

IEC TR 60099-10

Edition 1.0 2024-06

TECHNICAL REPORT



Surge arresters -

Part 10: Rationale for tests specified by IEC 60099-4:2014

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 29.120.50; 29.240.10

ISBN 978-2-8322-8969-3

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

-2-

Ε(JREWC	DRD	7
IN	TRODI	JCTION	9
1	Scor	De	10
2		native references	
3		ns and definitions	
4		cture of the document	
_	4.1	Content of each individual test rationale	
	4.1	Relation between each test of IEC 60099-4:2014 and this document	
5		lation withstand tests rationale	
J	5.1	Arrester type for which the tests are applicable	
	5.2	Purpose of the tests	
	5.3	Historical notes	
	5.4	Tests rationale	
	5.4.1		
	5.4.2		
	5.4.3	·	
	5.4.4	·	
	5.4.5		
6	Resi	dual voltage tests rationale	
	6.1	Arrester type for which the tests are applicable	19
	6.2	Purpose of the tests	
	6.3	Historical notes	19
	6.4	Tests rationale	19
	6.4.1	l General	19
	6.4.2	Sample selection rationale	20
	6.4.3	Tests procedures rationale	20
	6.4.4	Evaluation rationale	23
7	Test	to verify long term stability under continuous operating voltage rationale $\ldots\ldots$	23
	7.1	Arrester type for which the test is applicable	23
	7.2	Purpose of the test	23
	7.3	Historical notes	23
	7.4	Test rationale	24
	7.4.1	l General	24
	7.4.2	'	
	7.4.3	•	
	7.4.4		
8	Test	to verify the repetitive charge transfer rating $(Q_{\rm rs})$ rationale	26
	8.1	Arrester type for which the test is applicable	26
	8.2	Purpose of the test	26
	8.3	Historical notes	26
	8.4	Test rationale	27
	8.4.1		
	8.4.2	•	
	8.4.3	•	
	8.4.4		
	8.4.5	5 Common misunderstandings	28

IEC TR 60099-10:2024 © IEC 2024 - 3 -

9	Heat	dissipation beh	avior of test sample rationale	29
	9.1	Arrester type f	or which the test is applicable	29
	9.2	Purpose of the	test	29
	9.3	Historical note	s	29
	9.4	Test rationale.		29
	9.4.1	General		29
	9.4.2	Sample se	election rationale	30
	9.4.3	Test proce	edure rationale	30
	9.4.4		n rationale	
10	Oper	iting duty test i	ationale	31
	10.1	Arrester type f	or which the test is applicable	31
	10.2	Purpose of the	test	31
	10.3	Historical note	S	31
	10.4	Test rationale.		32
	10.4.			
	10.4.	•	election rationale	
	10.4.	-	edure rationale	
	10.4.		n rationale	
	10.4.		misunderstandings	
11	Powe	-	ltage-versus-time test rationale	
	11.1	• •	or which the test is applicable	
	11.2	•	test	
	11.3		S	
	11.4			
	11.4.			
	11.4.	•	election rationale	
	11.4.	•	edure rationale	
	11.4.		rationale	
	11.4.		misunderstandings	
12			connector rationale	
	12.1		or which the tests are applicable	
	12.2	•	tests	
	12.3		S	
	12.4			
	12.4.			
	12.4.		election rationale	
	12.4.	•	cedure rationale	
40	12.4.		n rationale	
13			tionale	
	13.1		or which the test is applicable	
	13.2	•	test	
	13.3		S	
	13.4			
	13.4.			
	13.4.		election rationale	
	13.4.	•	edure rationale	
	13.4.		n rationale	
	13.4.	Common	misunderstandings	44

14 Tes	t of th	ne bending moment of porcelain-housed arresters rationale	44
14.1	Arr	ester type for which the test is applicable	44
14.2	Pur	pose of the test	44
14.3	His	torical notes	44
14.4	Tes	st rationale	45
14.4	1.1	General	45
14.4	1.2	Sample selection rationale	46
14.4	1.3	Test procedure rationale	46
14.4	1.4	Evaluation rationale	46
15 Tes	t of th	ne bending moment of polymer-housed arresters rationale	47
15.1	Arr	ester type for which the test is applicable	47
15.2	Pur	pose of the test	47
15.3	His	torical notes	47
15.4	Tes	st rationale	48
15.4	1.1	General	48
15.4	1.2	Sample selection rationale	48
15.4	1.3	Test procedure rationale	49
15.4		Evaluation rationale	
16 Env	ironn	nental tests rationale	49
16.1	Arr	ester type for which the tests are applicable	49
16.2	Pur	pose of the tests	49
16.3	His	torical notes	50
16.4	Tes	st rationale	50
16.4	1.1	General	50
16.4	1.2	Sample selection rationale	50
16.4	1.3	Test procedure rationale	50
16.4	1.4	Evaluation rationale	50
17 Sea	l leak	rate test rationale	51
17.1	Arr	ester type for which the test is applicable	51
17.2	Pur	pose of the test	51
17.3	His	torical notes	51
17.4	Tes	st rationale	51
17.4	1.1	General	51
17.4	1.2	Sample selection rationale	51
17.4	1.3	Test procedure rationale	51
17.4	1.4	Evaluation rationale	51
18 Rad	lio int	erference (RIV) test rationale	51
18.1	Arr	ester type for which the test is applicable	51
18.2	Pur	pose of the test	52
18.3	His	torical notes	52
18.4	Tes	st rationale	52
18.4	1.1	General	
18.4	1.2	Sample selection rationale	52
18.4		Test procedure rationale	
18.4	1.4	Evaluation rationale	52

