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Road vehicles — Automotive cables —

Part 3: Dimensions and requirements for 30 V a.c. or 60 V d.c. single core copper conductor cables

Véhicules routiers — Câbles automobiles —

Partie 3: Dimensions et exigences des câbles en cuivre mono conducteurs de 30 V a.c. ou 60 V c.c.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

A list of all parts in the ISO 19642 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document was prepared following a joint resolution to improve the general structure of the ISO Automotive Electric Cable standards. This new structure adds more clarity and, by defining a new standard family, opens up the standard for future amendments.

Many other standards currently refer to ISO 6722-1, ISO 6722-2 and ISO 14572. So these standards will stay valid at least until the next scheduled systematic review and will be replaced later on by the ISO 19642 series.

For new Automotive Cable Projects customers and suppliers are advised on using the ISO 19642 series.

Road vehicles — Automotive cables —

Part 3: Dimensions and requirements for 30 V a.c. or 60 V d.c. single core copper conductor cables

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies the dimensions and requirements for single-core cables intended for general purpose vehicle applications where the nominal system voltage is less than or equal to 30 V a.c. or less than or equal to 60 V d.c.. It also applies to individual cores in multi-core cables.

This document specifies requirements for copper conductor cables.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 19642-1, *Road vehicles — Automotive cables — Vocabulary and design guidelines*

ISO 19642-2, *Road vehicles — Automotive cables — Test methods*

EN 13602, *Copper and copper alloys — Drawn, round copper wire for the manufacture of electrical conductors*

ASTM B1, *Standard Specification for Hard-Drawn Copper Wire*

ASTM B3, *Standard Specification for Soft or Annealed Copper Wire*

ASTM B33, *Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes*

ASTM B298, *Standard Specification for Silver-Coated Soft or Annealed Copper Wire*

ASTM B355, *Standard Specification for Nickel-Coated Soft or Annealed Copper Wire*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19642-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Specifications

4.1 General test conditions

The test conditions of ISO 19642-2 shall apply.

The cables shall be tested as specified in Table 2.

If suppliers and customers agree on modifications or changes to the methods and requirements, all the changes and modifications shall be clearly documented.

4.2 Safety concerns

The precautions as described in the WARNING at the beginning of this document shall be followed.

4.3 Voltage rating

The cable described in this document is limited to 30 V a.c. and 60 V d.c. maximum.

4.4 Temperature classes

All temperature classes in ISO 19642-1 are suitable for copper conductor cables.

4.5 Conductor material

The conductors shall consist of plain or coated copper strands as shown in Table 1.

ISO conductor sizes greater than or equal to 0,5 mm^2 shall consist of soft annealed copper or annealed compressed wires.

ISO conductor sizes less than 0,5 mm^2 shall consist of soft annealed copper, soft annealed compressed copper, hard un-annealed copper or a copper alloy.

The specifications for the conductors shall be completed by material specifications. Elongation requirements shall be established by agreement between the customer and the supplier.

The finished cable shall meet the resistance and cross-sectional area (CSA) requirements of Table 6 for all conductors except alloys. When an alloy is used, the resistance requirement shall be established by agreement between the customer and the supplier.

NOTE Examples for strands are shown in Annex A.

Table 1 — Conductor specifications

Description	Specification number
Hard-drawn copper wire	ASTM B1
Soft or annealed copper wire	ASTM B3 or EN 13602
Tinned soft or annealed copper wire	ASTM B33 or EN 13602
Silver-coated soft or annealed copper wire	ASTM B298
Nickel-coated soft or annealed copper wire	ASTM B355
NOTE Silver and Nickel coated conductors are intended for use with high “temperature class ratings”.	

4.6 Conductors

The conductors in the finished cable shall meet the CSA and resistance requirements of Table 6.

The maximum diameter of the conductors is standardized and presented in Table 7.

The configuration of the stranded conductor is not standardized.

NOTE 1 Existing stranding configurations for copper conductors are presented in Table A.1.

NOTE 2 Preferred stranding configurations for copper conductors are presented in Table A.2.

Other stranding configurations may be used for copper conductors provided they meet the above requirements and are agreed between the customer and the supplier.

