



SLOVENSKI STANDARD

SIST HD 22.1 S4:2003

01-februar-2003

Nadomešča:
SIST HD 22.1 S3:1998

Kabli z naznačenimi vrednostmi do vključno 450/750 V in s prečno povezano izolacijo - 1. del: Splošne zahteve

Cables of rated voltages up to and including 450/750 V and having cross-linked insulation - Part 1: General requirements

Starkstromleitungen mit vernetzter Isolierhülle für Nennspannungen bis 450/750 V - Teil 1: Allgemeine Anforderungen

Conducteurs et câbles isolés avec des matériaux réticulés de tension assignée au plus égale à 450/750 V - Partie 1: Prescriptions générales

Ta slovenski standard je istoveten z: HD 22.1 S4:2002

ICS:

29.060.20 Kabli Cables

SIST HD 22.1 S4:2003 en

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HARMONIZATION DOCUMENT

HD 22.1 S4

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOKUMENT

November 2002

ICS 29.060.20

Supersedes HD 22.1 S3:1997

English version

**Cables of rated voltages up to and including 450/750 V
and having cross-linked insulation
Part 1: General requirements**

Conducteurs et câbles isolés
avec des matériaux réticulés
de tension assignée
au plus égale à 450/750 V
Partie 1: Prescriptions générales

Starkstromleitungen mit vernetzter
Isolierhülle mit Nennspannungen
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This Harmonization Document was approved by CENELEC on 2002-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this Harmonization Document on a national level.

Up-to-date lists and bibliographical references concerning such national implementation 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and 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 edition 4 of HD 22.1 has been prepared by the Technical Committee CLC/TC 20, Electric cables.

HD 22 was originally adopted by CENELEC on 9th July 1975.

Edition 2 of HD 22 was implemented on 1st January 1984. A third edition of Part 1 was published in September 1997.

This 4th edition provides a full updating, including incorporation of amendments ratified during the maintenance of Part 3 onwards of HD 22, and introduces other improvements.

HD 22.1 S4 is related to IEC 60245-1:1994, but is not directly equivalent.

HD 22 now has the following parts:

HD 22.1 S4	General requirements
HD 22.2 S3	Test methods
HD 22.3 S3	Heat resistant silicone rubber insulated cables
HD 22.4 S3	Cords and flexible cables
HD 22.5	(Spare)
HD 22.6 S2	Arc welding cables
HD 22.7 S2	Cables with increased heat resistance for internal wiring for a conductor temperature of 110 °C
HD 22.8 S2	Polychloroprene or equivalent synthetic elastomer sheathed cable for decorative chains
HD 22.9 S2	Single core non-sheathed cables for fixed wiring having low emission of smoke and corrosive gases
HD 22.10 S1	EPR insulated and polyurethane sheathed flexible cable
HD 22.11 S1	EVA cords and flexible cables
HD 22.12 S1	Heat resistant EPR cords and flexible cables
HD 22.13 S1	Single and multicore flexible cables, insulated and sheathed with cross-linked polymer and having low emission of smoke and corrosive gases
HD 22.14 S2	Cords for applications requiring high flexibility
HD 22.15 S1	Multicore cables insulated and sheathed with heat resistant silicone rubber
HD 22.16 S1	Water resistant polychloroprene or equivalent synthetic elastomer sheathed cables

In order that this revision of Part 1 of HD 22 does not introduce unnecessary changes to long-established clause numbers, the normative references (which would otherwise be inserted as clause 2) are given in annex A.

The draft Harmonization Document was submitted to the Unique Acceptance Procedure and approved by CENELEC as HD 22.1 S4 on 2002-09-01.

The following dates were fixed:

- latest date by which the existence of the HD has to be announced at national level (doa) 2003-03-01
- latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement (dop) 2003-09-01
- latest date by which the national standards conflicting with the HD have to be withdrawn (dow) 2003-09-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex A is normative and annex B is informative.

