



SLOVENSKI STANDARD SIST HD 631.1 S2:2008

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Electric cables - Accessories - Material characterisation - Part 1: Fingerprinting and type tests for resinous compounds

Kabel und isolierte Leitungen - Garnituren - Materialcharakterisierung - Teil 1: Fingerprínt - und Typprüfungen für Reaktionsharzmassen

Câbles électriques - Accessoires - Caractérisation des matériaux - Partie 1: Essais d'identification et essais de type pour les composés résineux

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- 29.060.20 Kabli Cables

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English version

**Electric cables -
Accessories -
Material characterisation -
Part 1: Fingerprinting and type tests for resinous compounds**

Câbles électriques -
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Kabel und isolierte Leitungen -
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für Reaktionsharzmassen

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This Harmonization Document was approved by CENELEC on 2007-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document at national level.

Up-to-date lists and bibliographical references concerning such national implementations may be obtained on application to the Central Secretariat or to any CENELEC member.

This Harmonization Document exists in three official versions (English, French, German).

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, 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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

This Harmonization Document was prepared by a task force under the direction of WG 11 of CENELEC TC 20, Electric cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as HD 631.1 S2 on 2007-09-01.

This Harmonization Document supersedes HD 631.1 S1:1998.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 2008-03-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 2008-09-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 2010-09-01

HD 631 will have 4 parts:

- Part 1: Fingerprinting and type tests for resinous compounds
- Part 2: Fingerprinting and type tests for heat shrinkable components for low voltage applications
- Part 3: Fingerprinting for heat shrinkable components for medium voltage applications from 3,6/6 (7,2) kV up to 20,8/36 (42) kV
- Part 4: Fingerprinting for cold shrinkable components for low and medium voltage applications up to 20,8/36 (42) kV

NOTE It has been assumed in the preparation of this document that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

WARNING This Harmonization Document calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

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1 Scope

This Harmonization Document specifies the test methods and requirements of tests for

- a) fingerprinting (as defined in 3.12),
- b) type testing (as defined in 3.13)

of solvent-free polymerizable, reacting resinous compound intended to be used for electrical insulation and mechanical protection in cable accessories covered by EN 50393, HD 629.1 S2 and HD 629.2 S2, for low and medium voltage up to 20,8/36 (42) kV.

Fingerprinting and type testing of materials do not have a mandatory link to type testing of accessories. They shall be regarded as stand-alone tests, but can be carried out in combination with the accessory type tests.

NOTE Information on health and safety is given in Annex A.

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.

EN 50393, *Test methods and requirements for accessories for use on distribution cables of rated voltage 0,6/1,0 (1,2) kV*

EN 60243-1, *Electrical strength of insulating materials — Test methods — Part 1: Test at power frequencies (IEC 60243-1)*

EN 61234-2, *Electrical insulating materials — Methods of test for the hydrolytic stability — Part 2: Moulded thermosets (IEC 61234-2)*

HD 429, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials (IEC 60093)*

HD 629.1, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV — Part 1: Cables with extruded insulation*

HD 629.2, *Test requirements on accessories for use on power cables of rated voltage from 3,6/6(7,2) kV up to 20,8/36(42) kV — Part 2: Cables with impregnated paper insulation*

EN ISO 179, *Plastics — Determination of Charpy impact strength (ISO 179)*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291)*

EN ISO 527 series, *Plastics — Determination of tensile properties (ISO 527 series)*

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868)*

EN ISO 1183 series, *Plastics — Methods for determining the density of noncellular plastics (ISO 1183 series)*

EN ISO 2555, *Plastics — Resins in the liquid state or as emulsions or dispersions — Determination of apparent viscosity by the Brookfield test method (ISO 2555)*

EN ISO 2592, *Determination of flash and fire points — Cleveland open cup method (ISO 2592)*

EN ISO 3521, *Plastics — Unsaturated polyester and epoxy resins — Determination of overall volume shrinkage (ISO 3521)*

EN ISO 4895, *Plastics — Liquid epoxy resins — Determination of tendency to crystallize (ISO 4895)*

IEC 60050-461, *International Electrotechnical Vocabulary — Chapter 461: Electric cables*

IEC 60250, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths*

ISO 7056, *Plastics laboratory ware — Beakers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply together with those given in IEC 60050-461.

3.1

resinous compound

compound for cable accessories made by the mixture of at least two components (resin and reagent)

NOTE For some applications additional components such as filler may be needed.

