped line arrester (EGLA)

This type of surge arrester is connected directly in parallel with an insulator assembly. It comprises a series varistor unit (SVU), made up from non-linear metal-oxide resistors encapsulated in a polymer or porcelain housing, and an external series gap, see Figure 1.

The purpose of an EGLA is to protect the parallel-connected insulator assembly from lightning-caused overvoltages. The external series gap, therefore, should spark over only due to fast-front overvoltages. The gap should withstand all power-frequency and slow-front overvoltages occurring on the system.

In the event of SVU failure, the external series gap should be able to isolate the SVU from the system.

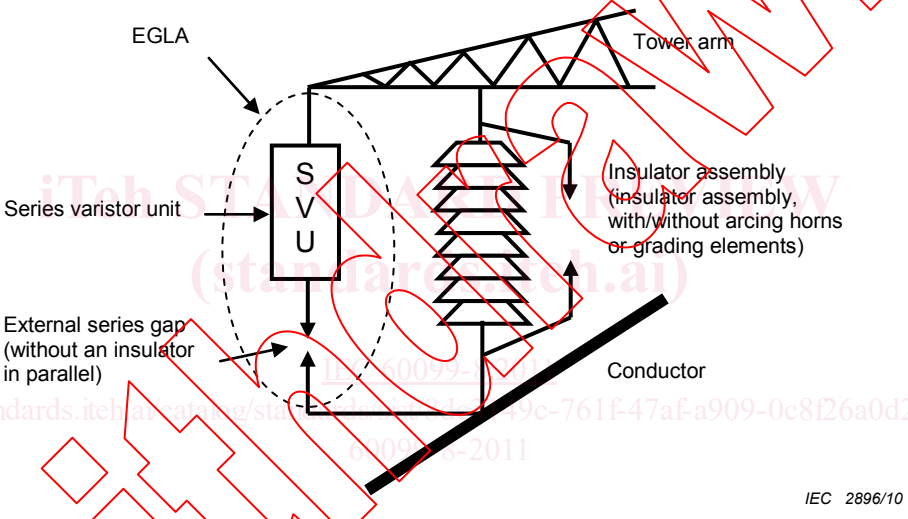

Figure 1 – Configuration of an EGLA with insulator and arcing horn

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

1 Scope

This part of IEC 60099 covers metal-oxide surge arresters with external series gap (externally gapped line arresters (EGLA) that are applied on overhead transmission and distribution lines, only to protect insulator assemblies from lightning-caused flashovers.

This standard defines surge arresters to protect the insulator assembly from lightning-caused overvoltages only. Therefore, and since the metal-oxide resistors are not permanently connected to the line, the following items are not considered for this standard:

- switching impulse sparkover voltage;
- residual voltage at steep current and switching current impulse;
- thermal stability;
- long-duration current impulse withstand duty;
- power-frequency voltage versus time characteristics of an arrester;
- disconnector test;
- aging duties by power-frequency voltage.

Considering the particular design concept and the special application on overhead transmission and distribution lines, some unique requirements and tests are introduced, such as the verification test for coordination between insulator withstand and EGLA protective level, the follow current interrupting test, mechanical load tests, etc.

Designs with the EGLA's external series gap installed in parallel to an insulator are not covered by this standard.

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 60068-2-14:2009, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

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

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/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 62217:2005, *Polymeric insulators for indoor and outdoor use with a nominal voltage > 1 000 V – General definitions, test methods and acceptance criteria*

ISO 3274, *Geometric product specifications (GPS) – Surface texture: Profile method – Nominal characteristics of contact (stylus) instruments*

ISO 4287, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General Guidance*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources*

ISO 4892-3, *Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

3 Terms and definitions

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

3.1
externally gapped line arrester
EGLA
arrester designed for installation on overhead lines to protect an insulator assembly from lightning-caused fast-front overvoltages only

NOTE This is accomplished by rising 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.

3.2
series varistor unit
SVU
non-linear metal-oxide resistor part, contained in a housing, which must be connected with an external series gap to construct the complete arrester

NOTE The series varistor unit may include several units.

