SLOVENSKI STANDARD
SIST EN 60947-6-2:1998/A11:1998

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Low-voltage switchgear and controlgear assemblies - Part 6: Multiple function equipment - Section 2: Control and protective switching devices (or equipment) (CPS) - Amendment A1

Low-voltage switchgear and controlgear -- Part 6-2: Multiple function equipment - Control and protective switching devices (or equipment) (CPS)

Niederspannungsschaltgeräte -- Teil 6-2: Mehrfunktions-Schaltgeräte - Steuer- und Schutz-Schaltgeräte (CPS)

Appareillage à basse tension -- Partie 6-2: Matériels à fonctions multiples - Appareils (ou matériel) de connexion de commande et de protection (ACP)

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English version

Low-voltage switchgear and controlgear
Part 6: Multiple function equipment
Section 2: Control and protective switching devices (or equipment) (CPS)

Appareillage à basse tension
Partie 6: Matériels à fonctions multiples
Section 2: Appareils (ou matériel) de connexion de commande et de protection (ACP)

Niederspannungsschaltgeräte
Teil 6: Mehrfunktionsschaltgeräte
Hauptabschnitt 2: Steuer- und Schutz-Schaltgeräte

This amendment A11 modifies the European Standard EN 60947-6-2:1993; it was approved by CENELEC on 1996-07-02. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment 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 amendment 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.

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

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Foreword

This amendment was prepared by the Technical Committee CENELEC TC 17B, Low-voltage switchgear and controlgear including dimensional standardization.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A11 to EN 60947-6-2:1993 on 1996-07-02.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-10-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-10-01

This amendment covers the requirements of EMC for control and protective switching devices. It contains additional requirements corresponding to subclause 7.3 of EN 60947-1.

CONTENTS

Add the titles of the new subclauses as follows :

6 Product information

Add new subclause:

6.1.3 *Electromagnetic compatibility*

v) environment 1 or 2;

w) special requirements if applicable, for example shielded or twisted conductors.

NOTE : Unshielded or untwisted conductors are considered as normal installation conditions.

6.3 *Instructions for installation, operation and maintenance*

Add the following second paragraph :

Information shall be provided by the manufacturer to advise the user on the measures to be taken with regard to the CPS, if any, concerning EMC.

8 Constructional and performance requirements

Add new subclauses :

8.3 *Electromagnetic compatibility (EMC)*

8.3.1 *General*

Subclause 7.3.1 of Part 1 applies with the following addition :

The environmental condition 1 or 2 shall be stated in the manufacturer's documentation.

All emission and immunity tests are type tests and shall be carried out under representative conditions, both operational and environmental, including any measures specified by the manufacturer, such as enclosures, wiring methods.

8.3.2 *Immunity*

The rest results are specified using the performance criteria of IEC 1000-4-1 as listed below :

1 Normal performance within the specification limits.

2 Temporary degradation or loss of function or performance which is self recoverable.

3 Temporary degradation or loss of function or performance which requires operator's intervention or systems reset. Normal functions must be restorable by simple intervention, e.g. by manual reset or restart. There must not be any damaged component.

Example for criterion 2 : unwanted LED illumination
Example for criterion 3 : tripping of the overload relay

Power frequency magnetic field tests are not required because such devices are naturally submitted to such fields. Immunity is demonstrated by the successful completion of the operating capability tests (see 9.3.3.5 and 9.3.3.6).

8.3.2.1 *Equipment not incorporating electronic circuits*

Subclause 7.3.2.1 of Part 1 applies with the following addition :

Equipment incorporating only components such as diodes, varistors, resistors or capacitors is not required to be tested.

8.3.2.2 *Equipment incorporating electronic circuits*

Subclause 7.3.2.2 of Part 1 applies.

The performance criteria are those of 8.3.2 and tests are given in more detail in table 16.

8.3.3 *Emission*

The levels of severity required for environment 1 cover those required for environment 2.

8.3.3.1 *Equipment not incorporating electronic circuits*

Subclause 7.3.3.1 of Part 1 applies with the following addition :

Equipment incorporating only components such as diodes, varistors, resistors or capacitors is not required to be tested (e.g. in surge suppressors).

The frequency and levels of these emissions are considered provisionally until further study as part of the normal electromagnetic environment of low voltage switchgear.

8.3.3.2 *Equipment incorporating electronic circuits*

Subclause 7.3.3.2 of Part 1 applies with the following addition :

Radiated radio frequency emission tests are only required for equipment incorporating circuits with fundamental switching frequency greater than 9 kHz, e.g. chopped supplies or high frequency clocks of microprocessors.

Verification tests are given in 9.3.5.3.

9 Tests

Add new subclauses :

9.3.5 *EMC Tests*

9.3.5.1 *General*

Subclauses 8.3.2.1, 8.3.2.3 and 8.3.2.4 of Part 1 apply with the following additions :

With the agreement of the manufacturer more than one EMC-test or all EMC-tests may be conducted on one and the same sample, which may initially be new or may have passed test sequences according to 9.3.1. The sequence of the EMC-tests may be at any convenience.

