SLOVENSKI STANDARD

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Rubber insulated cables of rated voltages up to and including 450/750 V - Part 9: Single core non-sheathed cables for fixed wiring having low emission of smoke and corrosive gases

ICS 29.060.20

Referenčna številka
SIST HD 22.9 S2:1998(en)

HARMONIZATION DOCUMENT **HD 22.9 S2**

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOKUMENT June 1995

ICS 29.060.20 Supersedes HD 22.9 S1:1992

Descriptors: Insulated cable, insulated conductor, rubber, fire performance, test, specification, construction

English version

Rubber insulated cables of rated voltages up to and including 450/750 V Part 9: Single core non-sheathed cables for fixed wiring having low emission of smoke and corrosive gases

Conducteurs et câbles isolés au caoutchouc de tension assignée au plus égale à 450/750 V
Partie 9: Câbles monoconducteurs sans gaine pour installation fixe, ayant une faible émission de fumée et de gaz corrosifs

Isolierte Starkstromleitungen mit einer Isolierung aus Gummi mit Nennspannungen bis 450/750 V
Teil 9: Einadrige Leitungen ohne Mantel für feste Verlegung mit geringer Entwicklung von Rauch und korrosiven Gasen im Brandfall

This Harmonization Document was approved by CENELEC on 1995-05-15. 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

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

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Foreword

HD22 was originally adopted by CENELEC on 9th July 1975.

Edition 2 of HD22 was implemented on 1st January 1984, and at that time contained four parts.

Since 1984, new parts have been published, original parts amended, and in addition HD 505 has superseded HD 385 as the cross-reference for test methods.

This Edition 2 of HD 22.9 has been introduced to cover agreed amendments and the complete revision of the overall dimensions in line with EN 60719, and was approved by TC20 at its Helsinki meeting in May 1994.

HD22 now has the following parts:

HD22.1 S2	-	General requirements (with AM1 to AM10)
HD22.2 S2	-	Test methods (with AM1 to AM4 inclusive)
HD22.3 S3	-	Heat resistant silicone rubber insulated cables
HD22.4 S3	-	Cords and flexible cables
HD22.5	-	(Spare)
HD22.6 S2	-	Arc welding cables
HD22.7 S2	-	Cables with increased heat resistance for internal wiring for a conductor temperature of 110°C
HD22.8 S2	-	Polychloroprene or equivalent synthetic elastomer sheathed cable for decorative chai
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 cables
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 crosslinked compound and having low emission of smoke and corrosive gases
HD 22.14 S1	-	Cords for applications requiring high flexibility

In order that this revision of Part 9 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.

This Harmonization Document was prepared by the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as HD 22.9 S2 on 1995-05-15.

The following dates were fixed:

– latest date by which the existence of the HD has to be announced at national level	(doa)	1996-01-01
– latest date by which the HD has to be implemented at national level by publication of a harmonized national standard or by endorsement	(dop)	1996-07-01
– latest date by which the national standards conflicting with the HD have to be withdrawn	(dow)	1996-07-01

For products which have complied with HD 22.9 S1:1992 before 1996-07-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1997-07-01.

CONTENTS

1. Scope

This particular part (Part 9) of the HD details the specifications for rubber insulated single core non-sheathed cables for fixed wiring of rated voltage up to and including 450/750V and having low emission of smoke and corrosive gases.

All cables shall comply with the appropriate requirements in Part 1 and the individual types of cable shall comply with the particular requirements of this Part of HD 22.

NOTE: The overall dimensions of the cables to this Part of HD 22 have been calculated in accordance with EN 60719.

2. Single core non-sheathed cable with rigid conductors for general purposes

2.1 **Code designation**

H07Z-U for cables with solid conductors.
H07Z-R for cables with stranded rigid conductors.

2.2 **Rated voltage**

450/750V

NOTE: 600/1000V when this cable is used in fixed installations with mechanical protection, within switchgear and control gear - see HD 516.

2.3 **Construction**

2.3.1 Conductor

Number of conductors : 1

The conductors shall comply with the requirements of HD 383:

Class 1 Solid conductor
Class 2 Stranded conductors

The wires may be plain or tinned.

2.3.2 Separator

A separator of suitable material may be applied around the conductor.