19 Test	to verify the dielectric withstand of internal components rationale	52
19.1	Arrester type for which the test is applicable	52
19.2	Purpose of the test	52
19.3	Historical notes	53
19.4	Test rationale	53
19.4	.1 General	53
19.4	.2 Sample selection rationale	53
19.4	.3 Test procedure rationale	54
19.4	.4 Evaluation rationale	54
20 Test	s of internal grading components rationale	54
20.1	Arrester type for which the tests are applicable	54
20.2	Purpose of the test	
20.3	Historical notes	
20.4	Test rationale	
20.4		
20.4		
20.4	•	
20.4	·	
	ther aging tests rationale	
21.1	Arrester type for which the tests are applicable	
21.2	Purpose of the tests	
21.2	·	
21.2	· · · · · · · · · · · · · · · · · · ·	
21.3	Historical notes	
21.3		
21.3		
21.4		
21.4		
21.4		
21.4	·	
21.4	·	
	ine tests and acceptance tests rationale	
22.1	Routine tests	
22.1		
	Acceptance tests	
ыынодгар	phy	60
	- Possible arcing distances (7 paths to consider for this example) for a multiter (from CIGRÉ 696-2017)	1.1
	,	
•	– Withstand voltage versus duration	
Figure 3 -	- Sequence of the test to verify the repetitive charge transfer rating	27
Figure 4	- Example of cooldown curves of test samples	31
Figure 5 -	- Operating duty test sequence	33
Figure 6 -	- Examples of TOV curves	35
_	- Power-frequency versus time test sequence	
	- Impact of the connecting leads on arc movement and short-circuit test	
	- impact of the connecting leads on arc movement and short-circuit test	43
	- Graphic representation of the relationships between tests in the bending	
•	ests for porcelain-housed arresters	45

This is a preview - click here to buy the full publication

- 6 - IEC TR 60099-10:2024 © IEC 2024

Figure 10 – Examples of MBL and SSL test results	46
Figure 11 – Graphic representation of the relationships between tests in the bending moment tests for polymer-housed arresters	47
Table 1 – Test rationale clause number for each test in 60099-4:2014	11
Table 2 – Calculated minimum life expectancy if MO resistors would perfectly follow the Arrhenius law	25

IEC TR 60099-10:2024 © IEC 2024

_ 7 _

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SURGE ARRESTERS -

Part 10: Rationale for tests specified by IEC 60099-4:2014

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TR 60099-10 has been prepared by IEC technical committee 37: Surge arresters. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
37/XX/DTR	37/XX/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

- 8 - IEC TR 60099-10:2024 © IEC 2024

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60099 series, published 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- · withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

IEC TR 60099-10:2024 © IEC 2024

_ 9 _

INTRODUCTION

This part of IEC 60099, which is a Technical Report, is informative in nature and does not contain requirements. Its primary purpose is to provide information to users of IEC 60099-4 to help them understand the underlying rationale for the tests and the specified test parameters.

A secondary purpose is to keep a record of substantive changes in the rationale over the last few editions of the standard.

This first edition of the Technical Report covers the tests specified in IEC 60099-4:2014. As tests are added, modified or deleted in future editions of IEC 60099-4, it is planned to amend this Technical Report to reflect such changes. It is understood that rationale behind requirements may change significantly over time, for example when a whole new test philosophy is implemented in a standard.

IEC TR 60099-10:2024 © IEC 2024

SURGE ARRESTERS -

- 10 -

Part 10: Rationale for tests specified by IEC 60099-4:2014

1 Scope

This part of IEC 60099, which is a Technical Report, is applicable to all tests and arrester types included in IEC 60099-4:2014 and explains the rationale behind each test specified in that document.

This document does not contain requirements and is not intended to replace any clauses of IEC 60099-4:2014.

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 60099-4:2014, Surge arresters – Part 4: Metal-oxide surge arresters without gaps for a.c. systems