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1 General

1.1 Scope

HD 22 applies to rigid and flexible cables, sheathed and unsheathed, and insulated with cross-linked material, of rated voltages U_0/U up to and including 450/750V, used in power installations.

NOTE For some types of flexible cables, the term "cord" is used.

This Part 1 specifies the general requirements applicable to these cables.

The test methods specified are given in Part 2 of this Harmonization Document (HD), or in the common test methods for cables given in EN 50265, EN 50266, EN 50267, EN 50268 and EN 60811.

The particular types of cables are specified in Part 3 onwards of this HD, which are hereafter referred to as "the particular specifications".

The code designations of these types of cables are in accordance with HD 361.

1.2 Object

The objects of this HD are to standardise cables and cords that are safe and reliable when properly used, to state the characteristics and manufacturing requirements directly or indirectly bearing on safety, and to specify methods for checking conformity with those requirements.

1.3 Common marking

The common marking (<HAR>) signifies that the manufacturer has been assessed, and his production is subjected to continuing surveillance in accordance with the technical procedures, by a recognised national Approval Organisation, which is a signatory to the "Agreement on the use of a Commonly Agreed Marking for Cables and Cords complying with Harmonised Specifications."

Compliance with this HD may be certified by the application of the agreed technical procedures for granting the common marking ¹⁾, which are the recognised means of ensuring that a manufacturer is competent and takes all reasonable care to produce cables complying with this HD.

The common marking may be used, under these conditions, by manufacturers in countries which have implemented this HD and in which the national Approval Organisations are signatories to the Agreement.

NOTE See annex B for guidance on national marking.

2 Definitions

2.1 Definitions relating to insulating and sheathing materials and their processing

2.1.1 cross-linking

the process of multiple intermolecular covalent bonding between polymer chains obtained through a chemical process, with or without the contribution of heat, or through a physical process such as irradiation

¹⁾ These are given in Appendices 4 and 5 of the 'Agreement on the use of a Commonly Agreed Marking for Cables and Cords complying with Harmonised Specifications'.

2.1.2 vulcanisation

a post-application treatment taking place after the insulation and/or sheath has been applied in order to induce cross-linking of the rubber or synthetic elastomer

NOTE Vulcanisation is an historical term now largely limited to use with the longer-established materials which did, and in some cases still do, use sulphur as the primary chemical agent of cross-linking.

2.1.3 type of compound

the category in which a compound is placed according to its properties, and determined by specific tests. The type designation is not directly related to the composition of the compound

2.1.4 rubber compound

combination of materials suitably selected, proportioned, treated, and vulcanised, of which the characteristic constituent is a rubber and/or synthetic elastomer

2.1.5 polychloroprene compound or equivalent synthetic elastomer

a vulcanised compound in which the elastomer is polychloroprene (PCP) or equivalent synthetic elastomer providing a compound with properties similar to polychloroprene

2.1.6 chlorinated rubber compound

a vulcanised compound in which the characteristic constituent is a synthetic chlorinated rubber, e.g. Polychloroprene (PCP), Chlorosulphonated Polyethylene (CSP), Chlorinated Polyethylene (CPE), etc

2.1.7 ethylene-propylene rubber compound (EPR) or equivalent synthetic elastomer

a cross-linked compound in which the elastomer is ethylene-propylene or equivalent synthetic elastomer providing a compound with properties similar to EPR

2.1.8 ethylene vinyl acetate rubber compound (EVA) or equivalent synthetic elastomer

a cross-linked compound in which the elastomer is ethylene vinyl acetate or equivalent synthetic elastomer providing a compound with properties similar to EVA

2.1.9 polyolefin based cross-linked compound or equivalent synthetic compound having a low level of emission of corrosive gases when burned

a cross-linked compound in which the polymer is a polyolefin or equivalent synthetic non-halogenated polymer providing a compound which, when burned, has low emission of corrosive gases and is suitable for use in cables which, when burned, have low emission of smoke

