



SLOVENSKI STANDARD
SIST HD 603 S1:1998/A1:2001
01-februar-2001

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Distribution cables of rated voltage 0,6/1 kV

Energieverteilungskabel mit Nennspannungen 0,6/1 kV

Câbles de distribution de tension nominale 0,6/1 kV

Ta slovenski standard je istoveten z: HD 603 S1:1994/A1:1997

[SIST HD 603 S1:1998/A1:2001](https://standards.iteh.ai/catalog/standards/sist/8c7ca821-a961-47e2-8acf-17467cbc05a8/sist-hd-603-s1-1998-a1-2001)

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ICS:

29.060.20 Kabli Cables

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HARMONIZATION DOCUMENT
DOCUMENT D'HARMONISATION
HARMONISIERUNGSDOKUMENT

HD 603 S1/A1

December 1997

UDC 621.315.2
ICS 29.060.20

Descriptors: Electric power distribution, electric cable, insulated cable, polyvinyl chloride, specification, dimension, test, marking

English version

Distribution cables of rated voltage 0,6/1 kV

Câbles de distribution de tension
nominale 0,6/1 kV

Verteilerkabel mit Nennspannung
0,6/1 kV

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This amendment A1 modifies the Harmonization Document HD 603 S1:1994; it was approved by CENELEC on 1996-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for implementation of this amendment 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 amendment 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, 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

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

HD 603 S1: 1994/A1:1997

DISTRIBUTION CABLES

OF RATED VOLTAGE 0.6 / 1 kV

PART 1 - GENERAL REQUIREMENTS

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Replace the pages :

1-4, 1-12, 1-13, 1-16, 1-17, 1-19, 1-22, 1-24 and 1-25
<https://standards.iteh.ai/catalog/standards/sist/ca821-a961-47e2-8acf-17467cbc05a8/sist-hd-603-s1-1998-a1-2001>

by the following A1 referred pages :

1-4, 1-12, 1-13, 1-16, 1-17, 1-19, 1-22, 1-24, 1-25 and 1-26

FOREWORD

This amendment was prepared by WG09 of CENELEC Technical Committee TC 20 , Electric Cables. CENELEC TC 20 confirmed at its Athens meeting (November 1995) that the amendment should go to the Unique Acceptance Procedure.

NOTE: During the preparation of this amendment, HD 505 (Sections 1.1 to 1.4 inclusive) has been replaced by EN 60811 (Sections 1.1 to 1.4 inclusive).

In general the updating of these references has not been included in this amendment unless a complete section has been introduced or replaced, but users should refer to EN 60811 for the most up-to-date information. The clause numbers for the test methods in EN 60811 are identical to those in HD 505.

The draft was submitted to the Unique Acceptance Procedure in March 1996 and was approved by CENELEC as amendment A1 to HD 603 S1:1994 on 1996-10-01.

The following dates were fixed :

- | | | |
|---|-------|------------|
| - latest date by which the existence of the amendment has to be announced at national level | (doa) | 1997-06-01 |
| - latest date by which amendment has to be implemented at national level by publication of a harmonized national standard or by endorsement | (dop) | 1998-09-01 |
| - latest date by which the national standards conflicting with the amendment have to be withdrawn | (dow) | 1998-09-01 |

HD 603 S1:1994/A1:1997

**DISTRIBUTION CABLES
OF RATED VOLTAGE 0.6 / 1 kV**

PART 0 - CONTENT

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CONTENTS OF THE HD 603 WITH THE AMENDMENT A1**PART 1 GENERAL REQUIREMENTS**

- | | | | |
|---|----------------------|----|-----------------|
| 1 | General requirements | A1 | Amended section |
|---|----------------------|----|-----------------|

