



LOVAG
TEST INSTRUCTION IEC 61439-2 Ed. 1.0

LOW VOLTAGE SWITCHGEAR AND CONTROLGEAR ASSEMBLIES

Part 2: Power switchgear and controlgear assemblies

This test instruction is based on the following Standard:

General Rules:

IEC 61439-1: Ed.1.0 (2009)

Specific Requirements:

IEC 61439-2: Ed.1.0 (2009)

It complies with these standards in all respects and provides additional information ensuring a suitable degree of repeatability of the tests between the different test stations.

Valid from: 2009-10-27

A handwritten signature in blue ink, reading 'S. Manganaro'.

Dr. Saverio Manganaro

Chairman of LOVAG Technical Committee

0. PREAMBLE

For convenience in the use of this test instruction, the paragraphs are numbered according to the clauses in the IEC document.

All references to clauses of IEC 61439-1: 2009 are preceded by the letter “G”.

Tests must be carried out according to the standard; this Test Instruction only adds few specific details.

1. SCOPE

The Standard IEC/EN61439-2 defines the specific requirements of power switchgear and control gear assemblies (PSC-ASSEMBLIES), the rated voltage of which does not exceed 1000V a.c or 1500V d.c.

The Standard does not apply to the specific types of ASSEMBLIES covered by other parts of IEC/EN61439.

2. NORMATIVE REFERENCES

Refer to Standard and G2

3. TERMS AND DEFINITIONS

Refer to Standard and G3

4. SYMBOLS AND ABBREVIATIONS

Refer to G4

5. INTERFACE CHARACTERISTICS

Refer to Standard and G5

6. INFORMATION

Refer to Standard and G6

7. SERVICE CONDITIONS

Refer to G7

8. CONSTRUCTIONAL REQUIREMENTS

G8.1 Strength of materials and parts

Refer to G8.1

8.2. Degree of protection provided by a PSC-ASSEMBLY enclosure

Refer to Standard and G8.2.

G8.3 Clearances and creepage distances

G8.3.1 General

Refer to G8.3.1

8.3.2 Clearances

Refer to Standard and G8.3.2

G8.3.3 Creepage distances

Refer to G8.3.3

G8.4 Protection against electric shock

Refer to Standard and G8.4

G8.5 Incorporation of switching devices and components

Refer to Standard and G8.5

G8.6 Internal electrical circuits and connections

Refer to G8.6

G8.7 Cooling

Refer to G8.7

G8.8 Terminals for external conductors

Refer to G8.8

8.101 Internal separation of PSC-ASSEMBLIES

Refer to Standard

9. PERFORMANCE REQUIREMENTS

Refer to G9

G9.1 Dielectric properties

Refer to G9.1

G9.2 Temperature rise limits

The temperature rise of an element or part is the difference between the temperature of this element or part measured in accordance with Sub-clause 10.10 and the ambient air temperature outside the ASSEMBLY; this means the external ambient temperature. The maximum allowable external ambient temperature according to the Standard is 40°C.

In case of tests required for external ambient temperature higher than 35°C (average value) or 40°C (maximum value) and taking into account that for higher ambient temperatures up to 55 °C the behavior of the temperature rise can be assumed to be linear, it is possible to test in an ambient at a temperature between 10°C and 40°C but it is necessary to refer to lower temperature rise limits than those given in the table 6 of the standard.

In the standard the value of 35 °C is assumed as an average ambient temperature value and the value of 40 °C is intended as maximum value (allowed for short times only); therefore the acceptable temperature rise limits for an ambient temperature of 55 °C has to be reduced of 20 K if the reference value is given as an average one or 15K if the reference value is give as maximum one.

The note in TABLE 6 for Built-in components states that the temperature rise for built-in components will be:

“In accordance with the relevant product standard requirements for the individual components, or, in accordance with the component manufacturer’s instructions, taking into consideration the temperature in the ASSEMBLY”.

This is taken to mean the relevant requirements for the individual component shall be the relevant international standard for the component, if any. Alternatively the temperature rise limits may be based on the data given by the manufacturer.

Where the terminals of the built-in component are also the terminals for external insulated conductors the lower of the two temperature rise values shall be applied i.e.

the difference between the specified temperature for the terminals of the built-in component and the maximum average ambient air temperature under service conditions or 70K whichever is the lower value.

Where applicable, the allowable temperature rise of built-in components, conductors and insulating materials etc shall be specified by the manufacturer and detailed in the test report.

Assuming all other criteria listed in the table 6 are met, a maximum temperature rise of 105K for bare copper busbars and conductors shall not be exceeded. The 105K relates to the temperature above which annealing of copper is likely to occur.

G9.3 Short-circuit protection and short-circuit withstand strength.

G9.3.1 General

Refer to G9.3.1

G9.3.2 Information concerning the short-circuit withstand strength

Refer to G9.3.2

Full details of the SCPDs necessary for protection of the assembly when conducting rated conditional short-circuit and rated short time withstand current tests shall be detailed in the test report in accordance with sub-clause 9.3.2 above.