2.1.10 cross-linked polyvinyl chloride (XLPVC)

combinations of materials of which polyvinyl chloride is the characteristic constituent, including adequate cross-linking agents, suitably selected, proportioned and treated which when cross-linked, meet the requirements given in the particular specification

2.1.11 cross-linked silicone rubber (SiR)

a compound based on a poly-siloxane polymer which, when cross-linked, meets the requirements given for the particular cable

2.1.12 thermoplastic polyurethane compound (TMPU)

a thermoplastic compound based on polyurethane which meets the requirements given in the particular specification

2.2 Definitions relating to the tests**2.2.1 type tests (Symbol T)**

tests required to be made before supplying a type of cable covered by this standard on a general commercial basis in order to demonstrate satisfactory performance characteristics to meet the intended application. These tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials, design or type of manufacturing process which might change the performance characteristics

2.2.2 sample tests (Symbol S)

tests made on samples of completed cable, or components taken from a completed cable adequate to verify that the finished product meets the design specifications

2.2.3 routine tests (Symbol R)

tests made on all production cable lengths to demonstrate their integrity

2.3 rated voltage

the rated voltage of a cable is the reference voltage for which the cable is designed, and which serves to define the electrical tests

The rated voltage is expressed by the combination of two values U_0/U , expressed in volts:

- U_0 being the r.m.s. value between any insulated conductor and "earth" (metal covering of the cable or the surrounding medium);
- U being the r.m.s. value between any two phase-conductors of a multicore cable or of a system of single-core cables.

In an alternating current system, the rated voltage of a cable shall be at least equal to the nominal voltage of the system for which it is intended.

This condition applies both to the value U_0 and to the value U .

In a direct current system, the nominal voltage between conductors shall be not higher than 1,5 times the rated voltage (U) of the cable, and the nominal voltage between any conductor and earth shall not be more than 1,5 times the rated voltage (U_0) of the cable.

NOTE The operating voltage of a system may permanently exceed the nominal voltage of such a system by 10 %. A cable can be used at a 10 % higher operating voltage than its rated voltage if the latter is at least equal to the nominal voltage of the system.

3 Marking**3.1 Indication of origin**

Cables shall be provided with an identification of origin consisting of either

1. the manufacturer's identification thread, or,
2. the continuous marking of the manufacturer's name or trademark, or (if legally protected) identification number, by one of the three following methods:
 - a) printed tape within the cable;

- b) printing, indenting or embossing on the insulation of at least one core (the core coloured blue, if any);
- c) printing, indenting or embossing on the sheath, if any.

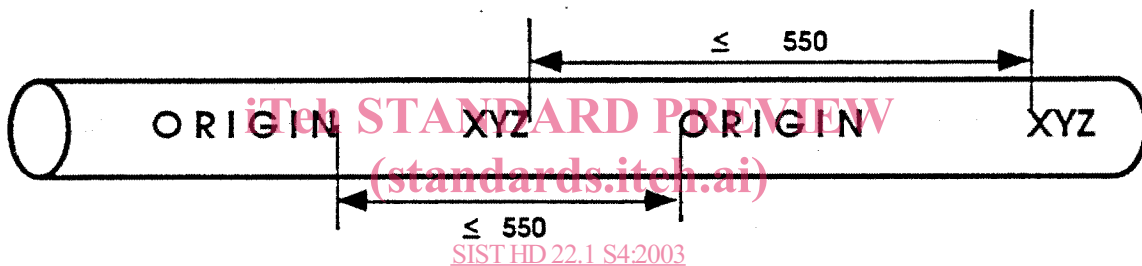
3.2 Continuity of marks

Each specified mark shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed:

- 550 mm if the marking is on the outer sheath or the covering of the cable;
- 275 mm if the marking is:
 - i) on the insulation of an unsheathed cable;
 - ii) on the insulation of a sheathed cable;
 - iii) on a tape within a sheathed cable.