PART 3 PVC INSULATED CABLES - UNARMoured

- | | | | |
|----|---|----|---|
| 3A | Cables with (type 3A -1) and without (type 3A-2) concentric conductor | A1 | Amended section |
| 3B | Cables without concentric conductor (type 3B-1) | - | |
| 3C | Cables without concentric conductor, PE sheath (type 3C) | - | |
| 3D | Cables without concentric conductor, PE sheath (type 3D-1) | - | |
| 3E | Cables without concentric conductors, PVC sheath (type 3E) | - | |
| 3F | Cables with and without concentric conductor (type 3F) | A1 | Amended section |
| 3G | Cables with (type 3G -1) or without (type 3G-2) concentric conductor | A1 | Amended section |
| 3H | Electric Cables for Rated Voltage 0.6 / 1 kV (Type 3 H) | - | |
| 3I | Cables with (Type 3 I-1) and without (Types 3 I-2 and 3 I-3) concentric conductor | A1 | Amended section |
| 3J | Cables with concentric conductor (Type 3 J) | A1 | Amended section |
| 3K | Cables without concentric conductor (Type 3K) | A1 | Withdrawn section |
| 3L | Cables with concentric conductor (Type 3L) | A1 | Amended section |
| 3M | Unarmoured cables (Type 3M) | A1 | Withdrawn section and replaced by the new one |
| 3N | Unarmoured cables (Type 3N) | - | |
| 3O | Cables without concentric conductor (Type 3O-1) | - | |

PART 4 PVC INSULATED CABLES - ARMoured

- | | | | |
|----|---|----|---|
| 4A | Cables without concentric conductor (screen) (Type 4A) | A1 | Amended section |
| 4B | Cables with braided (type 4B-1) or helically applied (type 4B-2) armour | A1 | Amended section |
| 4C | Steel tape armoured cables (Type 4C) | A1 | Withdrawn section and replaced by the new one |
| 4D | Armoured cables without concentric conductor (Type 4D-1) | A1 | Amended section |



PART 5 XLPE INSULATED CABLES - UNARMoured

5A	Cables without concentric conductor (Type 5A)	-	
5B	Cables without concentric conductor, PE sheath (Type 5B)	-	
5C	Cables without concentric conductor, PVC sheath (Type 5C)	-	
5D	Cables with (type 5 D -1) and without (type 5 D -2) concentric conductor	A1	Amended section
5E	Cables without concentric conductor (type 5 E)	A1	Amended section
5F	Cables with concentric screen and uninsulated neutral (Type 5F)	A1	Amended section
5G	Cables with (Type 5G -1) or without (Type 5G-2) concentric conductor	A1	Amended section
5H	Cables with 4 cores, XLPE - insulation, PE - sheath (Type 5H)	-	
5 I	Cables without concentric conductor (type 5 I)	A1	Amended section
5J	Cables with concentric conductor (Type 5J)	A1	Amended section
5K	Cables with concentric screen (Type 5K)	A1	Amended section
5L	Cables with concentric screen (Type 5L)	A1	Amended section
5M	Cables without concentric conductor (Type 5M)	A1	Amended section
5N	Cables without concentric conductor (Type 5N)	A1	Amended section
5O	Cables without concentric conductor (Type 5O)	A1	Amended section
5P	Cables with concentric conductor (Type 5P)	A1	Amended section
5Q	CNE cables with solid neutral/earth conductor (Type 5Q)	A1	Amended section
5R	CNE cables with concentric wave form neutral/earth conductor (Type 5R)	A1	Amended section
5S	Service cables with concentric conductor (Type 5S)	A1	Amended section
5T	Cables with (Type 5T-1) and without (Type 5T-2) concentric conductor	A1	Amended section
5U	Cables with concentric wave form neutral conductor (Type 5U-1)	-	
5V	Unarmoured cables (Type 5V)	A1	New section
5W	Cables with concentric conductor (Type 5W)	A1	New section