If the test circuit incorporates SCPDs, the report shall detail the SCPDs used for test i.e. manufacturer's name and reference, rated current, rated voltage, breaking capacity, cut-off current, I_{2t} , maximum time-delay setting, current setting as appropriate depending on whether the SCPD is a fuse or current limiting circuit-breaker (with or without time-delay release) and type of device. In addition, the short-circuit rating of the SCPD shall be stated where this differs from that of the associated connection of the ASSEMBLY.

G9.3.3 Relationship between peak current and short-time current

Refer to G9.3.3

G9.3.4 Co-ordination of protective devices

Refer to G9.3.4

G9.4 Electromagnetic compatibility (EMC)

Refer to G9.4

10. DESIGN VERIFICATION

G10.1 General

Refer to G10.1

Design verification shall be achieved by the application of one or more of the following equivalent and alternative methods as appropriate: testing, calculation, physical measurement or the validation of design rules. See Annex D. Taking into account that the aim of the Lovag Test Instruction is the improvement of the understanding of the Standard with regards to the testing, the present document will give information about the design verification achieved by testing method only.

G10.2 Strength of materials and parts

Refer to G10.2

G10.3 Degree of protection of enclosures

Refer to G10.3

See LTI IEC/EN 60529 Ed.2-1

G10.4 Clearances and creepage distances

Refer to G10.4

G10.5 Protection against electric shock and integrity of protective circuits

G10.5.1 Effectiveness of the protective circuit.

Refer to G10.5.1

G10.5.2 Effective earth continuity between the exposed conductive parts of the ASSEMBLY and the protective circuit

Refer to G10.5.2

G10.5.3 Verification of the short-circuit strength of the protective circuit by test.

Refer to G10.5.3

G10.6 Incorporation of switching devices and components

Refer to G10.6

This part is out of the scope of this document", because they can not be verified by testing" (see table D1 in 61439-1).

G10.7 Internal electrical circuits and connections

Refer to G10.7

This part is out of the scope of this document", because they can not be verified by testing" (see table D1 in 61439-1).

G10.8 Terminals for external conductors

Refer to G10.8

This part is out of the scope of this document", because they can not be verified by testing" (see table D1 in 61439-1).

G10.9 Dielectric properties

G10.9.1 General

Refer to G10.9.1

G10.9.2 Power-frequency withstand voltage

Refer to G10.9.2

10.9.3. Impulse withstand voltage

Refer to Standard and G10.9.2

G10.9.3.1 General

Refer to G10.9.3.1

G10.9.3.2 Impulse withstand voltage test

Refer to G10.9.3.2

G10.9.4 Testing of enclosures made of insulating material

Refer to G10.9.4

10.10. Verification of temperature-rise limits

G10.10.1 General

Refer to G10.10.1

G10.10.2 Verification by testing with current

G10.10.2.1 General

Refer to G10.10.2.1

G10.10.2.2 Selection of the representative arrangement

G10.10.2.2.1 General

The selection of the representative arrangements to be tested is given in G10.10.2.2.2 and G10.10.2.2.3 and is the responsibility of the original manufacturer. The complete test arrangement shall be detailed in the test report.

The scope of the test is to obtain with reasonable accuracy the highest possible temperature rise.

G10.10.2.2.2 Busbars

Refer to G10.10.2.2.2

G10.10.2.2.3 Functional units

Refer to G10.10.2.2.3

Additional test may be made on the discretion of the original manufacturer for less critical arrangements and variants of functional units.

G10.10.2.3 Methods of test

G10.10.2.3.1 General

Refer to G10.10.2.3.1

G10.10.2.3.2 Test conductors

- 1) For values of rated current up to and including 400A.
Refer to G10.10.2.3.2 and table 11
- 2) For values of test current higher than 400A but not exceeding 800A.
Refer to G10.10.2.3.2 and table 12.
- 3) For values of test current higher than 800A but not exceeding 4000A.
Refer to G10.10.2.3.2 and table 12.
- 4) For values of test current higher than 4000A
Refer to G10.10.2.3.2

G10.10.2.3.3 Measurement of temperatures.

Refer to G10.10.2.3.3

The positions at which measurements are made and the method of temperature measurement shall be detailed in the test report.

G10.10.2.3.4 Ambient air temperatures

Refer to G10.10.2.3.4 and to 9.2 of this document.

G10.10.2.3.5 Verification of the complete ASSEMBLY

Refer to G10.10.2.3.5

G10.10.2.3.6 Verification considering individual functional units separately and the complete ASSEMBLY

Refer to G10.10.2.3.6

G10.10.2.3.7 Verification considering individual functional units and the main and distribution busbars separately as well as the complete ASSEMBLY

Refer to Standard

G10.10.2.3.8 Results to be obtained

Refer to Standard

The results of the measurements taken shall be detailed in the test report.