NOTE A 'Specified Mark' is any mandatory mark covered by this Part of the HD or by the particular requirements of Part 3 onwards of this HD, or the optional common marking (<HAR>).

The diagram below shows an example of the marking as used on the outer sheath of the cable.



<https://standards.iteh.ai/catalog/standards/sist/4b81d419-e88a-4025-a95c-f2e0b178182f/sist-hd-22-1-s4-2003>

3.3 Durability

Printed markings shall be durable. Compliance with this requirement shall be checked by the test given in 1.8 of Part 2.

3.4 Legibility

All markings shall be legible.

The colours of the identification threads shall be easy to recognise or easily made recognisable, if necessary by cleaning with petrol or other suitable solvent.

3.5 Common marking

If the common marking (<HAR>) is used, it shall be as specified in the "Agreement on the use of a Commonly Agreed Marking for Cables and Cords complying with Harmonised Specifications". It shall consist of either

1. the common thread as specified and allotted in appendix 2 to the above mentioned "Agreement", or,
2. a continuous (see 3.2) marking of the symbols specified and allotted in appendix 1 to the above mentioned "Agreement", by one of the three methods a), b), c) specified in 3.1.

3.6 Use of the name CENELEC

The name CENELEC, in full or abbreviated, shall not be marked on, or in, the cables.

3.7 Code designation

Each cable or cord shall have its full code designation marked continuously (see 3.2) on the sheath or, where permitted by the particular specifications in Part 3 onwards of this HD, on the insulation of one core. The code designation for each cable is given in the particular specifications in Part 3 onwards of this HD.

NOTE The particular specifications of Part 3 onwards of this HD presently specify either no such marking, or only part of the code designation. The requirement in this 3.7 supersedes that in the particular specifications, which will be amended in due course.

4 Core identification

4.1 General requirements

Identification of the cores of a cable shall be achieved by the use of coloured insulation or by a coloured surface.

Each core of a multicore cable shall have only one colour, except the core identified by a combination of the colours green-and-yellow. In multicore cables, the colours green and yellow shall not be used separately as single colours.

The colours shall be clearly identifiable and durable. Durability shall be checked by the test given in 1.8 of Part 2.

4.2 Colour schemes (standards.iteh.ai)

4.2.1 Flexible cables SIST HD 22.1 S4:2003

<https://standards.iteh.ai/catalog/standards/sist/4b81d419-e88a-4025-a95c-123017816278/sist-hd-22-1-s4-2003>

The core colours, and their rotational position, for flexible cables and cords shall be in accordance with HD 308.

4.2.2 Single core non-sheathed cables

The core colours, which should be a reasonable match to those given in HD 402, shall be chosen from the following:

- a) for cable types rated 300/500 V (H05 types) the following mono-colours are recognised: black, blue, brown, grey, orange, pink, red, turquoise, violet, white, green and yellow. Bi-colours or any combination of the above mono-colours are permitted. The distribution of the colours for the core bi-coloured green-and-yellow shall comply with 4.3 of Part 1;

NOTE The use of green or yellow in some countries may be forbidden or restricted by National safety or other regulations. In some countries, green is specifically permitted for decorative chains.

- b) for cable types rated 450/750 V (H07 types) the following mono-colours are recognised: black, blue, brown, grey, orange, pink, red, turquoise, violet and white.

Bi-colours shall not be used except the combination of the mono-colours green and yellow, the distribution of the colours of which shall comply with 4.3 of Part 1.

NOTE Other mono-colours are permitted by National standards, pending CENELEC TC 64 harmonization of installation rules.

4.3 Colour combination green-and-yellow

The distribution of the colours for the core coloured green-and-yellow shall comply with the following condition: for every 15 mm length of core, one of these colours shall cover at least 30 % and not more than 70 % of the surface of the core, the other colour covering the remainder.

