



BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN 60099-8:2011. It is identical to IEC 60099-8:2011.

The UK participation in its preparation was entrusted to Technical Committee PEL/37, Surge Arresters - High Voltage.

A list of organizations represented on this committee can be obtained on request to its secretary.

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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 60099-8:2011)

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
(CEI 60099-8:2011)

Überspannungsableiter – Teil 8:

Metalloxid-Überspannungsableiter mit
externer Serienfunkenstrecke (EGLA) für
Übertragungs- und Verteilungsleitungen
von Wechselstromsystemen über 1 kV
(IEC 60099-8:2011)

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Foreword

The text of document 37/370/FDIS, future edition 1 of IEC 60099-8, prepared by IEC TC 37, Surge arresters, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60099-8 on 2011-03-03.

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The following dates were fixed:

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Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60099-8:2011 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	1989	High-voltage test techniques - Part 1: General definitions and test requirements	HD 588.1 S1 ¹⁾	1991
IEC 60060-2	1994	High-voltage test techniques - Part 2: Measuring systems	EN 60060-2 ²⁾	1994
IEC 60068-2-11	1981	Environmental testing - Part 2-11: Tests - Test Ka: Salt mist	EN 60068-2-11	1999
IEC 60068-2-14	2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	2009
IEC 60099-4 (mod) + A1 + A2	2004 2006 2009	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4 + A1 + A2	2004 2006 2009
IEC 60270	2000	High-voltage test techniques - Partial discharge measurements	EN 60270	2001
IEC 60507	1991	Artificial pollution tests on high-voltage insulators to be used on a.c. systems	EN 60507	1993
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	EN 62217	2006
ISO 3274	-	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Nominal characteristics of contact (stylus) instruments	EN ISO 3274	-
ISO 4287	-	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters	EN ISO 4287	-

¹⁾ HD 588.1 S1 is superseded by EN 60060-1:2010, which is based on IEC 60060-1:2010.

²⁾ EN 60060-2 is superseded by EN 60060-2:2011, which is based on IEC 60060-2:2010.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 4892-1	-	Plastics - Methods of exposure to laboratory light sources - Part 1: General guidance	EN ISO 4892-1	-
ISO 4892-2	-	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	EN ISO 4892-2	-
ISO 4892-3	-	Plastics - Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps	EN ISO 4892-3	-

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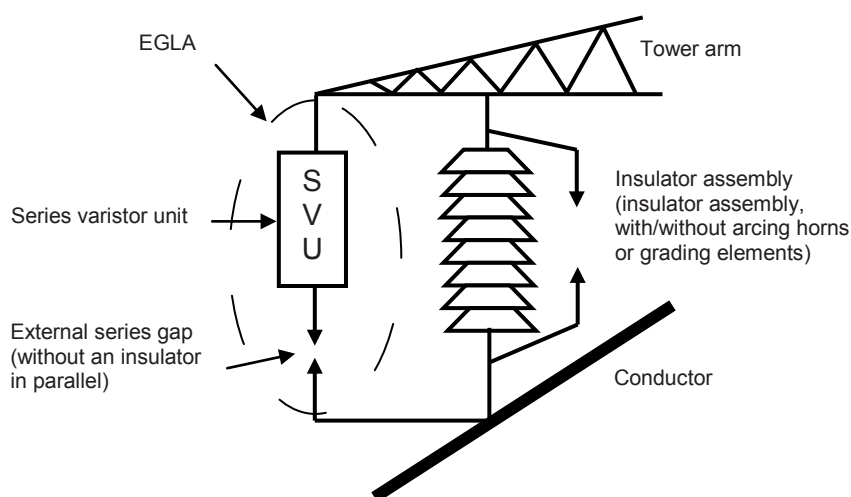
INTRODUCTION

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.



IEC 2896/10

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;
- disconnecter 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 $\sqrt{2}$, 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 SVU 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 °C to $+40\text{ °C}$;
- 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);

- b) the EGLA shall be able to withstand the maximum temporary overvoltages phase to ground for their maximum durations even if the SVU has been shorted due to overloading (failure).

6.2 Residual voltages

The purpose of the measurement of residual voltages is to obtain the maximum residual voltages for a given design for all specified currents and wave shapes. These are derived from the type test data and from the maximum residual voltage at a lightning impulse current used for routine tests as specified and published by the manufacturer.

