



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 (IEC 60099-8:2017)

National foreword

This British Standard is the UK implementation of EN IEC 60099-8:2018. It is identical to IEC 60099-8:2017. It supersedes BS EN 60099-8:2011, which is withdrawn.

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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 580 97606 3

ICS 25.040.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2018.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

EUROPEAN STANDARD

EN IEC 60099-8

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2018

ICS 29.240.10

Supersedes EN 60099-8:2011

English Version

**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 60099-8:2017)**

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
(IEC 60099-8:2017)

Überspannungsableiter - Teil 8: Metalloxid-Überspannungsableiter mit externer Serienfunkenstrecke (EGLA) für Übertragungs- und Verteilungsleitungen von Wechselstromsystemen über 1 kV
(IEC 60099-8:2017)

This European Standard was approved by CENELEC on 2017-12-19. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 37/436/FDIS, future edition 2 of IEC 60099-8, prepared by IEC/TC 37 "Surge arresters" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60099-8:2018.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-09-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-12-19

This document supersedes EN 60099-8:2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60099-8:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

ISO 3274 NOTE Harmonized as EN ISO 3274.

Annex ZA
 (normative)

**Normative references to international publications
 with their corresponding European publications**

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60060-1	2010	High-voltage test techniques -- Part 1: General definitions and test requirements	EN 60060-1	2010
IEC 60060-2	2010	High-voltage test techniques -- Part 2: Measuring systems	EN 60060-2	2011
IEC 60068-2-11	1981	Basic environmental testing procedures - 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	2014	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems	EN 60099-4	2014
IEC 60270	2000	High-voltage test techniques - Partial discharge measurements	EN 60270	2001
IEC 60507	2013	Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems	EN 60507	2014
IEC 62217	2012	Polymeric HV insulators for indoor and outdoor use - General definitions, test methods and acceptance criteria	EN 62217	2013
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		-
ISO 4287	-	Geometrical Product Specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters	EN ISO 4287	-
ISO 4892-1	-	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	EN ISO 4892-1	-
ISO 4892-2	-		EN ISO 4892-2	-
ISO 4892-3	-		EN ISO 4892-3	-

CONTENTS

FOREWORD	6
INTRODUCTION	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	10
4 Identification and classification	13
4.1 EGLA identification	13
4.2 EGLA classification	13
5 Standard ratings and service conditions	14
5.1 Standard rated voltages	14
5.2 Standard rated frequencies	14
5.3 Standard nominal discharge currents	14
5.4 Service conditions	14
5.4.1 Normal service conditions	14
5.4.2 Special service conditions	14
6 Requirements	15
6.1 Insulation withstand of the SVU and the complete EGLA	15
6.1.1 Insulation withstand of the housing of the SVU	15
6.1.2 Insulation withstand of EGLA with shorted (failed) SVU	15
6.2 Residual voltages	15
6.3 High current duty	15
6.4 Lightning discharge capability	15
6.5 Short-circuit performance of the SVU	15
6.6 Mechanical performance	16
6.7 Weather aging of SVU	16
6.8 Reference voltage of the SVU	16
6.9 Internal partial discharges	16
6.10 Coordination between insulator withstand and EGLA protective level	16
6.11 Follow current interrupting	17
6.12 Electromagnetic compatibility	17
6.13 End of life	17
7 General testing procedure	17
7.1 Measuring equipment and uncertainty	17
7.2 Test samples	17
8 Type tests	18
8.1 General	18
8.2 Insulation withstand tests on the SVU housing and on the EGLA with failed SVU	18
8.2.1 General	18
8.2.2 Insulation withstand test on the SVU housing	19
8.2.3 Insulation withstand tests on EGLA with failed SVU	19
8.3 Residual voltage tests	20
8.3.1 General	20
8.3.2 Procedure for correction and calculation of inductive voltages	20
8.3.3 Lightning current impulse residual voltage test	21

8.3.4	High current impulse residual voltage test	22
8.4	Standard lightning impulse sparkover test	22
8.5	High current impulse withstand test.....	23
8.5.1	Selection of test samples	23
8.5.2	Test procedure	23
8.5.3	Test evaluation	24
8.6	Test to verify the repetitive charge transfer rating, Q_{RS} with lightning discharges	24
8.6.1	MO resistors	24
8.6.2	Series gap	26
8.7	Short-circuit tests.....	27
8.7.1	General	27
8.7.2	Preparation of the test samples	28
8.7.3	Mounting of the test sample.....	29
8.7.4	High-current short-circuit tests.....	30
8.7.5	Low-current short-circuit test	32
8.7.6	Evaluation of test results	32
8.8	Follow current interrupting test.....	38
8.8.1	General	38
8.8.2	"Test method A".....	38
8.8.3	"Test method B".....	40
8.9	Mechanical load tests on the SVU.....	42
8.9.1	General	42
8.9.2	Bending test	42
8.9.3	Vibration test	51
8.10	Weather aging tests	52
8.10.1	General	52
8.10.2	Sample preparation	52
8.10.3	Test procedure	52
8.10.4	Test evaluation	52
8.10.5	Additional test procedure for polymer (composite and cast resin) housed SVUs.....	53
8.11	Radio interference voltage (RIV) test	53
9	Routine tests	53
9.1	General.....	53
10	Acceptance tests	54
10.1	General.....	54
10.2	Reference voltage measurement of SVU.....	54
10.3	Internal partial discharge test of SVU.....	55
10.4	Radio interference voltage (RIV) test	55
10.5	Test for coordination between insulator withstand and EGLA protective level.....	55
10.5.1	General	55
10.5.2	Steep front impulse test.....	55
10.5.3	Standard lightning impulse sparkover test.....	56
10.6	Follow current interrupting test.....	56
10.6.1	General	56
10.6.2	Test procedure	57
10.6.3	Test sequence	57
10.6.4	Test evaluation	57