PART 6 XLPE INSULATED CABLES - ARMoured

6A	Cables with braided (Type 6A-1) or helically applied (Type 6A-2) armour	A1	Amended section
6B	Armoured cables without concentric conductor (Type 6B)	A1	Withdrawn section
6C	Armoured cables with (Type 6C-1) and without (Type 6C-2) concentric conductor	A1	Amended section
6D	Steel tape armoured cables (Type 6D)	A1	New section

Part 7 EPR INSULATED CABLES - UNARMoured

7A	Cables with HEPR insulation and PVC sheath with and without concentric conductor (Type 7A)	-	
7B	Cables with HEPR insulation and PE sheath, preassembled (Type 7B)	-	
7C	Cables without concentric conductor (Types 7C-1, 7C-2, 7C-3, 7C-4)	A1	Amended section
7D	CNE cables with concentric wave form neutral/earth conductor (Type 7D)	A1	Amended section
7E	Cables with (Type 7E-1) and without (Type 7E-2) concentric conductor	A1	Amended section

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PART 8 EPR INSULATED CABLES - ARMoured

8A	Armoured cables without concentric conductor (Type 8A)	A1	Withdrawn section
8B	Armoured cables with (Type 8B-1) and without (Type 8B-2) concentric conductor	A1	Amended section

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DISTRIBUTION CABLES OF RATED VOLTAGE 0.6 / 1 kV

PART 1 - GENERAL REQUIREMENTS

1 General

1.1 Scope

HD 603 applies to cables of rated voltage $U_0 / U = 0.6 / 1$ kV used in underground power distribution systems mainly for public distribution, of nominal voltage not exceeding 0.6 / 1 kV A.C.

This part (Part 1) specifies the general requirements applicable to these cables, unless otherwise specified in the particular sections of this HD.

Test methods are specified in HD 605 and in HD 383, HD 405 and HD 505.

The particular types of cables are specified in Parts 3 to 8.

1.2 Object

The objects of this Harmonization Document are :

- to standardize cables that are safe and reliable when properly used, in relation to the technical requirements of the system of which they form a part,
- to state the characteristics and manufacturing requirements which have a direct or indirect bearing on safety,
- and to specify methods for checking conformity with those requirements.

2 Definitions

2.1 Definitions relating to insulating and sheathing materials

2.1.1 - Insulating and sheathing materials

The types of insulating and sheathing compounds covered in this HD are listed below, together with their abbreviated designations :

	Insulating and sheathing compounds	See:
1 : Insulation	a) <i>Thermoplastic</i> : Insulating compounds based on : - Polyvinyl chloride or copolymers (PVC)	Table 1
	b) <i>Crosslinked</i> Insulating compound based on : - Crosslinked polyethylene (XLPE) - Ethylene propylene rubber (EPR) - Hard ethylene propylene rubber (HEPR)	Table 2A Table 2B Table 2C
2 : Sheathing	a) <i>Elastomeric</i> : Sheathing compound based on : - Polychloroprene (PCP), - Chlorosulfonated polyethylene (CSP) or similar polymer	Table 3
	b) <i>Thermoplastic</i> : Sheathing compounds based on : - Polyvinyl chloride (PVC) - Polyethylene (PE) - Polyolefin (PO)	Table 4A Table 4B Table 4C