4.7 Insulation thickness

The following three different insulation thicknesses are allowed in this document:

1. thick wall insulation;
2. thin wall insulation;
3. ultra-thin wall insulation.

The minimum wall thickness requirements for the different ISO conductor sizes are standardized and specified in Table 7.

The nominal wall thickness is derived from the minimum wall thickness in Table 7 by the following formulae:

$$w_{nom} = 1{,}25 \times w_{min} \text{ or } w_{nom} = w_{min} / 0{,}8$$

where

w_{min} is the minimum wall thickness;

w_{nom} is the nominal wall thickness.

4.8 Cable outside diameter

The cable outside diameter for each ISO conductor size and insulation thickness is standardized and specified in Table 7.

4.9 Representative conductor sizes for testing

When a test is required, all combinations of conductor size, insulation thickness and insulation formulation shall meet the specified requirements.

However, if testing of representative conductor sizes is permitted by agreement between the customer and the supplier, compliance for a cable family may be demonstrated by testing examples of large and small conductor sizes only.

4.10 Reference and requirements for the tests according to ISO 19642-2

Table 2 provides a list of all relevant tests in ISO 19642-2:2019 for single core cables.

Table 2 — Tests

Test description	Mandatory			If required[c]	
	In process[a]	Initial certification	Periodic[b]	Initial certification	Periodic[b]
5.1 **Dimensional tests**					
5.1.2 Cable outside diameter	—	X	X	—	—
5.1.3 Insulation thickness	—	X	X	—	—
5.1.4 Conductor diameter	—	—	—	X	X
5.1.5 Cross sectional area	—	—	—	X	X
5.1.6 In-process cable outside diameter	X	—	—	—	—
5.2 **Electrical tests**					
5.2.1 Conductor resistance	—	X	X	—	—
5.2.2 Determination of temperature coefficients	—	X	—	—	—
5.2.3 Withstand voltage	—	X	X	—	—
5.2.4 Withstand voltage after environmental testing[d]	—	—	—	—	—
5.2.5 Insulation faults	X	—	—	—	—
5.2.6 Insulation volume resistivity	—	—	—	X	X
5.3 **Mechanical tests**					
5.3.1 Strip force	—		—	X	X
5.3.2 Abrasion[e]					
5.3.2.4 Sandpaper abrasion test	—	X	X	—	—
5.3.2.5 Scrape abrasion test	—	X	X	—	—
5.3.3 Breaking force of the finished cable	—	—	—	X	—
5.3.4 Cyclic bending	—	—	—	X	—
5.3.5 Flexibility	—	—	—	X	—
5.4 **Environmental tests**					
5.4.1 Specimen preparation and winding tests[d]					
5.4.2 Long term heat ageing, 3 000 h at temperature class rating	—	X	—	—	—
5.4.3 Short term heat ageing, 240 h at temperature class rating +25 °C	—	X	X	—	—
5.4.4 Thermal overload, 6 h at temperature class rating +50 °C	—	—	—	X	X
5.4.5 Pressure test at high temperature	—	X	X	—	—
5.4.6 Shrinkage by heat	—	X	X	—	—
5.4.7 Low temperature winding	—	X	X	—	—

Key

X: Test shall be performed according to ISO 19642-2

—: Test is not required

[a] A test made on the entire cable lot during or after manufacture.

[b] The frequency of periodic testing shall be established by agreement between the customer and the supplier.

[c] The usage of "If required" tests shall be established by agreement between the customer and the supplier.

[d] These tests are only used in preparation and after environmental endurance tests.

[e] Only one of the abrasion tests has to be performed by agreement between the customer and the supplier.

[f] Compliance for a cable family may be demonstrated by testing examples of large and small conductor sizes only.

[g] Some fluids are for "Initial certification" and others are "If required".