G10.10.3 Derivation of ratings for similar variants

This part is out of the scope of this document.

G10.10.4 Verification by calculation

This part is out of the scope of this document.

G10.11 Short-circuit withstand strength

G10.11.1 General

Refer to G10.11.1

G10.11.2 Circuits of ASSEMBLIES which are exempted from the verification of the short-circuit withstand strength.

Refer to G10.11.2

G10.11.3 Verification by the application of design rules

This part is out of the scope of this document.

G10.11.4 Verification by comparison with a reference design

This part is out of the scope of this document.

G10.11.5 Verification by test

G10.11.5.1 Test arrangements

All parts of the ASSEMBLY which may affect the results of the test or be affected by the test shall be fitted for the test e.g. enclosure covers, withdrawable outgoing units etc and this shall be stated in the test report using drawing, pictures or by description.

Where such fitments are not incorporated on equipment provided for test the results of any relevant tests shall not be utilised for the assignment of ratings.

G10.11.5.2 Performance of the test - General

Refer to G10.11.5.2

Where an ASSEMBLY incorporates or is intended to incorporate a built-in component e.g. circuit-breaker and the interconnections to this device are to be included in the test report, then the device shall be closed for test as in normal service OR the interconnections must be short-circuited for test up to and including the point at which the circuit-breaker is 'terminated', such that the interconnections are part of the electrical circuit to be tested. Whatever has been tested must be clearly and unambiguously stated in the test report.

G10.11.5.3 Testing of the main circuits

G10.11.5.3.1 General

Refer to Standard G10.11.5.3.1 and to

G10.11.5.3.4 Connections to the supply side of outgoing units

For the test to Sub-clause G10.11.5.3.4 the standard requires the value of the short-circuit current to be the same as that for the main bars. This shall be taken to relate to the magnitude of rms and peak currents including the associated duration, and to the busbars to which the interconnections are made.

G10.11.5.3.5 Neutral conductor

For the test to Sub-clause G10.11.5.3.5 the standard requires the value of test current to be 60% of the phase current and to be also agreed between the manufacturer and user if different to this. For the purposes of testing the term 'phase current' shall be taken to mean the rated short-time withstand, rated conditional short-circuit or rated short time withstand current as applicable, assigned to the associated main bus bars.

The relationship between the peak and rms current for the test to Sub-clause G10.11.5.3.5 shall be as in Table 7. The value of the rms test current, its peak and duration, shall be stated in the test report. The test applies to the main bus bars, bus bars, conductors connecting the bus bars to the outgoing circuit and the outgoing circuits.

The distance from the calibration point to the relevant short-circuit point(s) shall, however, be detailed within the test report. This may be in the form of a dimensioned diagrammatic representation of the main circuit(s) on the form XXXX "Configuration of the Assembly" of the TRF IEC/EN 61439-2 Ed.1.0.

Tests on a neutral bar to Clause G10.11.5.3.5 shall not be included in a Certificate unless tests on the main bus bar to Clause G10.11.5.3.3 are also included.

G10.11.5.4 Value and duration of the short-circuit current

Refer to Standard G10.11.5.4

The rated conditional short-circuit currents or short-time withstand currents may be any recognized value provided the Certificate Front Sheet clearly indicates the associated peak factor which in turn must be at least that specified in Table 5 for the relevant short-circuit rating.

It is allowed the peak withstand current test and short-time withstand current test to be separated. In this case, the rated values of short-time withstand current must be achieved within the tolerance of +5% / - 0% in each phase and the rated peak withstand current must be achieved in at least one phase.

G10.11.5.5 Results to be obtained

Refer to Standard G10.11.5.5

G10.11.5.6 Testing of the protective circuit

Refer to G10.11.5.6

G10.12 EMC tests

Refer to G - Annex J.10.12

G/J 10.12.1 Immunity tests

Refer to G - Annex J 10.12.1

G/J 10.12.1.1 ASSEMBLIES not incorporating electronic circuits

No tests are necessary

G/J 10.12.1.2 ASSEMBLIES incorporating electronic circuits

Refer to G - Annex J 10.12.1.2

G/J 10.12.2 Emission tests

Refer to G - Annex J 10.12.2

G/J 10.12.2.1 ASSEMBLIES not incorporating electronic circuits

No tests are necessary

G/J 10.12.2.2 ASSEMBLIES incorporating electronic circuits

Refer to G - Annex J 10.12.2.2

The ASSEMBLIES manufacturer shall specify the test methods used; the details of the arrangement as well as the characteristics test circuits used shall be detailed in the test report.

The emission limits are reported in the following tables respectively:

Emission limits for Environment A : Table J.1

Emission limits for Environment B : Table J.2

The tests required are listed in the following tables respectively:

The tests for EMC immunity for Environment A: Table J.3

The tests for EMC immunity for Environment B: Table J.4

The acceptance criteria when electromagnetic disturbances are present are listed in the table J.5.

10.13. Mechanical operation

Refer to standard and G10.13