ICS 29.200, 29.240.99 SLOVENSKÁ TECHNICKÁ NORMA August 2018

STN	**Usmerňovače konvertorov napájaných napätím pre statický synchrónny kompenzátor (STATCOM) Elektrické skúšky**	**STN EN 62927** 35 1540

Voltage sourced converter (VSC) valves for static synchronous compensator (STATCOM) - Electrical Testing

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 07/18

Obsahuje: EN 62927:2017, IEC 62927:2017

127012

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 62927

October 2017

ICS 29.200; 29.240.99

English Version

Voltage sourced converter (VSC) valves for static synchronous compensator (STATCOM) - Electrical Testing (IEC 62927:2017)

Valves de convertisseur source de tension (VSC) pour compensateur synchrone statique (STATCOM) - Essais électriques (IEC 62927:2017)

Ventile von Spannungszwischenkreis-Stromrichtern (VSC) für STATCOM - Elektrische Prüfungen (IEC 62927:2017)

This European Standard was approved by CENELEC on 2017-08-16. 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: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 62927:2017 E

EN 62927:2017

European foreword

The text of document 22F/412/CDV, future edition 1 of IEC 62927, 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 approved by CENELEC as EN 62927:2017.

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)	2018-05-16
latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-08-16

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 62927:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

ISO/IEC 17025	NOTE	Harmonized as EN ISO/IEC 17025.
IEC 61954	NOTE	Harmonized as EN 61954.
IEC 62747	NOTE	Harmonized as EN 62747.

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 When 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.

Publication	Year	Title	EN/HD	Year
IEC 60060	series	High-voltage test techniques -- Part 1: General definitions and test requirements	EN 60060	series
IEC 60060-1	-	High-voltage test techniques -- Part 1: General definitions and test requirements	EN 60060-1	-
IEC 60071-1	2006	Insulation co-ordination -- Part 1: Definitions, principles and rules	EN 60071-1	2006
IEC 60700-1	2015	Thyristor valves for high voltage direct current (HVDC) power transmission -- Part 1: Electrical testing	EN 60700-1	2015
IEC 62501	-	Voltage sourced converter (VSC) valves for high-voltage direct curent (HVDC) power transmission - Electrical testing	EN 62501	-

IEC 62927

Edition 1.0 2017-07

INTERNATIONAL STANDARD

colour inside

Voltage sourced converter (VSC) valves for static synchronous compensator (STATCOM) – Electrical testing

IEC 62927:2017-07(en)

IEC 62927

Edition 1.0 2017-07

INTERNATIONAL STANDARD

colour inside

Voltage sourced converter (VSC) valves for static synchronous compensator (STATCOM) – Electrical testing

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.200; 29.240.99 ISBN 978-2-8322-4521-7

CONTENTS

FOREWORD 5
1 Scope 7
2 Normative references 7
3 Terms and definitions 7
3.1 Insulation co-ordination terms 7
3.2 Power semiconductor terms 8
3.3 Operating states of converter 8
3.4 STATCOM construction terms 9
3.5 Valve structure terms 10
4 General requirements 11
4.1 Guidelines for the performance of type tests 11
4.1.1 General 11
4.1.2 Dielectric tests 11
4.1.3 Operational tests 11
4.1.4 Electromagnetic interference tests 11
4.1.5 Evidence in lieu 11
4.1.6 Test object 12
4.1.7 Test procedure 12
4.1.8 Ambient temperature for testing 12
4.1.9 Frequency for testing 12
4.1.10 Conditions to be considered in determination of type test parameters 12
4.1.11 Test reports 12
4.2 Atmospheric correction factor 12
4.3 Treatment of redundancy 13
4.3.1 Operational tests 13
4.3.2 Dielectric tests 13
4.4 Permissible component failures during type testing 14
5 List of tests 14
6 Operational tests 15
6.1 Purpose of tests 15
6.2 Test object 15
6.3 Test circuit 16
6.4 Maximum continuous operating duty test 16
6.5 Maximum temporary overload operating duty test 17
6.6 Minimum start voltage test 17
7 Dielectric tests on valve support 18
7.1 Purpose of tests 18
7.2 Test object 18
7.3 Test requirements 18
7.3.1 Valve support DC voltage test 18
7.3.2 Valve support AC voltage test 19
7.3.3 Valve support lightning impulse test 20
8 Dielectric tests on multiple valve unit (MVU) 20
8.1 General 20
8.2 Purpose of tests 20
8.3 Test object 20