Table 2 *(continued)*

Test description	Mandatory			If required[c]	
	In process[a]	Initial certification	Periodic[b]	Initial certification	Periodic[b]
5.4.8 Cold impact	—	—	—	X	X
5.4.9 Temperature and humidity cycling[f]	—	—	—	X	—
5.4.10 Resistance to hot water[f]	—	X	—	—	—
5.4.11 Resistance to liquid chemicals[f, g]	—	X	—	X	—
5.4.12 Durability of cable marking[f]	—	—	—	X	X
5.4.13 Stress cracking resistance[f]	—	—	—	X	—
5.4.14 Resistance to ozone[f]	—	—	—	X	—
5.4.15 Resistance to flame propagation	—	X	X	—	—

Key

X: Test shall be performed according to ISO 19642-2

—: Test is not required

a A test made on the entire cable lot during or after manufacture.

b The frequency of periodic testing shall be established by agreement between the customer and the supplier.

c The usage of "If required" tests shall be established by agreement between the customer and the supplier.

d These tests are only used in preparation and after environmental endurance tests.

e Only one of the abrasion tests has to be performed by agreement between the customer and the supplier.

f Compliance for a cable family may be demonstrated by testing examples of large and small conductor sizes only.

g Some fluids are for “Initial certification” and others are “If required”.

5 Requirements

5.1 General

The cables shall be tested per ISO 19642-2 according to their temperature class rating.

The cables shall be tested as specified in Table 2.

5.2 Dimensional tests

5.2.1 Cable outside diameter

No single value shall be greater or less than the standardized values in Table 7.

5.2.2 Insulation thickness

No single value shall be less than the standardized minimum value in Table 7.

5.2.3 Conductor diameter

No single value shall be greater than the maximum value in Table 7.

5.2.4 Cross-sectional area (CSA)

No single value shall be greater or less than the standardized values in Table 6.

5.2.5 In-process cable outside diameter

In-process cable outside diameter monitoring is mandatory.

The cable outside diameter measurement shall be within the standardized values of Table 7.

5.3 Electrical tests

5.3.1 Conductor resistance

No single value shall be greater than the maximum value in Table 6.

5.3.2 Requirement for determination of temperature coefficients

For pure copper, $\alpha_\rho = 3{,}93 \times 10^{-3}\ 1/K$.

For copper alloys, determine α_ρ per ISO 19642-2:2019, 5.2.2.

5.3.3 Withstand voltage

Breakdown shall not occur when a voltage of 1 kV is applied for 30 min.

NOTE No ramp up of the voltage is necessary.

5.3.4 Withstand voltage after environmental testing

Breakdown shall not occur when a voltage of 1 kV is applied for 1 min.

5.3.5 Insulation faults

A voltage of 3 kV a.c. shall be continuously applied.

Breakdown shall not occur.

5.3.6 Insulation volume resistivity

The insulation volume resistivity shall not be less than $1 \times 10^9\ \Omega{\cdot}mm$.

5.4 Mechanical tests

5.4.1 Strip force

The measured force shall be within the values as agreed between the customer and the supplier.

5.4.2 Abrasion

5.4.2.1 General

This test is only applicable to cables with an ISO conductor size less than or equal to 6 mm^2, for which either sandpaper abrasion or scrape abrasion shall be used.

The customer and the supplier shall define which test shall be used.

No abrasion test is required for ISO conductor sizes greater than 6 mm^2.

5.4.2.2 Sandpaper abrasion test

Perform the test with an additional mass according to Table 3.

The mean value of the 4 readings shall be equal to or greater than the specified value in Table 3.

Table 3 — Sandpaper abrasion

ISO conductor size	Thick wall		Thin wall		Ultra-thin wall	
	Additional mass[a]	Minimum length of sandpaper	Additional mass[a]	Minimum length of sandpaper	Additional mass[a]	Minimum length of sandpaper
mm²	kg	mm	kg	mm	kg	mm
0,13	X		0,1	200	0,05	150
0,22				225		175
0,35				250		200
0,5	0,5	400	0,2	300	0,1	175
0,75		410		350		200
1		420		400		225
1,25		425		425		240
1,5		430		450		250
2		450		500		275
2,5	1,5	280	0,5	250	0,2	125
3		330		300	X	
4		400		350		
5		450		430		
6		500		500		

Key

X: Cable size does not exist

[a] The total vertical force exerted on the test specimen shall be the combination of the force exerted by the bracket, pivoting arm, support rod and additional mass.

5.4.2.3 Scrape abrasion test

Apply a total vertical force as specified in Table 4.