TABLE 1 - REQUIREMENT OF INSULATING COMPOUNDS : PVC

1	3	4	5	6	7	8	9
COMPOUND N°	UNIT	DIV 1	DIV 2	DIV 4	DIV 5	DIV 6	DIV 7
TYPE		PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.
MAXIMUM CONDUCTOR TEMPERATURE IN NORMAL SERVICE	°C	70	70	70	70	70	70
Mechanical properties							
<i>-before ageing on sample</i>							
minimum tensile strength	MPa	12,5	12,5	12,5	12,5	12,5	12,5
minimum elongation at break	%	125	125	175	125	150	150
<i>-after ageing on sample</i>							
temperature	°C	80	80	100	80	100	100
duration T1	h	168	168	168	168	168	168
minimum tensile strength	MPa	12,5	12,5	12,5	12,5	12,5	12,5
maximum variation T1/T0	%	+/-20	+/-20	+/-20	+/-20	+/-25	+/-25
minimum elongation at break	%	125	125	175	125	150	150
maximum variation T1/T0	%	+/-20	+/-20	+/-20	+/-20	+/-25	+/-25
<i>-after ageing on complete cable (non contamination test)</i>							
temperature	°C	80		90	80	80	80
duration T1	h						
duration T2	h	168		168	168	168	168
minimum tensile strength	MPa			12,5	12,5	12,5	12,5
maximum variation T2/T0	%	+/-25		+/-25	+/-20	+/-25	+/-25
maximum variation T2/T1	%						
minimum elongation at break	%			175	125	150	150
maximum variation T2/T0	%	+/-25		+/-25	+/-20	+/-25	+/-25
maximum variation T2/T1	%						
Physical and chemical properties							
Water absorption							
temperature	°C	70		70		70	70
duration	h	240		240		240	240
a) maximum variation of mass	mg/cm ²	OK		OK		OK	OK
b) with DC voltage: no breakdown	V	OK				OK	
Loss of mass							
duration	h	168		168	168	168	168
temperature	°C	80		100	80	80	80
maximum loss of mass	mg/cm ²	2		1,0	2	2	2
Pressure test at high temperature							
duration	h	4 / 6	3(wat)/4(alr)	4 / 6	4	6	4 / 6
temperature	°C	80	80	90	70	80	80
coefficient k		0,8				0,8	0,6
maximum depth of indentation	%	50	50	50	50	50	50
Heat shock test							
duration	h	1	1	1,0	1	1	1
temperature	°C	150	150	150	150	150	150
Tests at low temperature							
<i>Elongation test at low temperature</i>							
temperature	°C	-15		-20	-15	-25	-15
minimum elongation	%	20		40	20	20	20
<i>Impact test at low temperature on complete cable</i>							
temperature	°C	-15			-15	-20	-15
<i>Bending test at low temperature</i>							
temperature	°C	-15		-20	-15 (or -25)	-25	-15
Thermal stability							
temperature	°C	200		200			
duration	min	60		100			
Insulation resistance (min.value)							
Volume resistivity	at 20°C	Ω . cm		5,5.10exp13		10exp14	10exp13
	at 60°C	Ω . cm		1,1.10exp11		5,10exp10	
	at 70°C	Ω . cm	10exp10		10exp10		10exp10
	at 90°C	Ω . cm					
Insulation constant Ki	at 70°C	MΩ . km					

Note: 1MPa=1N/mm²

Remark: The tolerance on temperature values is given in HD.605 sub-clause 1.5.2 but may be others if given in specific sections.

TABLE 1 - REQUIREMENT OF INSULATING COMPOUNDS : PVC (Concluded)