NOTE Information on the use of the colours green-and-yellow and blue.

It is understood that the colours green and yellow when they are combined as specified above are recognised exclusively as a means of identification of the core intended for use at earth connection or similar protection, and that the colour blue is intended for the identification of the core intended to be connected to neutral. If, however, there is no neutral, blue can be used to identify any core except the earthing or protective conductor.

4.4 Core identification of flexible cables by the 'Marking by inscription' method

Where the cores of cables are identified by marking by inscription, this shall be in accordance with EN 50334.

For special types of cable in this HD (see for instance HD 22.4, clause 6) other means of identification are permitted.

5 General requirements for the construction of cables

5.1 Conductors

5.1.1 Material

The conductors shall consist of annealed copper. Unless otherwise specified in the particular specifications, the wires of conductors may be plain or metal coated, for example with tin or silver. Coated wires shall be covered with an effective layer of the coating.

5.1.2 Construction SIST HD 22.1 S4:2003

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The maximum diameters of the wires of flexible conductors and the minimum number of wires of rigid conductors shall be in accordance with HD 383, unless otherwise specified in the particular specifications.

The classes of the conductors relevant to the various types of cables are given in the particular specifications.

5.1.3 Separator between conductor and insulation

If permitted or required in the particular specification a separating tape may or shall be placed between the conductor and the insulation.

5.1.4 Check of construction

Compliance with the requirements of 5.1.1 and 5.1.2 of Part 1, including the requirements of HD 383, shall be checked by inspection and by measurement.

5.1.5 Electrical resistance

Unless otherwise specified in the particular specifications, the resistance of each conductor at 20 °C shall be in accordance with the requirements of HD 383 for the given class of the conductor.

Compliance shall be checked by the test given in 2.1 of Part 2.

5.1.6 Solderability test for plain conductors

To assess any possible interaction between insulation and bare copper conductor, plain conductors shall comply with the solderability test specified in 1.12 of Part 2, unless otherwise specified in the particular specifications of the HD.

5.2 Insulation

5.2.1 Material

The insulation shall be a cross-linked or vulcanised material, of the type specified for each type of cable in the particular specifications:

Type EI 2	for cables insulated with silicone rubber compound;
Type EI 3	for cables insulated with EVA or equivalent material;
Type EI 4	for cables insulated with ordinary ethylene-propylene rubber compound;
Types EI 5 and EI 8	for cables insulated with polyolefin-based cross-linked compound having a low level of emission of corrosive gases when burned and which is suitable for use in cables which, when burned, have low emission of smoke. Type EI 8 is for flexible cables;
Types EI 6 and EI 7	for cables insulated with ethylene propylene rubber or equivalent synthetic elastomer. Type EI 6 is for cables requiring handling down to -40 °C;
Type XI 1	for cables insulated with cross-linked PVC.

The test requirements for these compounds are specified in Part 1, Table 1.

NOTE 1 The requirements for XI 1 are presently in annex A of HD 22.14 S2.

The maximum continuous conductor operating temperatures for each insulation compound, and the maximum temperatures for short-circuit conditions, are given in Table 1.

NOTE 2 The value of 180 °C for Type EI 2 applies only if there are no limits imposed by environmental conditions.

NOTE 3 The maximum operating and short-circuit temperatures for a particular cable may be lower than that given for the specific insulation compound. See HD 516 for further guidance.

5.2.2 Application to the conductor

The insulation shall be closely applied to the conductor or separator. In the particular specifications it is stated, for each type of cable, whether the insulation shall be applied in a single layer or in a number of layers, and whether it shall or shall not be covered with a proofed tape. It shall be possible to remove the insulation, without damage to the insulation itself, to the conductor, or to the tin or metal coating if any. Compliance shall be checked by inspection and by manual test.

5.2.3 Thickness

The mean value of the thickness of insulation shall be not less than the specified value for each type and size of cable shown in the tables of the particular specifications.