3.3
section of an EGLA
complete, suitably assembled part of a complete EGLA necessary to represent the behaviour of a complete EGLA with respect to a particular test

3.4
section of an SVU
complete, suitably assembled part of an SVU unit necessary to represent the behaviour of an SVU with respect to a particular test

3.5
unit of an SVU
completely housed part of an SVU which may be connected in series and/or in parallel with other units of an SVU to construct, in combination with the external series gap, an EGLA of higher voltage and/or current rating

3.6
rated voltage of an EGLA
U_r
maximum permissible r.m.s. value of power-frequency voltage between the EGLA terminals, at which it is designed to operate correctly

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

NOTE 2 Different to the rated voltage of gapless (line) arresters, the rated voltage of an EGLA is a voltage that may be applied continuously.

3.7
reference voltage of an SVU
U_{ref}
peak value of power-frequency voltage divided by √2, which should be applied to the SVU to obtain the reference current

NOTE The reference voltage of a multi-unit SVU is the sum of the reference voltages of the individual units.

3.8
reference current of an SVU
I_{ref}
peak value (the higher peak value of the two polarities if the current is asymmetrical) of the resistive component of a power-frequency current used to determine the reference voltage of the SVU

NOTE 1 The reference current should be high enough to make the effects of stray capacitances at the measured reference voltage of the SVU units negligible. It is to be specified by the manufacturer.

NOTE 2 Depending on the nominal discharge current of the EGLA, the reference current will be typically in the range of 0,05 mA to 1,0 mA per square centimetre of metal-oxide resistor area for a single column SVU.

3.9
rated short-circuit current of an SVU
I_s
r.m.s. value of the highest short-circuit current under which the SUV will not fail in a manner that causes violent shattering of the housing and under which self-extinguishing of open flames (if any) will occur within a defined period of time

3.10
residual voltage of an EGLA
peak value of voltage that appears across the terminal-to-terminal length of the EGLA including series gap and connection leads during the passage of discharge current

3.11
residual voltage of an SVU
peak value of voltage that appears between the terminals of the SVU during the passage of discharge current

3.12
surface leakage current of an SVU
current that flows on the surface of the SVU

3.13
follow current
I_{follow}
the current immediately following an impulse through an EGLA with the power-frequency voltage as the source

3.14
specified long-term load of an SVU
SLL
mechanical force perpendicular to the longitudinal axis of an SVU, allowed to be continuously applied during service without causing any mechanical damage to the SVU

3.15
specified short-term load of an SVU
SSL
greatest mechanical force perpendicular to the longitudinal axis of an SVU, allowed to be applied during service for short periods and for relatively rare events (for example, short-circuit current loads and extreme wind gusts) without causing any mechanical damage to the SVU

3.16
mean breaking load of an SVU
MBL
the average breaking load for porcelain or cast resin-housed SVUs determined from tests

3.17
high current impulse
peak value of discharge current having a 4/10 or 2/20 impulse shape, which is used to test the withstand capability of the SVU on extreme lightning occasions

3.18
salt deposit density
SDD
the amount of salt in the deposit on a given surface of the SVU housing, divided by the area of this surface; generally expressed in mg/cm²

3.19
verification test for coordination between insulator withstand and EGLA protective level
test used to verify that the EGLA will exhibit correct sparkover operation and clamp the overvoltage caused by lightning considerably lower than the flashover voltage of the parallel-connected insulator assembly

3.20
vibration withstand test
test to verify that the SVU and its connectors can withstand the specified mechanical vibration levels

4 Identification and classification

4.1 EGLA identification

An EGLA shall be identified by the following minimum information, which shall appear on a nameplate permanently attached to the arrester:

- rated voltage U_r in kV;
- rated frequency in Hz, only if it is less than 48 Hz or larger than 62 Hz;
- classification series information (examples: "X1", "Y2");

- rated short-circuit current I_s in kA;
- manufacturer's name or trade mark;
- year of manufacture;
- serial number (at least for arresters for U_m > 52 kV);
- lightning discharge capability (only charge value) in C; example: "8 C".