2.3.3 Insulation

The insulation shall be a polyolefin based cross-linked material, Type EI 5, applied around the conductor by extrusion in one or two layers. The insulation thickness shall comply with the specified value given in Part 9 Table I column 3.

The insulation resistance shall not be less than the value given in Part 9 Table I column 6.

NOTE: The requirements for EI 5 define that it shall comply with HD 602 in respect of emission of acidic (corrosive) gases when burned. The properties of EI 5 should not conflict with the requirement for cable to this Part of HD 22 in respect of low emission of smoke.

2.3.4 Overall diameter

The mean overall diameter shall be within the limits given in Part 9, Table I, columns 4 and 5.

2.3.5 Smoke emission of cable

When tested in accordance with the method and procedure given in HD 606, all sizes of cable in this Part 9 of HD 22 shall exceed 60% light transmittance throughout the test.

2.4 Tests

Compliance with the requirements of Part 9 sub-clause 2.3 shall be checked by inspection and by the tests given in Part 9 Table II.

2.5 Indication of origin and fire performance marking

In addition to the general requirements of Part 1, Clause 3, a continuous marking indicating fire performance shall be applied, by printing, indenting or embossing on the insulation, using symbol Z, indicating cable having low emission of smoke and acidic (corrosive) gases when burned*.

* This is verified by tests specified in the document.

2.6 Guides to use (informative)

See HD 516.

TABLE I

General Data for Types H07Z-U and H07Z-R

1	2	3	4	5	6
Nominal cross-sectional area of conductor	Class of conductor (HD 383)	Thickness of insulation. Specified value	Mean overall diameter		Minimum insulation resistance at 90°C[1]
			lower limit	upper limit	
mm²		mm	mm	mm	(MΩ.km)
1.5	1	0.7	2.6	3.3	0.011
1.5	2	0.7	2.7	3.4	0.010
2.5	1	0.8	3.2	4.0	0.010
2.5	2	0.8	3.3	4.1	0.009
4	1	0.8	3.6	4.6	0.0085
4	2	0.8	3.8	4.7	0.0077
6	1	0.8	4.1	5.2	0.0070
6	2	0.8	4.3	5.4	0.0065
10	1	1.0	5.3	6.6	0.0070
10	2	1.0	5.6	7.0	0.0065
16	2	1.0	6.4	8.0	0.0050
25	2	1.2	8.1	10.1	0.0050
35	2	1.2	9.0	11.3	0.0043
50	2	1.4	10.6	13.2	0.0043
70	2	1.4	12.1	15.1	0.0035
95	2	1.6	14.1	17.6	0.0035
120	2	1.6	15.6	19.4	0.0032
150	2	1.8	17.3	21.6	0.0032
185	2	2.0	19.3	24.1	0.0032
240	2	2.2	22.0	27.5	0.0032
300	2	2.4	24.5	30.6	0.0030
400	2	2.6	27.5	34.3	0.0028

(1) The values of insulation resistance were calculated using the following formula, and based on a volume resistivity of 1 x 10^8 Ω.m at 90°C.

$$R = 0.0367 \log D/d$$

where:

R = Insulation resistance in MΩ.km at 90°C.
D = Nominal diameter over insulation (mm)
d = Diameter of the circumscribed circle of the conductor (mm)

TABLE II

Tests for Types H07Z-U and H07Z-R

1	2	3	4	5
Ref. No.	Tests	Category of Test	Test method described in	
			HD	Clause
1.	**Electrical tests**			
1.1	Resistance of conductors	T, S	22.2	2.1
1.2	Voltage test on completed cable at 2500V	T, S	22.2	2.2
1.3	Insulation resistance at 90°C	T, S	22.2	2.4.1
1.4	Absence of faults in insulation	R	22.2	2.6
2.	**Provisions covering constructional and dimensional characteristics**			
2.1	Checking of compliance with constructional provisions	T, S	22.1	Inspection and Manual tests
2.2	Measurement of thickness of insulation	T, S	22.2	1.9
2.3	Measurement of overall diameter	T, S	22.2	1.11
3.	**Mechanical properties of insulation**			
3.1	Tensile test before ageing	T	505.1.1	9.1
3.2	Tensile test after ageing	T	505.1.2	8.1.3.1
4.	**Hot set test**	T	505.2.1	9
5.	**Tests at low temperature**			
5.1	Bending test for insulation (+)	T	505.1.4	8.1
5.2	Elongation test for insulation (*)	T	505.1.4	8.3
5.3	Impact test	T	505.1.4	8.5
6.	**Pressure test at high temperature**	T	505.3.1	8.1
7.	**Test under fire conditions**			
7.1	Test on a single vertical cable	T & S	405.1	-
7.2	Test for acidic (corrosive) gases evolved from combustion of insulation	T & S	602	-
7.3	Smoke emission of cable	T & S	606	-
8.	**Ozone resistance test for insulation** (either method may be used)	T	505.2.1 or 22.2	8 7.3

