

INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

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

Valves de convertisseur source de tension (VSC) pour compensateur synchrone statique (STATCOM) – Essais électriques

<https://standards.iteh.ai/catalog/standards/sist/26c2ca8c-1c6f-41f1-bdbf-97dd79a3f20a/iec-62927-2017-amd1-2023>



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**VOLTAGE SOURCED CONVERTER (VSC) VALVES
FOR STATIC SYNCHRONOUS COMPENSATOR (STATCOM) –
ELECTRICAL TESTING****AMENDMENT 1****FOREWORD**

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Amendment 1 to IEC 62927:2017 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 Amendment is based on the following documents:

Draft	Report on voting
22F/699/CDV	22F/721/RVC

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 Amendment is English.

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/.

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- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

2 Normative references

Replace the existing reference "IEC 60071-1:2006" and its title with the following new reference and title:

IEC 60071-1:2019, *Insulation co-ordination – Part 1: Definitions, principles and rules*

[IEC 62927:2017/AMD1:2023](https://standards.iteh.ai/catalog/standards/sist/26c2ca8c-1c6f-41f1-bdbf-97dd79a3f20a/iec-62927-2017-amd1-2023)

4.1.5 Evidence in lieu

Add, in the second sentence of the existing paragraph, after the words "performing a type test", the words "or individual parts of it".

4.1.6 Test object

Delete, in the first existing paragraph, the first sentence.

Delete, in the second sentence of the existing paragraph, the words "for those tests".

Table 1 – Minimum number of valve levels to be tested as a function of the number of valve levels per valve

Replace, in the existing table, the header of the first column "Number of valve levels per valve" with the new header "Number of valve levels, including redundant levels".

Add, in the third row of the existing second column, after the number "10", the word "valve".

Delete, in item c) of the existing paragraph, in the second sentence, the words "with the agreement of the purchaser and supplier".

Replace, in the item d) of the existing paragraph, the verb "should" with "shall".

Add, after item d) of the existing paragraph, the following new paragraph:

Subclause 4.1.6 does not apply to tests on the valve supporting structure and multiple valve unit. The test object for those tests is defined in 7.2 and 8.3.

4.1.10 Conditions to be considered in determination of type test parameters

Replace, in the existing paragraph, the verb "should" with "shall".

4.4 Permissible component failures during type testing

Add, at the end of the existing third paragraph, the following new sentence:

Malfunction of valve level and component degrading detected in the routine test after type test are deemed as faults shown by the rightmost column of Table 2.

Table 3 – List of type tests

Delete, in the existing seventh row of the first column, the brackets "(optional)".

6.3 Test circuit

Add, after the existing second paragraph, the following new paragraph:

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In order to reproduce correct heating effects, the operational test should be performed at the service frequency. When the service frequency is different from the test frequency, then the test conditions shall be adjusted so as to approximately compensate the difference in frequency dependent losses, as necessary to demonstrate the proper stressing of the equipment.

6.4 Maximum continuous operating duty test

Add, in the existing second paragraph, at the start of the third bulleted list item, the words "where snubbers are used,".

Add, in the existing third paragraph, at the start of the second bulleted list item, the words "where snubbers are used,".

Add, at the start of the existing seventh paragraph, starting with "The test voltage U_{tpv1} ", the text "In principle,".

Add, before the existing last paragraph, the following new note:

NOTE Test voltage for MMC valves can be defined by the operating voltage of the submodule capacitor. A test safety factor of 1,05 is applied to the test voltage for MMC valves.

6.5 Maximum temporary overload operating duty test

Add, after the existing first paragraph, the following new paragraph:

The test current shall be the specified overload current without a test safety factor.

Add, in the second sentence of the existing third paragraph, between "temporary" and "operating", the word "overload".

Add, at the end of the last sentence of the existing third paragraph, the words "as a test safety factor".

Add, at the end of the last sentence of the existing last paragraph, the words "as in 6.4".

7.2 Test object

Replace, in the first existing paragraph, the last sentence with the following new sentence:

The coolant shall be in a condition representative of the most onerous service conditions, except for flow rate, which can be reduced.

7.3.3 Valve support lightning impulse test

Replace the existing third paragraph with the following new paragraph:

The peak test voltage shall be selected in accordance with the insulation co-ordination of the STATCOM valve substation or selected from the standard lightning impulse withstand voltage according to IEC 60071-1:2019, Table 2 or Table 3. When the latter is used, the transformer secondary side (converter side) highest phase-to-phase voltage, instead of the STATCOM valve highest voltage, shall be used as the highest equipment voltage to select the corresponding lightning impulse peak.

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8.3 Test object

Replace, in the first existing paragraph, the last sentence with the following new sentence:

The coolant shall be in a condition representative of the most onerous service conditions, except for flow rate, which can be reduced.