Unless otherwise stated in this standard or specified by the manufacturer, performance criterion 2 applies and it shall be noted in the test report.

Unless otherwise specified in the relevant clause, after the tests, the operating limits of 9.3.3.2 and if applicable 8.2.1.5.1 shall be verified.

The test report shall also include any special measures that have been taken to achieve compliance, e.g. the use of shielded or special cables. If auxiliary equipment is used with the device in order to comply with immunity or emission requirements, it shall be included in the report.

The test sample shall be in the open or closed position, whichever is worse, and shall be operated with the rated control supply voltage U_S or its rated current if applicable.

According to their utilization category and to their overcurrent protection CPS incorporating electronic circuits shall be submitted to the following test levels :

- "Normal" severity test level for CPS's of utilization categories AC-40, -41, -45a, -45b, DC-40, -41, -46, not provided with electronic overcurrent protection, and for all CPS's of utilization categories AC-42, -43, -44, DC-43, -45.

- "Increased" severity test level for CPS's of utilization categories AC-40, -41, -45a, -45b, DC-40, -41, -46, provided with electronic overcurrent protection.

9.3.5.2 *Immunity*

The tests of table 16 are required. Special requirements are specified in 9.3.5.2.1 to 9.3.5.2.6.

If during the EMC-tests conductors are to be connected to the test sample the cross-section and the type of conductors is optional but shall be in accordance with the manufacturer's literature.

Table 16: EMC immunity tests

Type of test	Test levels	
	"Normal" severity 1)	"Increased" severity 2)
1,2/50 µs surges IEC 1000-4-5	2 kV (CM) *) 1 kV (DM) *)	4kV/2kA (Uimp ≤ 4kV) (CM) *) + (DM) *) 6kV/3kA (Uimp > 4kV) (CM) *) + (DM) *)
Fast transient bursts IEC 1000-4-4	2 kV	4 kV
Electromagnetic field IEC 1000-4-3	10 V/m	10 V/m
Electrostatic disturbances IEC 1000-4-2	4 kV/contact discharge 8 kV/air discharge	8 kV/contact discharge 15 kV/air discharge
1) This corresponds to level 3 in IEC 1000-4-1 2) When specifically required; *) CM : Common mode DM : Differential mode		

9.3.5.2.1 *Electrostatic discharge*

9.3.5.2.1.1 *"Normal" severity* (see 9.3.5.1)

The test shall be conducted using the methods of IEC 1000-4-2. Ten positive and ten negative pulses shall be applied to each selected point, the time interval between each successive single discharge being 1 second. Terminals are not required to be tested.

Except for control supply voltage terminals, connections are not required to be made to other terminals.

Tests are not possible if the device is an open frame or of degree of protection IP 00. In this case the manufacturer shall attach a label to the unit advising of the possibility of damage due to static discharges.

9.3.5.2.1.2 *"Increased" severity* (see 9.3.5.1)

i) *Test conditions*

Testing shall be made by contact discharge according to IEC 1000-4-2, level 4, the corresponding voltage being 8 kV.

The test circuit shall be in accordance with figure 2.

The CPS shall be tested in a metallic enclosure connected to a ground plane supporting the transient generator in accordance with figure 8 (connecting cables not shown) .

The minimum distance of conducting parts to the metallic enclosure shall be 0,1 m. The door opening shall be such as to permit access to the actuator, all setting means and indicators if relevant.

ii) *Test procedure*

The tests are made on all parts of the CPS normally accessible to the operator (e.g. setting means, keyboard, actuator, enclosure).

The test current is applied to any one pair of poles at any convenient voltage.

In case a discharge occurs at any test point, the test is repeated ten times with an interval of 1 second minimum.

Discharges shall be made on the metallic enclosures at a sufficient number of points (see subclause 8.3.2 of IEC 1000-4-2).

The CPS may be reclosed as often as necessary if tripping at twice the current setting occurs during the test, due to the number of discharge points.

iii) *Performance of the test sample during and after the test*

During the application of the transients, the overload tripping characteristics shall comply with the following requirements:

- at a current of 0,9 times the current setting, no tripping shall occur;
- at a current of two times the current setting, the tripping time shall be in accordance with the manufacturer's time-current characteristics.

The short-time and instantaneous trip current settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the closest higher settings shall be used.

No other performance verification is required after the test.

9.3.5.2.2 *Electromagnetic field*

9.3.5.2.2.1 *"Normal" severity* (see 9.3.5.1)

The tests shall be conducted using the methods of IEC 1000-4-3. The test procedure of clause 6 of IEC 1000-4-3 shall apply. The test level shall be 10 V/m swept over the frequency range 26 MHz to 1 GHz. The device shall comply with performance criterion 1.

9.3.5.2.2.2 *"Increased" severity* (see 9.3.5.1)

i) *Test conditions*

The required severity level is 10 V/m, from 26 MHz to 1 GHz (level 3).

The test shall be made in accordance with IEC 1000-4-3.

The test diagram shall be in accordance with figure 2. All auxiliaries shall be disconnected during the test. CPS's may be tested in free air, or in an individual enclosure (see 9.3.5.2.3.2 i)) and 9.3.5.2.1.2 i)), in accordance with the manufacturer's instructions.