The minimum cycles shall be greater than or equal to the specified value in Table 4.

Table 4 — Scrape abrasion

ISO conductor size	mm²	0,13	0,22	0,35	0,5	0,75	1	1,25	1,5	2	2,5	3	4	5	6
Vertical force	N	4,00	7,00												
Tolerance	N	±0,05													
Cycles	Minimum	100	125	150	300	350	400	400	450	500	550	600	700	700	700

5.4.3 Breaking force of the finished cable

The cable sizes to be tested and the requirements shall be as agreed between the customer and the supplier.

5.4.4 Cyclic bending

This test is only applicable to cables with an ISO conductor size less than or equal to 25 mm².

The requirement for this test shall be established by agreement between the customer and the supplier.

5.4.5 Flexibility test

This test is applicable to cables with an ISO conductor size greater than or equal to 8 mm^2.

The requirement for this test shall be established by agreement between the customer and the supplier.

5.5 Environmental tests

5.5.1 Test specimen preparation and winding tests

ISO 19642-2:2019, 5.4.1 describes the mandrel sizes used for preparation of specimens in subsequent environmental tests.

It also describes the winding tests used to detect defects caused by environmental stresses.

5.5.2 Long term heat ageing, 3 000 h at temperature class rating

The specimen shall be aged for 3 000 h at the upper value of the temperature class rating.

After winding, no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.3 Short term heat ageing, 240 h at temperature class rating +25 °C

The specimen shall be aged for 240 h at the upper value of the temperature class rating plus 25 °C.

After winding, no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.4 Thermal overload, 6 h at temperature class rating +50 °C

The specimen shall be aged for 6 h at the upper value of the temperature class rating plus 50 °C.

After winding, no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.5 Pressure test at high temperature

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.6 Shrinkage by heat

The maximum shrinkage shall not exceed 2 mm from either end.

5.5.7 Low temperature winding

The specimen shall be conditioned for 4 h at the lower value of the temperature class rating.

After winding no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.8 Cold impact

Perform the test with a mass of the hammer according to Table 5.

After impact no conductor shall be visible.

During Withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

Table 5 — Cold impact

ISO conductor size (a) mm²	Mass of the hammer (g)		
	Thick wall cable	Thin wall cable	Ultra-thin wall cable
$a \leq 0{,}35$	X	100	100
$0{,}35 < a \leq 2{,}5$	100		
$2{,}5 < a \leq 4$			X
$4 < a \leq 10$	200	200	
$10 < a \leq 50$	300	300	
$50 < a \leq 95$			
$95\ a$	400	400	
$2{,}5 < a \leq 4$		X	
Key			
X: Cable type does not exist			

5.5.9 Temperature and humidity cycling

After unwinding no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.10 Resistance to hot water

Perform the test with "+" on the conductor and "–" on the copper electrode.

With a new specimen, perform the test with reverse polarity.

For both specimens, the insulation volume resistivity shall not be less than $1 \times 10^9\ \Omega{\cdot}mm$.

A visual examination of the insulation shall show no cracks.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.11 Resistance to liquid chemicals

After winding, no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.12 Durability of cable marking

All cable markings shall remain legible.

5.5.13 Stress cracking resistance

This test shall be performed for cables with insulation materials that are prone to environmental stress cracking problems (e.g. FEP and ETFE, with an ISO conductor size smaller than 6 mm²) by agreement between the customer and the supplier.

After the test, no conductor shall be visible.

During withstand voltage after environmental testing (5.3.4), breakdown shall not occur.

5.5.14 Resistance to ozone

The visual examination of the insulation shall show no cracks.

5.5.15 Resistance to flame propagation

Any combustion flame of insulating material shall extinguish within 30 s from the end of ignition and a minimum of 50 mm of insulation at the top of the test specimen shall remain unburned.

All 5 specimens shall pass the test.