The maximum residual voltage of a given EGLA design for any current and wave shape is calculated from the residual voltage of SVU sections tested during type tests multiplied by a specific scale factor plus a calculated inductive voltage drop across the SVU, the gap and connection leads. The scale factor is equal to the ratio of the declared maximum residual voltage, as checked during the routine tests, to the measured residual voltage of the sections at the same current and wave shape.

The value of the residual voltage of the EGLA at nominal discharge current and at high current impulse, respectively, multiplied by a factor as given in 6.1.1, shall be lower than the minimum flashover voltage of the insulator assembly to be protected.

6.3 High current duty

The capability of the SVU for discharging operations shall be demonstrated by injecting two high current impulses.

6.4 Lightning discharge capability

The capability of the metal-oxide resistors to withstand lightning discharges having current waveforms with durations of several tens of microseconds for arresters applied on shielded lines and several hundreds of microseconds for arresters on unshielded lines shall be demonstrated. The related test also covers effects of multiple lightning strikes.

6.5 Short-circuit performance of the SVU

The manufacturer shall claim a short-circuit rating of the SVU. The short-circuit currents according to this rating shall not cause violent shattering of the SVU, and any open flames shall self-extinguish in a given time.

NOTE The gap is not subject of the short-circuit tests on the SVU, and its short-circuit performance should be verified separately. The gap should be able to maintain its mechanical integrity after having been subjected to the rated short-circuit current of the EGLA, and its sparkover voltage should not be decreased.

6.6 Mechanical performance

For the EGLA to be mounted on transmission towers or poles, mechanical performance to withstand tensile, bending and/or vibration loads due to wind pressure, conductor vibration abnormal load during installation work and moisture ingress shall be demonstrated.

The applicable values of tensile and bending loads shall be agreed between the manufacturer and the purchaser.

The SVU shall be able to withstand the vibration load to be expected in service.

NOTE The complete EGLA including gap assembly and mounting structure should be able to withstand at least the same mechanical stress.

6.7 Weather aging of SVU

The SVU must be able to withstand the environmental stress expected in service. Environmental tests demonstrate by accelerated test procedures that the sealing mechanism and the exposed metal combinations of the SVU are not impaired by environmental conditions. For SVUs with polymer (composite and cast resin) housings, resistance to UV radiation has to be demonstrated in addition.

NOTE A revision of the UV test is currently under consideration by Cigré WG D1.14.

6.8 Reference voltage of the SVU

The reference voltage (U_{ref}) of the SVU shall be measured at the reference current on sections and units when required. The measurement shall be performed at an ambient temperature of $20\text{ °C} \pm 15\text{ K}$, and the actual temperature shall be recorded.

NOTE As an acceptable approximation, the instantaneous value of the current at the instant of voltage peak may be taken to correspond to the peak value of the resistive component of current.

6.9 Internal partial discharges

The level of internal partial discharges in the SVU in the tests according to 9.1 and 10.3 shall not exceed 10 pC.

6.10 Coordination between insulator withstand and EGLA protective level

The correct coordination between flashover characteristics of the insulator assembly, the sparkover voltage of the EGLA with front-of-wave and standard lightning impulses and the residual voltage of the EGLA at nominal discharge current and, for "Series Y" arresters, at high current impulse shall be demonstrated.

Any sparkover operation for lightning impulse voltage shall occur in the external series gap of the EGLA, without causing any flashover of the insulator assembly to be protected.

The value of

- for "Series X": 1,4 times the residual voltage at the nominal discharge current according to Table 1 and 8.3.3;
- 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 according to Table 1 and 8.3.3 and 8.3.4

must be lower than $U_{50, \text{Insulator}}$ minus X times the standard deviation, ($U_{50, \text{Insulator}} - X \cdot \sigma$), of the insulator assembly to be protected, where $\sigma = 0,03$ and X is to be agreed upon between manufacturer and user, a recommended value being $X = 2,5$.

6.11 Follow current interrupting

Follow current interrupting operation of the EGLA under wet and polluted conditions shall be demonstrated by a test procedure which takes these operating conditions into account. Performing a follow current interrupting test is mandatory, either as a type test according to 8.8 or as an acceptance test according to 10.6.

6.12 Electromagnetic compatibility

Arresters are not sensitive to electromagnetic disturbances, and therefore no immunity test is necessary.