3.2

resin

liquid organic material that cures as a result of polymerization by means of reagents (e.g. hardener or accelerator) without releasing additional volatile products

3.3

reagent

substance or compound of substances which causes, when added to resin, hardening of resin by cross-linking of molecules or accelerates hardening of resin

3.4

pot life

time available to mix the components of the resinous compound together and pour or inject the compound into the cable accessory, such that it continues to flow smoothly and cohesively

3.5

“use before” date (shelf-life)

date until which a resinous compound, when stored under specified conditions of temperature and humidity, retains specified properties

3.6

density

ratio of mass to volume

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3.7

tendency to crystallization

measurement of the ability of epoxy base resin not to change state (liquid to solid) by a certain temperature close to water freezing point for a fixed time

3.8

exotherm peak temperature

highest temperature that is reached during the hardening process of a defined volume of a resinous compound after mixing at a defined temperature

3.9

hardness

measurement of the resistance of a material to indentation by means of durometers or by penetration of a needle (soft material)

3.10

hydrolytic stability

measurement of the resistance to hydrolytic degradation of resinous compounds exposed to the simultaneous influence of water and temperature, which may lead to an irreversible change in mechanical and or electrical properties of the compound

3.11

fingerprinting

tests made to establish and subsequently confirm the properties of materials or components used in cable accessories

3.12**type test**

tests made on materials or components of a cable accessory in order to demonstrate satisfactory performance characteristics to meet the intended application

3.13**deviation**

variation of a property between the initial test values and the test values measured on new samples at a later date

3.14**initial test**

tests made to establish the properties of materials or components used in cable accessories

4 Classification

Resinous compounds are classified according to their application in categories as follows:

Table 1 - Categories of resinous compounds

Voltage Class	Function	Characteristic
Low Voltage (L)	Mechanical Protection (MP)	Cures in water (W)
Medium Voltage (M)	Insulation (I)	Cures at low temperature (LT) Cures at high temperature (HT)

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A resinous compound is identified by a combination of categories.

For example: Low voltage compound for mechanical protection, curing at high temperature: **LMP-HT**;
 Low voltage compound for insulation, curing in presence of water: **LI-W**;
 Low voltage compound for insulation & mechanical protection: **LMP/LI**.

Tests for fingerprinting and type testing are carried out in accordance with each of the resinous compound categories.

5 Fingerprinting**5.1 General**

Tests shall be carried out based on the category of the resinous compound as defined in Table 1.

5.2 Sampling

Samples for fingerprinting shall be taken from material stored under conditions prescribed by the supplier. The fingerprinting test of resinous compound shall be carried out either:

- as a stand-alone test. Samples used for the initial test shall be taken from material available as agreed between supplier and user, or
- in combination with an accessory type test. Samples used for the initial test shall be taken from the same batch as those used in the accessory type test. In the event that no material from the same batch is available, the samples used for the initial test shall be taken from material available as agreed between supplier and user.

5.3 Preparation and conditioning

5.3.1 General

For all tests, unless otherwise specified, conditioning shall be carried out in accordance with EN ISO 291 using atmosphere 23/50.

5.3.2 Individual components prior to mixing

Components (resin and reagent) shall be individually prepared, conditioned and tested in accordance with the relevant test method as specified in stage 1 of the sequence of tests given in Table 2. Filler, when supplied as a separate item, shall not be tested as a component.

5.3.3 Resinous compound just after mixing (curing stage)

Compounds shall be prepared according to the supplier's instructions, and then tested as specified in stage 2 of the sequence of tests given in Table 2.

5.3.4 Cured resinous compound (original)

Compounds shall be prepared according to supplier's instructions and cured for 24 h at room temperature unless otherwise specified in the test method. The specimens shall be post-cured at (80 ± 2) °C for 24 h unless otherwise specified in the test method and then cooled in a desiccator for 24 h at room temperature.

NOTE If degassing is needed, it will be indicated in the relevant test method and the conditions for the degassing will also be indicated.

Tests shall then be carried out as specified in stage 3 of the sequence of tests given in Table 2.

5.3.5 Cured resinous compound after thermal ageing (dry)

Compounds shall be prepared as per 5.3.4.

Tests shall then be carried out as specified in stage 4 of the sequence of tests given in Table 2.

5.4 Sequence of tests

Sequences of tests shall be carried out on the resinous compound in the following four stages, in accordance with Table 2:

- Stage 1: individual components prior to mixing;
- Stage 2: resinous compound just after mixing (curing stage);
- Stage 3: cured resinous compound (original);
- Stage 4: cured resinous compound after thermal ageing (dry).