10.7	Vibration test on the SVU with attached electrode	57
10.7.1	General	57
10.7.2	Sample preparation	57
10.7.3	Test procedure and test condition	57
10.7.4	Test evaluation	58
Annex A (informative)	Example of a test circuit for the follow current interrupting test	59
Annex B (normative)	Mechanical considerations	60
B.1	Test of bending moment	60
B.2	Definition of mechanical loads	61
B.3	Definition of seal leak rate	62
B.4	Calculation of wind-bending-moment	63
B.5	Flow chart – Procedures of tests of bending moment for porcelain/cast resin and polymer-housed SVUs	64
Annex C (normative)	Special service conditions	65
C.1	General	65
C.2	Temperature in excess of +40 °C or below –40 °C	65
C.3	Application at altitudes higher than 1 000 m	65
C.4	Fumes or vapours that may cause deterioration of insulating surface or mounting hardware	65
C.5	Excessive contamination by smoke, dirt, salt spray or other conducting materials	65
C.6	Excessive exposure to moisture, humidity, dripping water, or steam	65
C.7	Live washing of arrester	65
C.8	Unusual transportation or storage	65
C.9	Non-vertical erection and suspended erection	66
C.10	Wind speed > 34 m/s	66
C.11	Earthquake	66
C.12	Torsional loading of the arrester	66
Bibliography	67
Figure 1	– Configuration of an EGLA with insulator and arcing horn	8
Figure 2	– Test procedure to verify the repetitive charge transfer rating, Q_{RS}	25
Figure 3	– Test procedure to verify the repetitive charge withstand of the series gap	27
Figure 4	– Examples of SVU units	36
Figure 5	– Short-circuit test setup	37
Figure 6	– Example of a test circuit for re-applying pre-failing circuit immediately before applying the short-circuit test current	38
Figure 7	– Thermo-mechanical test	46
Figure 8	– Example of the test arrangement for the thermo-mechanical test and direction of the cantilever load	47
Figure 9	– Test sequence of the water immersion test	48
Figure A.1	– Example of a test circuit for the follow current interrupting test	59
Figure B.1	– Bending moment – Multi-unit SVU	60
Figure B.2	– Definition of mechanical loads	61
Figure B.3	– SVU unit	62
Figure B.4	– SVU dimensions	63

Figure B.5 – Procedures of tests of bending moment for porcelain/cast resin and polymer-housed SVUs	64
Table 1 – EGLA classification – “Series X” and “Series Y”	13
Table 2 – Steps of rated voltages (r.m.s. values)	14
Table 3 – Type tests (all tests to be performed with or without insulator assembly; by manufacturer's decision)	18
Table 4 – Test requirements	34
Table 5 – Required currents for short-circuit tests	35
Table 6 – Acceptance tests	54
Table 7 – Virtual steepness of wave front of steep front impulses	55

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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****FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

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

- a) The Lightning discharge capability test has been completely re-written and re-named to Test to verify the repetitive charge transfer rating, Qrs with lightning discharges to reflect changes introduced in IEC 60099-4 Ed. 3 (2014) regarding new methods for rating the energy and charge handling capability of metal-oxide arresters. In addition to testing to

evaluate the performance of the MO resistors, procedures for evaluating the performance of the EGLA series gaps have been introduced.

- b) Omissions from Ed. 1 of this standard have been included, notably an RIV test and a means for determining the thermal time constant of the SUV portion of the EGLA.
- c) Definitions for new terms have been added
- d) A number of NOTES in Ed. 1 have been converted to normative requirements

A number of editorial changes have been made throughout the document to improve grammar and general flow of information.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
37/436/FDIS	37/438/RVD

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document 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.

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 over-voltages. The external series gap, therefore, should spark over only due to fast-front over-voltages. The gap should withstand all power-frequency and slow-front over-voltages occurring on the system.

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

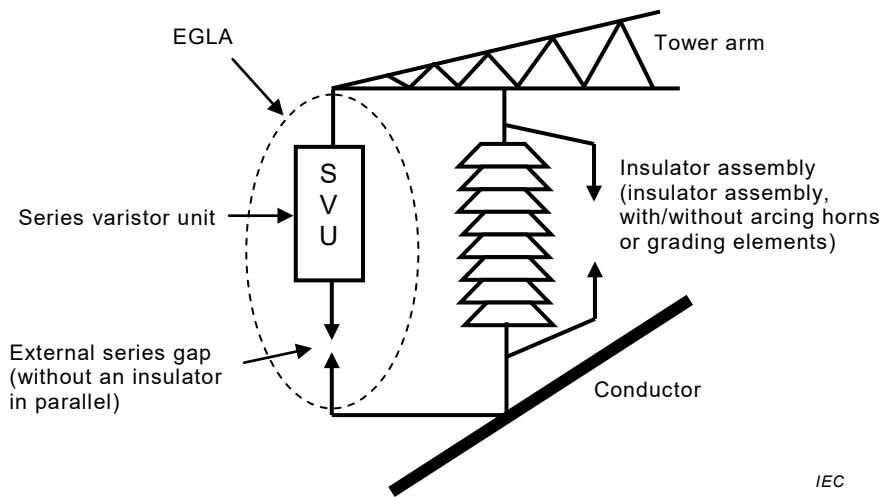


Figure 1 – Configuration of an EGLA with insulator and arcing horn

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

- switching impulse spark-over 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 document.

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 60060-1:2010, *High-voltage test techniques – Part 1: General definitions and test requirements*

IEC 60060-2:2010, *High-voltage test techniques – Part 2: Measuring systems*

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

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