Table 6 — Cross-sectional area (CSA) and conductor resistance

ISO conductor size mm²	CSA mm²		Maximum conductor resistance mΩ/m at 20 °C		
	maximum[a]	minimum	Bare or Ag plated copper	Sn plated copper	Ni plated copper
0,13	0,137	0,127	136	140	142
0,22	0,220	0,203	84,8	86,5	87,9
0,35	0,345	0,317	54,4	55,5	56,8
0,50	0,502	0,465	37,1	38,2	38,6
0,75	0,754	0,698	24,7	25,4	25,7
1	1,01	0,932	18,5	19,1	19,3
1,25	1,25	1,16	14,9	15,9	16,0
1,5	1,47	1,36	12,7	13,0	13,2
2	1,98	1,83	9,42	9,69	9,82
2,5	2,45	2,27	7,60	7,82	7,92
3	3,03	2,80	6,15	6,36	6,41
4	3,95	3,66	4,71	4,85	4,91
5	4,73	4,38	3,94	4,02	4,11
6	5,93	5,49	3,14	3,23	3,27
8	7,82	7,24	2,38	2,52	2,60
10	10,2	9,47	1,82	1,85	1,90
12	12,3	11,3	1,52	1,60	1,66
16	16,1	14,9	1,16	1,18	1,21
20	19,5	18,1	0,955	0,999	1,03
25	25,1	23,2	0,743	0,757	0,774
30	28,8	26,6	0,647	0,684	0,706
35	35,3	32,7	0,527	0,538	0,549
40	39,4	36,5	0,473	0,500	0,516
50	50,6	46,9	0,368	0,375	0,383
60	59,1	54,7	0,315	0,333	0,344
70	71,9	66,6	0,259	0,264	0,270
85	85,0	78,7	0,219	0,225	0,228
95	95,0	88,0	0,196	0,200	0,204
120	122	113	0,153	0,156	0,159

[a] Additional maximum CSAs may be used. Maximum CSA requirements shall be established by agreement between the customer and the supplier.

Table 7 — Dimensions

ISO conductor size	Conductor Diameter	Thick wall			Thin wall			Ultra-thin wall		
		Insulation thickness	Cable outside diameter		Insulation thickness	Cable outside diameter		Insulation thickness	Cable outside diameter	
mm²	mm	mm	mm		mm	mm		mm	mm	
	maximum[a]	minimum[b]	maximum[a]	minimum[c]	minimum[b]	maximum[a]	minimum[c]	minimum[b]	maximum[a]	minimum[c]
0,13	0,55	X			0,20	1,05	0,95	0,16	0,95	0,85
0,22	0,70				0,20	1,20	1,10	0,16	1,05	0,95
0,35	0,90				0,20	1,40	1,20	0,16	1,20	1,10
0,50	1,10	0,48	2,30	2,00	0,22	1,60	1,40	0,16	1,40	1,30
0,75	1,30	0,48	2,50	2,20	0,24	1,90	1,70	0,16	1,60	1,45
1	1,50	0,48	2,70	2,40	0,24	2,10	1,90	0,16	1,75	1,55
1,25	1,70	0,48	2,95	2,40	0,24	2,30	2,10	0,16	2,00	1,70
1,5	1,80	0,48	3,00	2,70	0,24	2,40	2,20	0,16	2,10	1,90
2	2,00	0,48	3,30	3,00	0,28	2,80	2,50	0,20	2,40	2,20
2,5	2,20	0,56	3,60	3,30	0,28	3,00	2,70	0,20	2,70	2,50

Key

X: Cable type does not exist

[a] The maximum cable diameter listed in the table is standardized for bunched conductors. Different maximum conductor diameters for rope and other stranding may be allowed as agreed between the customer and the supplier. This change can affect the cable outside diameter dimension in the table.

[b] Nominal insulation thickness w_{nom} is calculated by

$w_{nom} = 1{,}25 \times w_{min}$ or $w_{nom} = w_{min} / 0{,}8$

where

w_{min} is the minimum wall thickness;

w_{nom} is the nominal wall thickness.

[c] Minimum cable diameter is not valid for compressed conductors.

