



SLOVENSKI STANDARD

SIST EN 61954:2011

01-september-2011

Statični kompenzatorji jalove energije (var) - Preskušanje tiristorskih elektronk

Static VAR compensators (SVC) - Testing of thyristor valves

Static VAR compensators (SVC) - Testing of thyristor valves

Compensateurs statiques de puissance réactive (SVC) - Essais des valves à thyristors

Ta slovenski standard je istoveten z: **EN 61954:2011**

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ICS:

29.240.99	Druga oprema v zvezi z omrežji za prenos in distribucijo električne energije	Other equipment related to power transmission and distribution networks
31.080.20	Tiristorji	Thyristors

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en

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61954

June 2011

ICS 29.240.99; 31.080.20

Supersedes EN 61954:1999 + A1:2003

English version

**Static VAR compensators (SVC) -
Testing of thyristor valves
(IEC 61954:2011)**

Compensateurs statiques de puissance
réactive (SVC) -
Essais des valves à thyristors
(CEI 61954:2011)

Static VAR compensators (SVC) -
Testing of thyristor valves
(IEC 61954:2011)

This European Standard was approved by CENELEC on 2011-05-26. 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 Central Secretariat 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 Central Secretariat 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

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Foreword

The text of document 22F/217/CDV, future edition 2 of IEC 61954, prepared by SC 22F, Power electronics for electrical transmission and distribution systems, of IEC TC 22, Power electronic systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61954 on 2011-05-26.

This European Standard supersedes EN 61954:1999 + A1:2003.

EN 61954 :2011 includes the following significant technical changes with respect to EN 61954:1999 + A1:2003:

- a) Definitions of terms "thyristor level", "valve section", "valve base electronics" and "redundant thyristor levels" have been changed for clarification.
- b) Conditions of testing thyristor valve sections instead of a complete thyristor valve have been defined.
- c) The requirement has been added that if, following a type test, one thyristor level has become short-circuited, then the failed level shall be restored and this type test repeated.
- d) The time period of increasing the initial test voltage from 50 % to 100 % during type a.c. dielectric tests on TSC, TCR or TSR valves has been set equal to approximately 10 s.
- e) The duration of test voltage U_{ts2} during type a.c.-d.c. dielectric tests between TSC valve terminals and earth as well as the duration of test voltage U_{tv2} during dielectric tests between TSC valves (for MVU only) has been changed from 30 min to 3 h.
- f) The reference on the number of pulses per minute of the periodic partial discharge recorded during a.c.-d.c. dielectric tests on TSC valves and exceeding the permissible level has been deleted.

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The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2012-02-26 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2014-05-26 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61954:2011 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	Series	High-voltage test techniques	EN 60060	Series
IEC 60060-1	-	High-voltage test techniques - Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60060-2	-	High-voltage test techniques - Part 2: Measuring systems	EN 60060-2	-
IEC 60071	Series	Insulation co-ordination	EN 60071	Series
IEC 60071-1	2006	Insulation co-ordination - Part 1: Definitions, principles and rules	EN 60071-1	2006
IEC 60270	-	High-voltage test techniques - Partial discharge measurements	EN 60270	-
IEC 60700-1	2008	Thyristor valves for high voltage direct current - (HVDC) power transmission – Part 1: Electrical testing		-

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IEC 61954

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Static var compensators (SVC) – Testing of thyristor valves

Compensateurs statiques de puissance réactive (SVC) – Essais des valves à thyristors

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CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	7
4 General requirements for type, production and optional tests.....	9
4.1 Summary of tests.....	9
4.2 Objectives of tests	10
4.2.1 General	10
4.2.2 Dielectric tests	10
4.2.3 Operational tests	10
4.2.4 Electromagnetic interference tests	11
4.2.5 Production tests	11
4.2.6 Optional tests	11
4.3 Guidelines for the performance of type and optional tests.....	11
4.4 Test conditions	12
4.4.1 General	12
4.4.2 Valve temperature at testing	13
4.4.3 Redundant thyristor levels.....	13
4.5 Permissible component failures during type testing.....	14
4.6 Documentation of test results.....	14
4.6.1 Test reports to be issued	14
4.6.2 Contents of a type test report.....	15
5 Type tests on TCR and TSR valves.....	15
5.1 Dielectric tests between valve terminals and earth.....	15
5.1.1 General	15
5.1.2 AC test	16
5.1.3 Lightning impulse test.....	16
5.2 Dielectric tests between valves (MVU only)	17
5.2.1 General	17
5.2.2 AC test	17
5.2.3 Lightning impulse test	18
5.3 Dielectric tests between valve terminals.....	18
5.3.1 General	18
5.3.2 AC test	18
5.3.3 Switching impulse test	20
5.4 Operational tests	21
5.4.1 Periodic firing and extinction test.....	21
5.4.2 Minimum a.c. voltage test	22
5.4.3 Temperature rise test.....	23
6 Type tests on TSC valves	23
6.1 Dielectric tests between valve terminals and earth	23
6.1.1 General	23
6.1.2 AC-DC test	24
6.1.3 Lightning impulse test.....	26
6.2 Dielectric tests between valves (for MVU only).....	26
6.2.1 General	26
6.2.2 AC-DC test	26