8.4.3 MVU lightning impulse test

Replace the existing third paragraph with the following new paragraph:

The peak test voltage shall be selected in accordance with the insulation co-ordination of the STATCOM valve substation or selected from the standard lightning impulse withstand voltage according to IEC 60071-1:2019, Table 2 or Table 3. When the latter is used, the transformer secondary side (converter side) highest phase-to-phase voltage, instead of the STATCOM valve highest voltage, shall be used as the highest equipment voltage to select the corresponding lightning impulse peak.

9.1 Purpose of the test

Delete, in the bulleted list item c) of the existing first paragraph, the word "and" and replace the comma with a full stop.

Delete the existing bulleted list item d).

Delete, at the start of the existing second paragraph, the words "It should be noted that".

9.2 Test object

Replace, in the existing second paragraph, the verb "should" with "shall".

9.3.3 Method 2

Add, at the end of the existing second paragraph, the following new text:

Insulation and partial discharge tests with AC, DC and/or combined AC-DC voltage shall be performed on sub-component level (e.g., without power module electronics activated and without capacitor) or on full submodule level. The aim is to test both insulation withstand capability for every single sub-component and proofness of partial discharge for every sensitive point within the valve level.

9.4.1.1 General

Add, after the existing first paragraph, the following new note:

NOTE A composite AC-DC test applies to the valve that is terminated between one DC terminal and one AC phase similar to an HVDC converter.

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9.4.1.2 Valve AC voltage test

Delete, in the existing first paragraph, the word "directly".

9.4.1.3 Valve AC-DC voltage test

Replace, in the existing fifth paragraph, the words "RMS value of valve AC-DC" with "valve".

Replace, in the existing sixth paragraph, under "30 min test", the three formulae with the following new formula:

$$U_{tv} = \left(\frac{k_{c2} \times \sqrt{2} U_{\max\text{-cont}} \times \sin(2\pi ft)}{\sqrt{3}} + U_{d\max} \right) \times k_o \times k_7$$

Replace, in the existing key to the formulae, the description of notation "f" with the new description "is the test frequency, Hz".

Add, in the existing key to the formulae, after the notation "f", the following new key and description:

t is the time variable, s.

9.4.2 Valve switching impulse test

Replace, in the first sentence of the first paragraph, the verb "should" with "shall".

10.2 Test object

Replace the existing paragraph with the following new paragraph:

Test object is described in 6.2. In case of controllable voltage source type VSC valves, this test may also be performed on valve level. However, certain protection or monitoring circuits shall be represented if they are essential for the detection of an overcurrent event.

10.3 Test requirements

Add, before the last existing paragraph, the following new paragraph:

Test voltage for MMC valves shall be defined by the operating voltage of the submodule capacitor; it shall incorporate a test safety factor of 1,05.

Replace, in the last existing paragraph, the verb "should" with "shall".

12 Short-circuit current test (optional)

Delete, in the existing title, the brackets "(optional)".

12.1 Purpose of tests

Replace, in the second sentence of the existing second paragraph, the verb "should" with "shall".

Replace the last sentence of the existing second paragraph with the following new text:

Valve electronics shall normally be energized for the part of the fault event where any actions are taken by it, for example, when blocking the IGBTs or turning on protective devices such as bypass thyristors. For other parts of the fault event, it is not necessary to energize the valve electronics.

12.3 Test requirements

Replace, in the second existing paragraph, the verb "should" with "shall".

13.4 Test requirements

Replace, in the existing third paragraph, the verb "should" with "shall".

Annex B – Valve component fault tolerance

Add, at the end of item g) of the existing first paragraph, the following new text and note:

If the valve is liquid cooled, small leaks may not be easily detected. Escaped coolant can contaminate sensitive components, leading to malfunction, and can increase the probability of insulation failure. However, experience acquired in the wet test performed on high-voltage power electronic valves indicates that the valve wet test on a new and dust free valve surface is unable to identify locations where might cause valve dielectric failure in service due to the leakage of small quantities of valve coolant.

NOTE IEEE Std 857TM-1996, to which the wet test is often referred to, was withdrawn in 2010.

Delete item h) of the existing first paragraph.

Add, before the existing last paragraph, the following new paragraph:

Tests to demonstrate the valve component fault tolerance are not categorized as type tests since most of them are destructive tests of valve or valve components and the tests are usually done on small number of valve levels. Those tests should be done in design stage of new type of valves for compliance check of valve fault component tolerance. Supplier should document the tests and provide project related report, based on evidence in lieu, on purchasers' request.

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Bibliography

Add, in the existing list of publications, the following new reference:

IEEE Std 857-1996, *IEEE recommended practice for test procedures for high-voltage direct-current thyristor valves*¹

¹ This publication has been withdrawn.