In normal working operating conditions, the EGLA shall not emit significant disturbances. A radio interference voltage test (RIV) shall be applied as an acceptance test to the complete

EGLA (see 10.4). The maximum radio interference level of the EGLA energized at the maximum continuous phase to ground system voltage ($U_g/\sqrt{3}$) shall not exceed 2 500 μV .

6.13 End of life

On request from users, each manufacturer shall give enough information so that all the arrester components may be scrapped and/or recycled in accordance with international and national regulations.

7 General testing procedure

7.1 Measuring equipment and accuracy

The measuring equipment shall meet the requirements of IEC 60060-2 and IEC 60099-4. The values obtained shall be accepted as accurate for the purpose of compliance with the relevant test clauses.

Unless stated elsewhere, all tests with power-frequency voltages shall be made with an alternating voltage having a frequency between the limits of 48 Hz and 62 Hz and an approximately sinusoidal wave shape.

7.2 Test samples

Unless otherwise specified, for each test item, the complete test sequence shall be carried out on the same test sample. The number of test samples is given in Table 3. The test samples shall be new, clean, completely assembled and arranged to simulate the condition in service.

When tests are made on sections or units, the following shall be fulfilled:

- a) The ratio between rated voltage of the complete EGLA to the rated voltage of the section or unit is defined as n .
- b) The volume of the resistor elements used as test samples shall not be greater than the minimum volume of all resistor elements used in the complete EGLA divided by n .
- c) The reference voltage U_{ref} of the SVU of the test section should be equal to the minimum reference voltage of the SVU of the EGLA divided by n . If the reference voltage of the SVU of the test section is greater than the minimum reference voltage of the SVU of the complete EGLA divided by n , the factor n shall be reduced correspondingly. If the reference voltage of the SVU of the test section is less than the minimum reference voltage of the SVU of the complete EGLA divided by n , the test section is not allowed to be used.

The factor n of the test samples shall be recorded in the test report.

8 Type tests

8.1 General

Table 3 identifies the type tests that shall be performed on the complete EGLA or on components of the EGLA.

Table 3 – Type tests (all tests to be performed without insulator assembly)

Test item	Number of test samples	EGLA	Section of EGLA	Unit of SVU	Section of SVU	Clause number
Insulation withstand tests						
1.1 Housing withstand test of SVU	1			Test		8.2.2
1.2 EGLA withstand test with failed SVU	1	Test				8.2.3
2. Residual voltage tests	3				Test	8.3
3. Standard lightning impulse sparkover test ^{a)}	1	Test				8.4
4. High current impulse withstand test	3				Test	8.5
5. Lightning discharge capability test	3				Test	8.6
6. Short-circuit tests	4 or 5			Test		8.7
7. Follow current interrupting test ^{b)}	1	Test ^{c)}	Test ^{c)}			8.8
8. Bending test	3 or 6			Test		8.9.1
9. Vibration test ^{d)}	1			Test ^{e)}		8.9.2
10. Weather aging test	1			Test		8.10
^{a)} This test is mandatory if not performed as an acceptance test in accordance with 10.5. ^{b)} This test is mandatory if not performed as an acceptance test in accordance with 10.6. ^{c)} This test is performed either on a complete EGLA or a section of an EGLA, see 8.8.2. ^{d)} This test is mandatory if not performed as an acceptance test in accordance with 10.7. ^{e)} The vibration test is performed on one complete SVU, see 8.9.2.1						

8.2 Insulation withstand tests on the SVU housing and on the EGLA with failed SVU

8.2.1 General

These tests demonstrate the lightning impulse withstand voltage of the SVU housing under dry conditions and the withstand voltage of the EGLA against the maximum expected switching surge and power-frequency overvoltages in the system under wet conditions if the SVU had failed and is shorted.

8.2.2 Insulation withstand test on the SVU housing

8.2.2.1 General

This test demonstrates the dielectric withstand capability of the external housing of the SVU against lightning impulse voltages.

8.2.2.2 Test procedure

The SVU housing shall be subjected to a standard lightning impulse voltage dry test according to procedure A or B in 20.1 of IEC 60060-1.

The test shall be performed on the SVU housing with the highest specific voltage stress per unit length. The non-linear metal-oxide resistors shall be removed or replaced by parts of insulating material.

Fifteen consecutive impulses at the test voltage value shall be applied for each polarity.