(+) only applicable to cables having mean overall diameters up to and including 12.5mm

(*) only applicable if the mean overall outer diameter of the core exceeds 12.5mm

3. Single core non-sheathed cable with flexible conductors for general purposes

3.1 **Code designation**

H07Z-K

3.2 **Rated voltage**

450/750V

NOTE: 600/1000V when this cable is used in fixed installations with mechanical protection, within switchgear and control gear - see HD 516.

3.3 **Construction**

3.3.1 Conductor

Number of conductors : 1
The conductors shall comply with Class 5 requirements given in HD 383.

The wires may be plain or tinned.

3.3.2 Separator

A separator of suitable material may be applied around the conductor.

3.3.3 Insulation

The insulation shall be a polyolefin based cross-linked material, Type EI 5, applied around the conductor by extrusion in one or two layers. The insulation thickness shall comply with the specified value given in Part 9 Table III column 2.

The insulation resistance shall be not less than the value given in Part 9 Table III column 5.

NOTE: The requirements for EI 5 define that it shall comply with HD 602 in respect of emission of acidic (corrosive) gases when burned. The properties of EI 5 should not conflict with the requirement for cable to this Part of HD 22 in respect of low emission of smoke.

3.3.4 Overall diameter

The mean overall diameter shall be within the limits given in Part 9 Table III columns 3 and 4.

3.3.5 Smoke emission of cable

When tested in accordance with the method and procedure given in HD 606, all sizes of cable in this Part 9 of HD 22 shall exceed 60% light transmittance throughout the test.

3.4 **Tests**

Compliance with the requirements of Part 9 sub-clause 3.3 shall be checked by inspection and by the tests given in Part 9 Table IV.

3.5 Indication of origin and fire performance marking

In addition to the general requirements of Part 1, Clause 3, a continuous marking indicating fire performance shall be applied, by printing, indenting or embossing on the insulation, using symbol Z, indicating cable having low emission of smoke and acidic (corrosive) gases when burned*.

* This is verified by tests specified in the document.

3.6 Guides to use (informative)

See HD 516.

TABLE III

General Data for Type H07Z-K

1	2	3	4	5
Nominal cross sectional area of conductor	Thickness of insulation specified value	Mean overall diameter		Minimum insulation resistance at 90°C[1]
		lower limit	upper limit	
mm²	mm	mm	mm	(MΩ.km)
1.5	0.7	2.8	3.5	0.010
2.5	0.8	3.4	4.3	0.009
4	0.8	3.9	4.9	0.007
6	0.8	4.4	5.5	0.006
10	1.0	5.7	7.1	0.0056
16	1.0	6.7	8.4	0.0046
25	1.2	8.4	10.6	0.0044
35	1.2	9.7	12.1	0.0038
50	1.4	11.5	14.4	0.0037
70	1.4	13.2	16.6	0.0032
95	1.6	15.1	18.8	0.0032
120	1.6	16.7	20.9	0.0029
150	1.8	18.6	23.3	0.0029
185	2.0	20.6	25.8	0.0029
240	2.2	23.5	29.4	0.0028

(1) The values of insulation resistance were calculated using the following formula, and based on a volume resistivity of 1 x 10^8 Ω.m at 90°C.

$$R = 0.0367 \log D/d$$

where:

R = Insulation resistance in MΩ.km at 90°C.
D = Nominal diameter over insulation (mm)
d = Diameter of the circumscribed circle of the conductor (mm)