Table 7 *(continued)*

ISO conductor size	Conductor Diameter	Thick wall			Thin wall			Ultra-thin wall		
		Insulation thickness	Cable outside diameter		Insulation thickness	Cable outside diameter		Insulation thickness	Cable outside diameter	
	mm	mm	mm		mm	mm		mm	mm	
mm2	maximuma	minimumb	maximuma	minimumc	minimumb	maximuma	minimumc	minimumb	maximuma	minimumc
3	2,40	0,56	4,10	3,80	0,32	3,40	3,10			
4	2,80	0,64	4,40	4,00	0,32	3,70	3,40			
5	3,10	0,64	4,90	4,50	0,32	4,20	3,90			
6	3,40	0,64	5, 00	4,60	0,32	4,30	4,00			
8	4,30	0,64	5,90	5,00	0,32	5,00	4,60			
10	4,50	0,8	6,50	5,90	0,48	6,00	5,30			
12	5,40	0,8	7,40	6,60	0,48	6,50	5,80			
16	6,30	0,8	8,30	7,70	0,52	7,20	6,40			
20	6,90	0,88	9,10	8,10	0,52	7,80	7,00			
25	7,80	1,04	10,40	9,40	0,52	8,70	7,90	X		
30	8,30	1,04	10,90	9,70	0,64	9,60	8,70			
35	9,00	1,04	11,60	9,60	0,64	10,40	9,40			
40	9,60	1,12	12,40	11,20	0,71	11,10	10,00			
50	10,50	1,2	13,50	11,50	0,71	12,20	11,00			
60	11,60	1,2	14,60	13,40	0,80	13,30	12,00			
70	12,50	1,2	15,50	13,50	0,80	14,40	13,00			
85	13,60	1,28	16,80	14,80	0.90	15,80	14,40			
95	14,80	1,28	18,00	16,00	0,90	16,70	15,30			
120	16,50	1,28	19,70	17,70	X					

Key

X: Cable type does not exist

[a] The maximum cable diameter listed in the table is standardized for bunched conductors. Different maximum conductor diameters for rope and other stranding may be allowed as agreed between the customer and the supplier. This change can affect the cable outside diameter dimension in the table.

[b] Nominal insulation thickness w_{nom} is calculated by

$w_{nom} = 1{,}25 \times w_{min}$ or $w_{nom} = w_{min} / 0{,}8$

where

w_{min} is the minimum wall thickness;

w_{nom} is the nominal wall thickness.

[c] Minimum cable diameter is not valid for compressed conductors.

Annex A
(informative)

ISO conductor sizes, number of strands and strand diameters

A.1 Conductors — Existing stranding configurations

Table A.1 — ISO conductor sizes, number of strands and strand diameter

ISO conductor size	Structure A[a] (symmetrical)		Structure B[a] (asymmetrical)		Structure C[a] (asymmetrical)	
	Number of strands	Maximum strand diameter	Number of strands	Maximum strand diameter	Number of strands	Maximum strand diameter
mm^2		mm		mm		mm
0,13	7	0,16	X		X	
0,22	7	0,21				
0,35	7	0,27	12	0,21	19	0,16
0,50	7	0,32	X		X	
	19	0,19	16	0,21	26	0,16
0,75	19	0,24	24	0,21	38	0,16
1	19	0,27	32	0,21	54	0,16
1,25	19	0,30	16	0,33	50	0,19
1,5	19	0,33	30	0,26	76	0,16
2	19	0,38	28	0,31	105	0,16
2,5	37	0,30	50	0,26	140	0,16
3	37	0,34	44	0,31	160	0,16
4	37	0,38	56	0,31	224	0,16
5	37	0,43	65	0,33	250	0,16
6	37	0,45	84	0,31	320	0,16
8	98	0,33	50	0,46	240	0,21
10	63	0,46	80	0,41	320	0,21
12	154	0,33	96	0,41	380	0,21
16	105	0,46	126	0,41	512	0,21
20	247	0,33	152	0,41	610	0,21
25	154	0,46	196	0,41	790	0,21
30	361	0,33	224	0,41	900	0,22
35	551	0,30	276	0,41	1 070	0,21
40	494	0,33	308	0,41	1 200	0,21
50	798	0,30	396	0,41	1 600	0,21

Key

X: Conductor does not exist

[a] The strandings above highlight examples of conceptual configurations and are not intended to reflect any preferred constructions. Other stranding configurations may be used providing they meet the conductor resistance and CSA requirements and are agreed between the customer and the supplier.