6.2.3	Lightning impulse test	28
6.3	Dielectric tests between valve terminals	29
6.3.1	General	29
6.3.2	AC-DC test	29
6.3.3	Switching impulse test	31
6.4	Operational tests	32
6.4.1	Overcurrent tests	32
6.4.2	Minimum a.c. voltage test	35
6.4.3	Temperature rise test.....	36
7	Electromagnetic interference tests	36
7.1	Objectives	36
7.2	Test procedures	36
7.2.1	General	36
7.2.2	Switching impulse test	37
7.2.3	Non-periodic firing test.....	37
8	Production tests.....	37
8.1	General	37
8.2	Visual inspection	37
8.3	Connection check	37
8.4	Voltage-dividing/damping circuit check.....	38
8.5	Voltage withstand check	38
8.6	Check of auxiliaries	38
8.7	Firing check.....	38
8.8	Cooling system pressure test	38
8.9	Partial discharge tests	38
9	Optional tests on TCR and TSR valves	38
9.1	Overcurrent test.....	38
9.1.1	Overcurrent with subsequent blocking	38
9.1.2	Overcurrent without blocking	39
9.2	Positive voltage transient during recovery test.....	39
9.2.1	Objectives	39
9.2.2	Test values and waveshapes	39
9.2.3	Test procedures.....	40
9.3	Non-periodic firing test.....	40
9.3.1	Objectives	40
9.3.2	Test values and waveshapes	40
9.3.3	Test procedures.....	42
10	Optional tests on TSC valves	42
10.1	Positive voltage transient during recovery test.....	42
10.1.1	Test objective	42
10.1.2	Test values and waveshapes	42
10.1.3	Test procedures.....	42
10.2	Non-periodic firing test.....	43
10.2.1	Objectives	43
10.2.2	Test values and waveshapes	43
10.2.3	Test procedures.....	44
	Figure 1 – TSC branch	33

Figure 2 – One-loop overcurrent.....	34
Figure 3 – Two-loop overcurrent.....	35
Table 1 – List of tests.....	9
Table 2 – Number of thyristor levels permitted to fail during type tests	15

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SIST EN 61954:2011

<https://standards.iteh.ai/catalog/standards/sist/e8f0e761-3856-43ac-8d7d-7390b9c4b1bd/sist-en-61954-2011>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**STATIC VAR COMPENSATORS (SVC) –
TESTING OF THYRISTOR VALVES**
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.
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- 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 61954 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronics.

This second edition cancels and replaces the first edition published in 1999, amendment 1 (2003) and constitutes a technical revision.

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

- a) Definitions of terms "thyristor level", "valve section", "valve base electronics" and "redundant thyristor levels" have been changed for clarification.
- b) Conditions of testing thyristor valve sections instead of a complete thyristor valve have been defined.
- c) The requirement has been added that if, following a type test, one thyristor level has become short-circuited, then the failed level shall be restored and this type test repeated.
- d) The time period of increasing the initial test voltage from 50 % to 100 % during type a.c. dielectric tests on TSC, TCR or TSR valves has been set equal to approximately 10 s.

- e) The duration of test voltage U_{ts2} during type a.c.-d.c. dielectric tests between TSC valve terminals and earth as well as the duration of test voltage U_{tvv2} during dielectric tests between TSC valves (for MVU only) has been changed from 30 min to 3 h.
- f) The reference on the number of pulses per minute of the periodic partial discharge recorded during a.c.-d.c. dielectric tests on TSC valves and exceeding the permissible level has been deleted.