1	3	10	11	12	13	14	15
COMPOUND N°	UNIT	DIV 8	DIV 9	DIV 10	DIV 11	DIV 12	DIV 13
TYPE		PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.	PVC Insulat.
MAXIMUM CONDUCTOR TEMPERATURE IN NORMAL OPERATION	°C	70	70	70	70	70	70
Mechanical properties							
-before ageing on sample							
minimum tensile strength	MPa	12,5	12,5	12,5	12,5	12,5	12,5
minimum elongation at break	%	150	125	150	150	150	125
-after ageing on sample							
temperature	°C	100	90	100	100	100	80
duration T1	h	168	240	168	168	168	168
minimum tensile strength	MPa	12,5		12,5	12,5	12,5	12,5
maximum variation T1/T0	%	+/-25	+/-25	+/-25	+/-25	+/-25	+/-20
minimum elongation at break	%	150	125	150	150	150	125
maximum variation T1/T0	%	+/-25	+/-25	+/-25	+/-25	+/-25	+/-20
-after ageing on complete cable (non contamination test)							
temperature	°C	80	80	80	80	80	80
duration T1	h	168	168	168	168	168	168
duration T2	h						
minimum tensile strength	MPa						12,5
maximum variation T2/T0	%	+/-25	+/-25	+/-25	+/-25	+/-25	+/-20
maximum variation T2/T1	%						
minimum elongation at break	%						125
maximum variation T2/T0	%	+/-25	+/-25	+/-25	+/-25	+/-25	+/-20
maximum variation T2/T1	%						
Physical and chemical properties							
Water absorption							
temperature	°C	70	60	70	70	70	
duration	h	240	240	240	240	240	
a) maximum variation of mass	mg/cm ²						
b) with DC voltage: no breakdown	V		1200	OK	OK	OK	
Loss of mass							
duration	h	168	168			168	168
temperature	°C	80	80			80	80
maximum loss of mass	mg/cm ²	2	2			2	2
Pressure test at high temperature							
duration	h	4	other test	4/6	4/6	6	4/6
temperature	°C	80		80	80	80	80
coefficient k		0,6 or 0,7		0,6/0,7	0,6	0,6	0,6/0,8
maximum depth of indentation	%	50		50	50	50	50
Heat shock test							
duration	h	1	1	1	1	1	1
temperature	°C	150	150	150	150	150	150
Tests at low temperature							
Elongation test at low temperature							
temperature	°C	-15	-15	-15	-20	-15	-15
minimum elongation	%	20	20	20	20	20	20
Impact test at low temperature on complete cable							
temperature	°C	-15	-25	-15	-20		-15
Bending test at low temperature							
temperature	°C	-15	-15	-15	-20	-15	-15
Thermal stability							
temperature	°C						
duration	min						
Insulation resistance (min.value)							
Volume resistivity							
at 20°C	Ω . cm	10exp13				10exp13	
at 60°C	Ω . cm						
at 70°C	Ω . cm	10exp10	10exp11	10exp10	10exp10	10exp10	10exp10
at 90°C	Ω . cm						
Insulation constant Ki	MΩ . km						0,0367

Note: 1MPa=1N/mm²

Remark: The tolerance on temperature values is given in HD.605 sub-clause 1.5.2 but may be others if given in specific sections.

TABLE 2B - REQUIREMENT OF INSULATING COMPOUNDS : EPR

1	2	3	5	6	7
COMPOUND N°	(spare)	UNIT	DIE 3	DIE 4	DIE 5
TYPE		°C	EPR Insul.	EPR Insul.	EPR Insul.
MAXIMUM CONDUCTOR TEMPERATURE IN NORMAL OPERATION		°C	90	90	90
Mechanical properties					
-before ageing on sample					
minimum tensile strength		MPa	42	5	4,2
minimum elongation at break		%	200	200	200
-after ageing on sample					
temperature		°C	135	135	135
duration T1		h	168	168	168
minimum tensile strength		MPa			
maximum variation T1/T0		%	+/-30	+/-30	+/-30
minimum elongation at break		%			
maximum variation T1/T0		%	+/-30	+/-30	+/-30
-after ageing in air bomb at 0,55 MPa					
temperature		°C	127		127
duration T1		h	40		40
minimum tensile strength		MPa			
maximum variation T1/T0		%	+/-30		+/-30
minimum elongation at break		%			
maximum variation T1/T0		%	+/-30		+/-30
-after ageing in O₂ bomb at 2,1 MPa					
temperature		°C		80	
duration T1		h		168	
minimum tensile strength		MPa			
maximum variation T1/T0		%		+/-25	
minimum elongation at break		%			
maximum variation T1/T0		%		+/-25	
-after ageing on complete cable (non contamination test)					
temperature		°C		100	100
duration T1		h		168	168
duration T2		h			
minimum tensile strength		MPa			
maximum variation T2/T0		%		+/-30	+/-30
maximum variation T2/T1		%			
minimum elongation at break		%			
maximum variation T2/T0		%		+/-30	+/-30
maximum variation T2/T1		%			
Physical and chemical properties					
Hot set test					
temperature		°C	250	250	250
duration		min	15	15	15
mechanical stress		MPa	0,20	0,20	0,20
maximum elongation under load		%	175	175	175
maximum residual elongation		%	15	15	15
Hot modulus					
duration		min		15	
temperature		°C		130	
minimum strength at 100%		N/mm ²		1,75	
Water absorption					
temperature		°C	85	70	85
duration		h	336	336	336
a) maximum variation of mass		mg/cm ²	5	0,8	5
b) with DC voltage: no breakdown					
Insulation resistance (min.value)					
Volume resistivity		Ω . cm			
at 20°C		Ω . cm		13,079 x 10 ^{exp11}	
at 60°C		Ω . cm	10 exp12	68 x 10 exp11	
at 90°C		Ω . cm			
Insulation resistance constant		MΩ . km			3,67
at 90°C					
Ozone resistance test					
duration		h	24	24	30
concentration of O ₃		ppm	250 to 300	250 to 300	250 to 300
duration		h			