If the connections to and from the CPS are unspecified, lengths of 1 m of unshielded cable shall be used and installed in a manner so that the CPS is exposed to the greatest interference.

The test shall be made in a semi-anechoic shielded room or in an anechoic chamber.

When using an antenna which generates a polarized signal such as a biconical or log-periodic antenna, the tests are to be made twice, once at horizontal polarization and once at vertical polarization, on the two faces deemed to be the most sensitive.

ii) *Test procedure*

The test current is applied to any one pair of poles at any convenient voltage.

The signal generator is operated so as to sweep each required frequency band and dwell at a minimum of three frequencies per octave in order to verify the protective function of the CPS.

iii) *Performance of the test sample during and after the test*

While sweeping through the required frequency band, the overload tripping characteristics shall comply with the following requirements:

- at a current of 0,9 times the overload current setting, no tripping shall occur.

- at each of the three dwell frequencies per octave, at a current of two times the current setting, the tripping time shall be between the maximum tripping time and 0,5 times the minimum tripping time of the manufacturer's time-current characteristics.

The short-time and instantaneous trip currents settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the closest higher settings shall be used.

No other performance verification is required after the test.

9.3.5.2.3 *Fast transient bursts*

9.3.5.2.3.1 *"Normal" severity* (see 9.3.5.1)

The test shall be conducted using the method of IEC 1000-4-4. The bursts shall be applied to all main, control or auxiliary terminals whether comprising electronic or conventional contacts. The test voltage shall be applied for the duration of 1 minute.

9.3.5.2.3.2 *"Increased" severity* (see 9.3.5.1)

i) *Test conditions*

The tests are made at level 4, common mode.

The CPS shall be tested in a metallic enclosure connected to a ground plane supporting the transient generator in accordance with figure 8 (connecting cables not shown) .

The minimum distance of conducting parts to the metallic enclosure shall be 0,1 m. The door opening shall be such as to permit access to the actuator, all the setting means and indicators if relevant.

ii) *Test procedure*

a) Transients applied to the main-circuit:
Tests are made between all pairs of poles in turn, according to figure 4.

b) Transients applied to auxiliary circuits which can be connected to the main circuit :
Tests are made between the input and the output of each auxiliary which can be connected to the main circuit, according to figure 6.

iii) *Performance of the test sample during and after the test*

During the application of the transients the overload tripping characteristics shall comply with the following requirements:

- at a current of 0,9 times the current setting, no tripping shall occur during the application of the transients. The duration of the test shall be three to four times the maximum tripping time corresponding to twice the current setting or 10 minutes, whichever is the lower;

- at a current of two times the current setting, the tripping time shall be between the maximum tripping time and 0,5 times the minimum tripping time of the manufacturer's time-current characteristics.

The short-time and instantaneous trip current settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the closest higher settings shall be used.

No other performance verification is required after the test.

9.3.5.2.4 *Surges* (1,2/50 μs)

9.3.5.2.4.1 *"Normal" severity* (see 9.3.5.1)

The test shall be conducted using the method of IEC 1000-4-5. Capacitive coupling shall be preferred. The surges shall be applied to all main, control or auxiliary terminals whether comprising electronic or conventional contacts.

The repetition rate shall be one per minute, with the number of pulses being five positive and five negative.

9.3.5.2.4.2 *"Increased" severity* (see 9.3.5.1)

i) *Test conditions*

The tests are made at common mode and at differential mode

at level 4 kV/2 kA for CPS's of $U_{imp} \leq 4$ kV

at level 6 kV/3 kA for CPS's of $U_{imp} > 4$ kV.

The CPS shall be tested in a metallic enclosure connected to a ground plane supporting the transient generator in accordance with figure 8 (connecting cables not shown) .

The minimum distance of conducting parts to the metallic enclosure shall be 0,1 m. The door opening shall be such as to permit access to the actuator, all the setting means and indicators if relevant.

ii) *Test procedure*

The number of transients shall be ten for each polarity.

The surge test is repeated six times per minute without synchronization.

a) Transients applied to the main circuit:
Tests are made between all pairs of poles in turn, according to figures 4 or 5, as applicable .

b) Transients applied to auxiliary circuits which can be connected to the main circuit:
Tests are made between the input and the output of each auxiliary circuit which may be connected to the main circuit, according to figures 6 or 7, as applicable.

iii) *Performance of the test sample during and after the test*

During the application of the transients the overload tripping characteristics shall comply with the following requirements:

- at a current of 0,9 times the current setting, no tripping shall occur during the application of the transients. The duration of the test shall be three to four times the maximum tripping time corresponding to twice the current setting or 10 minutes, whichever is the lower;

- at a current of two times the current setting, the tripping time shall be between the maximum tripping time and 0,5 times the minimum tripping time of the manufacturer's time-current characteristics.

The short-time and instantaneous trip current settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the closest higher settings shall be used.

No other performance verification is required after the test.

9.3.5.2.5 *Harmonics*

9.3.5.2.5.1 *"Normal" severity* (see 9.3.5.1)

The tests are under consideration.