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

CDV	Report on voting
22F/217/CDV	22F/231A/RVC

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 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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STATIC VAR COMPENSATORS (SVC) – TESTING OF THYRISTOR VALVES

1 Scope

This International Standard defines type, production and optional tests on thyristor valves used in thyristor controlled reactors (TCR), thyristor switched reactors (TSR) and thyristor switched capacitors (TSC) forming part of static VAR compensators (SVC) for power system applications. The requirements of the standard apply both to single valve units (one phase) and to multiple valve units (several phases).

Clauses 4 to 7 detail the type tests, i.e. tests which are carried out to verify that the valve design meets the requirements specified. Clause 8 covers the production tests, i.e. tests which are carried out to verify proper manufacturing. Clauses 9 and 10 detail optional tests, i.e. tests additional to the type and production tests.

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 (all parts), *High-voltage test techniques*

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

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

IEC 60071 (all parts), *Insulation co-ordination*

IEC 60071-1:2006, *Insulation co-ordination – Part 1: Definitions, principles and rules*

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

IEC 60700-1:2008, *Thyristor valves for high-voltage direct current (HVDC) power transmission – Part 1: Electrical testing*

3 Terms and definitions

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

3.1

thyristor level

part of a thyristor valve comprising a thyristor, or thyristors connected in parallel or antiparallel, together with their immediate auxiliaries and reactor, if any

3.2

thyristor (series) string

series connected thyristors forming one direction of a thyristor valve

3.3**valve reactor**

reactor incorporated within some valves for limitation of stresses

NOTE For testing purposes it is considered an integral part of the valve.

3.4**valve section**

electrical assembly, comprising a number of thyristors and other components, which exhibits pro-rated electrical properties of a complete thyristor valve but only a portion of the full voltage blocking capability of the thyristor valve and which can be used for tests

3.5**thyristor valve**

electrically and mechanically combined assembly of thyristor levels, complete with all connections, auxiliary components and mechanical structures, which can be connected in series with each phase of the reactor or capacitor of a SVC

3.6**valve structure**

physical structure which insulates the valves to the appropriate level above earth potential and from each other

3.7**valve base electronics****VBE**

electronic unit, at earth potential, which is the interface between the control system of the SVC and the thyristor valves

3.8**multiple valve unit****MVU**

assembly of several valves in the same physical structure which cannot be separated for test purposes (e.g. three-phase valves)

3.9**redundant thyristor levels**

the maximum number of thyristor levels in the thyristor valve that may be short-circuited, externally or internally, during service without affecting the safe operation of the thyristor valve as demonstrated by type tests; and which if and when exceeded, would require either the shutdown of the thyristor valve to replace the failed thyristors, or the acceptance of increased risk of failures

3.10**voltage breakover (VBO) protection**

means of protecting the thyristors from excessive voltage by firing them at a predetermined voltage

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4 General requirements for type, production and optional tests

4.1 Summary of tests

Table 1 lists the tests given in the following clauses and subclauses.

Table 1 – List of tests

Test	Clause or subclause		Test object
	TCR/TSR	TSC	
Dielectric tests between valve terminals and earth (type tests)			
AC test	5.1.2		Valve
AC-DC test		6.1.2	Valve
Lightning impulse test	5.1.3	6.1.3	Valve
Dielectric tests between valves (MVU only) (type tests)			
AC test	5.2.2		MVU
AC-DC test		6.2.2	MVU
Lightning impulse test	5.2.3	6.2.3	MVU
Dielectric tests between valve terminals (type tests)			
AC test	5.3.2		Valve
AC-DC test		6.3.2	Valve
Switching impulse test	5.3.3	6.3.3	Valve
Operational tests (type tests)			
Periodic firing and extinction test	5.4.1		Valve or valve section
Overcurrent test		6.4.1	Valve or valve section
Minimum a.c. voltage test	5.4.2	6.4.2	Valve or valve section
Temperature rise test	5.4.3	6.4.3	Valve or valve section
Electromagnetic interference tests (type tests)			
Switching impulse test	7.2.2	7.2.2	Valve
Non-periodic firing test	7.2.3	7.2.3	Valve
Production tests			
Visual inspection	8.2	8.2	
Connection check	8.3	8.3	
Voltage dividing/damping circuit check	8.4	8.4	
Voltage withstand check	8.5	8.5	
Check of auxiliaries	8.6	8.6	
Firing check	8.7	8.7	
Cooling system pressure test	8.8	8.8	
Partial discharge tests	8.9	8.9	
Optional tests			
Overcurrent test	9.1		Valve or valve section
Positive voltage transient during recovery test	9.2	10.1	Valve or valve section
Non-periodic firing test	9.3	10.2	Valve