Information on required gap spacing including tolerances shall be given in an appropriate way, for example in the manual.

4.2 EGLA classification

EGLAs are classified by their nominal discharge currents and their high current impulse withstand capabilities as per Table 1, and they shall meet at least the test requirements and performance characteristics specified in Table 3. These arresters have no operating duties for slow-front surges and power-frequency overvoltages.

Table 1 – EGLA classification – "Series X" and "Series Y"

Series X					Series Y				
Class name	X1	X2	X3	X4	Class name	Y1	Y2	Y3	Y4
Nominal discharge current (kA), 8/20	5	5	10	20	Nominal discharge current (kA), 2/20	5	10	15	20
High current impulse (kA), 4/10	40	65	100	100	High current impulse (kA), 2/20	10	25	40	65
NOTE 1 "Series X" corresponds to the classification used in IEC 60099-4. A nominal discharge current of 8/20 wave shape and a high current impulse of 4/10 wave shape are used in IEC and in IEEE standards. "Series Y" corresponds to the classification applied e.g. in Japan on shielded line applications. Specification of wave shape 2/20 both for the nominal discharge current and for the high current impulse is based on this special application.									
NOTE 2 According to service conditions, other high current impulse values than those specified in this table may be applied.									

5 Standard ratings and service conditions

5.1 Standard rated voltages

Standard values of rated voltages (r.m.s. values) are specified in Table 2 in equal voltage steps within specified voltage ranges.

Table 2 – Steps of rated voltages (r.m.s. values)

Range of rated voltages (kV)	Steps of rated voltage (kV)
3 - 30	1
> 30 - 54	3
> 54 - 96	6
> 96 - 288	12
> 288 - 396	18
> 396	24
NOTE Other values of rated voltage may be acceptable, provided they are multiples of 6.	

5.2 Standard rated frequencies

The standard rated frequencies are 48 Hz to 62 Hz.

5.3 Standard nominal discharge currents

The standard nominal discharge currents for 8/20 or 2/20 shapes are: 5 kA, 10 kA, 15 kA and 20 kA.

5.4 Service conditions

5.4.1 Normal service conditions

EGLAs which conform to this standard shall be suitable for normal operation under the following normal service conditions:

a) ambient air temperature within the range of –40 ºC to +40 ºC;

b) altitude not exceeding 1000 m;

c) frequency of the a.c. power supply not less than 48 Hz and not more than 62 Hz;

d) power-frequency voltage applied continuously between the terminals of the EGLA not exceeding its rated voltage;

e) mechanical conditions: not specified (see NOTE);

f) wind speed: not specified (see NOTE);

g) pollution conditions: pollution by dust, smoke, corrosive gases, vapours or salt may occur; pollution does not exceed “heavy” as defined in IEC/TS 60815-1.

NOTE It is recognized that mechanical and environmental issues are important for service, but due to the large variety of possible installation configurations it is not possible to provide standard values for items e) and f).

5.4.2 Abnormal service conditions

Surge arresters subject to other than normal application or service conditions may require special consideration in design, manufacture or application. The use of this standard in case of abnormal service conditions shall be subject to agreement between the manufacturer and the purchaser.

6 Requirements

6.1 Insulation withstand of the SVU and the complete EGLA

6.1.1 Insulation withstand of the housing of the SVU

The housing of the SVU shall withstand a lightning impulse voltage of

a) for "Series X": 1,4 times the residual voltage at the nominal discharge current

b) for "Series Y": 1,13 times the residual voltage at high current impulse, but not less than 1,3 times the residual voltage at nominal discharge current

NOTE The factor of 1,4 in case a) covers variations in atmospheric conditions and discharge currents up to three times the nominal discharge current.

6.1.2 Insulation withstand of EGLA with shorted (failed) SVU

The EGLA shall have the following insulation withstand performance:

a) the EGLA shall withstand the specified switching impulse withstand voltage level of the system even if the SVU has been shorted due to overloading (failure);