5.5 Test report

The test report shall include the following data:

- 1) resin category and identification;
- 2) batch number or identification;
- 3) marking and labelling according to material safety data sheet (MSDS);
- 4) test methods and results;
- 5) major test parameters, including conditioning and calibration, if any;
- 6) processing conditions to mix the compound;
- 7) copy of technical data sheet (TDS) and MSDS.

Table 2 — Fingerprinting tests: Test methods and requirements

Number	Property	Test method	Units	Max. acceptable deviation ^a		Comments
				Resin categories		
				LMP/LMPW/ MMP/MMPW	LI/LIW MI/MIW	Applies to all combinations with LT or HT resin types
Stage 1 – Individual components prior to mixing						
1	Viscosity	EN ISO 2555	Pa.s	± 10 %	± 10 %	
Stage 2 – Resinous compound just after mixing (curing stage)						
2	Pot life (0,3 l at 23 °C)	7.2	min	± 25 %	± 25 %	
3	Exotherm at 23 °C	7.3	°C	± 10 %	± 10 %	
	Peak temperature		°C	± 10 %	± 10 %	
	Time to peak		min	± 20 %	± 20 %	
Stage 3 – Cured resinous compound (original)						
4	Density non-filled compound	EN ISO 1183-1	g/cm ³	± 2 %	± 2 %	
	Density filled compound	EN ISO 1183-1	g/cm ³	± 5 %	± 5 %	
5	Impact strength (without notch)	EN ISO 179	kJ/m ²	± 25 %	± 25 %	Only for Epoxy and Acrylic resins
6	Shore hardness	EN ISO 868		± 5	± 5	
7	Tensile strength	EN ISO 527	MPa	± 25 %	-	
8	Elongation at break	EN ISO 527	%	± 25 %	-	
9	Volume resistivity	HD 429	Ω.cm	-	± 10 %	
Stage 4 – Cured resinous compound after thermal ageing (dry)						
10	Weight loss	Annex C		± 20 %	± 20 %	
11	Change in impact strength (without notch)	Annex C		± 25 %	± 25 %	Only for Epoxy and Acrylic resins
^a From value for original batch of compound.						

6 Type tests

6.1 General

Tests shall be carried out based on the category of the resinous compound as defined in Table 1. These tests are of such a nature that, once successfully completed, they need not be repeated unless changes are made in the material, component formulation or manufacturing process, which might change the performance characteristics.

6.2 Sampling

Samples for type testing shall be taken from material stored under conditions prescribed by the supplier. The type testing of resinous compound shall be carried out either:

- a) as a stand-alone test. Samples used for the type test shall be taken from material available as agreed between supplier and user, or
- b) in combination with an accessory type test. Samples used for the resinous compound type test shall be taken from the same batch as used in the accessory type test. In the event that no material from the same batch is available, the samples used for the resinous compound type test shall be taken from material available as agreed between supplier and user.

6.3 Preparation and conditioning

6.3.1 General

For all tests, unless otherwise specified, conditioning shall be made in accordance with EN ISO 291 using atmosphere 23/50.

6.3.2 Individual components prior to mixing

Components (resin and reagent) shall be individually prepared, conditioned and tested in accordance with the relevant test method as specified in stage 1 of the sequence of tests given in Table 3. Filler, when supplied as a separate item, shall not be tested as a component.

6.3.3 Resinous compound just after mixing (curing stage)

Compounds shall be prepared and mixed according to supplier's instructions and tested as specified in stage 2 of the sequence of tests specified in Table 3.

6.3.4 Cured resinous compound (original)

Compounds shall be prepared according to supplier's instructions and cured for 24 h at room temperature unless otherwise specified in the test method. The specimens shall be post-cured at (80 ± 2) °C for 24 h unless otherwise specified in the test method, and then cooled in a desiccator for 24 h at room temperature.

NOTE If degassing is needed, it will be indicated in the relevant test method and the conditions for the degassing will also be indicated.

6.3.5 Cured resinous compound after thermal ageing (dry and wet)

Compounds shall be prepared according to supplier's instructions and cured for 24 h at room temperature unless otherwise specified in the test method. The specimens shall be post-cured at (80 ± 2) °C for 24 h unless otherwise specified in the test method, and then cooled in a desiccator for 24 h at room temperature.

NOTE If degassing is needed, it will be indicated in the relevant test method and the conditions for the degassing will also be indicated.