8.4 Test requirements 20
8.4.1 MVU AC voltage test 20
8.4.2 MVU DC voltage test 21
8.4.3 MVU lightning impulse test 21
9 Dielectric tests between valve terminals 21
9.1 Purpose of the test 21
9.2 Test object 22
9.3 Test methods 22
9.3.1 General 22
9.3.2 Method 1 22
9.3.3 Method 2 23
9.4 Test requirements 23
9.4.1 Valve AC voltage or AC-DC voltage test 23
9.4.2 Valve switching impulse test 25
10 IGBT overcurrent turn-off test 26
10.1 Purpose of test 26
10.2 Test object 26
10.3 Test requirements 26
11 Tests for valve insensitivity to electromagnetic disturbance 27
11.1 Purpose of tests 27
11.2 Test object 27
11.3 Test requirements 27
11.3.1 General 27
11.3.2 Approach 1 27
11.3.3 Approach 2 28
11.3.4 Acceptance criteria 28
12 Short-circuit current test (optional) 28
12.1 Purpose of tests 28
12.2 Test object 28
12.3 Test requirements 29
13 Production tests 29
13.1 General 29
13.2 Purpose of tests 29
13.3 Test object 29
13.4 Test requirements 29
13.5 Production test objectives 30
13.5.1 Visual inspection 30
13.5.2 Connection check 30
13.5.3 Voltage-grading circuit check 30
13.5.4 Control, protection and monitoring circuit checks 30
13.5.5 Voltage withstand check 30
13.5.6 Turn-on/turn-off check 30
13.5.7 Pressure test 30
14 Presentation of type test results 30
Annex A (informative) Overview of STATCOM valves 32
A.1 General 32
A.2 STATCOM applications and operating limits 32
A.3 Overview of STATCOM valve types 33

A.4 STATCOMs based on switch type valve 33
A.4.1 General 33
A.4.2 Two-level converter 34
A.4.3 Three-level converters 34
A.4.4 Multi-level converters 35
A.5 STATCOMs based on controllable voltage source type valve 36
A.6 Valve switching principles 37
Annex B (informative) Valve component fault tolerance 39
Bibliography 40

Figure A.1 – STATCOM U-I characteristics 33
Figure A.2 – Two-level converter 34
Figure A.3 – Three-level NPC converter 35
Figure A.4 – Three-level flying capacitor converter 35
Figure A.5 – Modular multilevel converter 36
Figure A.6 – Single-phase full-bridge converter 37
Figure A.7 – Two-level converter output voltage 37
Figure A.8 – Output voltage shape of three-level converter and modular multi-level converter 38

Table 1 – Minimum number of valve levels to be tested as a function of the number of valve levels per valve 12
Table 2 – Valve level faults permitted during type tests 14
Table 3 – List of type tests 15

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR STATIC SYNCHRONOUS COMPENSATOR (STATCOM) – ELECTRICAL TESTING

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 62927 has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment.

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

CDV	Report on voting
22F/412/CDV	22F/431A/RVC

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.

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.

VOLTAGE SOURCED CONVERTER (VSC) VALVES FOR STATIC SYNCHRONOUS COMPENSATOR (STATCOM) – ELECTRICAL TESTING

1 Scope

This document applies to self-commutated valves, for use in voltage sourced converter (VSC) for static synchronous compensator (STATCOM). It is restricted to electrical type and production tests.

The tests specified in this document are based on air insulated valves. For other types of valves, the test requirements and acceptance criteria are agreed between the purchaser and the supplier.

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

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

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

IEC 60700-1:2015, *Thyristor valves for high voltage direct current (HVDC) power transmission – Part 1: Electrical testing*

IEC 62501, *Voltage sourced converter (VSC) valves for high-voltage direct current (HVDC) power transmission – Electrical testing*