Note: 1MPa=1N/mm²Remark: The tolerance on temperature values is given in HD.605 sub-clause 1.5.2
but may be others if given in specific sections.

TABLE 2C - REQUIREMENT OF INSULATING COMPOUNDS : HEPR

1	2	3	4	5	6	7
COMPOUND N°	(spare)	UNIT		DIH 1 HEPR insul.	DIH 2 HEPR insul.	DIH 3 HEPR insul.
TYPE MAXIMUM CONDUCTOR TEMPERATURE IN NORMAL OPERATION		°C		90	90	90
Mechanical properties						
<i>-before ageing on sample</i>						
minimum tensile strength		MPa		8.5	8.5	8.5
minimum elongation at break		%		200	200	200
minimum elastic modulus at 150% elongation		%		4.5		
<i>-after ageing on sample</i>						
temperature duration T1		°C h		135 168	135 168	135 168
minimum tensile strength		MPa				
maximum variation T1/T0		%		+/-30	+/-30	+/-30
minimum elongation at break		%				
maximum variation T1/T0		%		+/-30	+/-30	+/-30
<i>-after ageing in air bomb at 0,55 MPa</i>						
temperature duration T1		°C h		127 40	127 40	127 40
minimum tensile strength		MPa				
maximum variation T1/T0		%		+/-30	+/-30	+/-30
minimum elongation at break		%				
maximum variation T1/T0		%		+/-30	+/-30	+/-30
<i>-after ageing on complete cable (non contamination test)</i>						
temperature duration T1		°C h		100	100	100
duration T2		h		168	168	168
minimum tensile strength		MPa				
maximum variation T2/T0		%		+/-30	+/-30	+/-30
maximum variation T2/T1		%				
minimum elongation at break		%				
maximum variation T2/T0		%		+/-30	+/-30	+/-30
maximum variation T2/T1		%				
Physical and chemical properties						
Hot set test						
temperature		°C		250	250	250
duration		min		15	15	15
mechanical stress		MPa		0.20	0.20	0.20
maximum elongation under load		%		100	175	100
maximum residual elongation		%		10	15	25
Water absorption						
temperature		°C		100	85	85
duration		h		24	336	336
a) maximum variation of mass		mg/cm ²		3	5	5
b) with DC voltage: no breakdown						
Hardness						
Shore-D						
minimum		%			80	
International Rubber Hardness Degree						
minimum		%				80
Insulation resistance (min.value)						
Insulation constant Ki		MΩ . km		3670		
at 20°C		MΩ . km			3.67	
at 60°C		MΩ . km				3.67
at 90°C		MΩ . km		3.67		
Ozone resistance test						
duration		h		30	30	30
concentration of O ₃		ppm		250 to 300	250 to 300	250 to 300

Note: 1MPa=1N/mm²Remark: The tolerance on temperature values is given in HD.605 sub-clause 1.5.2
but may be others if given in specific sections.