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**Road vehicles — 60 V and 600 V  
single-core cables —**

**Part 2:  
Dimensions, test methods and  
requirements for aluminium  
conductor cables**

iTeh STANDARD PREVIEW  
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*Véhicules routiers — Câbles monoconducteurs de 60 V et 600 V —*

*Partie 2: Méthodes d'essai des dimensions et exigences pour les câbles  
conducteurs en aluminium*

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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](http://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](http://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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This fourth edition of ISO 6722-2 ~~is cancelled and replaced by ISO 6722:2006~~ <sup>ISO 6722-2:2013</sup> ~~5500-4996-a23d-6f4d8299ed9d/iso-6722-2-2013~~

ISO 6722 consists of the following parts, under the general title *Road vehicles — 60 V and 600 V single-core cables*:

- *Part 1: Dimensions, test methods and requirements for copper conductor cables*
- *Part 2: Dimensions, test methods and requirements for aluminium conductor cables*

## Introduction

ISO 6722 deals with single-core cables, with copper conductor cables covered in ISO 6722-1 and aluminium conductor cables covered in this part of ISO 6722. The performance of aluminium conductor cables is, in general, not to be expected to be the same as the performance of copper conductor cables in a one-to-one comparison basis.

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# Road vehicles — 60 V and 600 V single-core cables —

## Part 2:

# Dimensions, test methods and requirements for aluminium conductor cables

**WARNING** — The use of this part of ISO 6722 may involve hazardous materials, operations, and equipment. This part of ISO 6722 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 part of ISO 6722 to establish appropriate safety practices and determine the applicability of regulatory limitations prior to use.

## 1 Scope

This part of ISO 6722 specifies the dimensions, test methods, and requirements for single-core 60 V cables intended for use in road vehicle applications where the nominal system voltage is  $\leq 60$  V d.c. or 25 V a.c. It also specifies additional test methods and/or requirements for 600 V cables intended for use in road vehicle applications, where the nominal system voltage is from  $> 60$  V d.c. or 25 V a.c. to  $\leq 600$  V d.c. or 600 V a.c. It also applies to individual cores in multi-core cables.

This part of ISO 6722 specifies requirements for aluminium conductor cables.

## 2 Normative references

ISO 6722-2:2013

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The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6722-1, *Road vehicles — 60 V and 600 V single-core cables — Part 1: Dimensions, test methods and requirements for copper conductor cables*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

EN 573-1, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 1: Numerical designation system*

EN 573-3:2009, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition and form of products*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6722-1 apply.

**NOTE** Whenever a.c. voltage is specified throughout this part of ISO 6722, the a.c. rms value shall be used.

## 4 General

### 4.1 Safety concerns

See “WARNING” at the beginning of this part of ISO 6722.

## 4.2 Temperature classes

Temperature classes are defined in [Table 1](#).

**Table 1 — Temperature class rating**

Class	Temperature
A	–40 °C to 85 °C
B	–40 °C to 100 °C
C	–40 °C to 125 °C
D	–40 °C to 150 °C
E	–40 °C to 175 °C
F	–40 °C to 200 °C

## 4.3 Conductors

The conductors shall consist of annealed or annealed compressed/compacted aluminium, aluminium alloy, or copper-cladded aluminium strands. The specifications for the conductors shall be according to [Table 2](#) and shall be completed by material specifications. Elongation requirements shall be established by the agreement between the customer and the supplier. The finished cable shall meet the resistance requirements of [Table 5](#) for all conductors.

The individual strands of the aluminium conductor shall be manufactured per 1 000 series aluminium, pursuant to EN 573-1. The chemical composition shall follow EN 573-3:2009, Table 1.

NOTE Examples of strandings are shown in [Table A.1](#). These strandings highlight examples of conceptual configurations and are not intended to reflect any preferred constructions. Other stranding configurations may be used provided they meet the requirements specified and are agreed upon by the customer and the supplier.

**Table 2 — Characteristics of individual single strand wire after annealing**

Tensile strength <sup>a,b</sup> R <sub>m</sub> MPa	Elongation at break <sup>a</sup> A <sub>c</sub> %	Conductivity κ <sub>20</sub> Sm/mm <sup>2</sup>
70 to 120	≥16	≥35,5
90 to 140 <sup>c,d</sup>	≥8 <sup>c,d</sup>	≥33,5 <sup>d</sup>
<p><sup>a</sup> Determined pursuant to ISO 6892-1, (Reference [2]).</p> <p><sup>b</sup> Measured at clamping length of 200 mm.</p> <p><sup>c</sup> Not applicable for compressed conductors. The tensile strength, elongation, and chemical composition requirements shall be established by the agreement between the customer and the supplier.</p> <p><sup>d</sup> Additional aluminium alloys may be used. The conductivity, tensile strength, elongation requirements, and chemical composition shall be established by the agreement between the customer and the supplier.</p>		

## 4.4 Tests

The cables shall be submitted to tests as specified in [Table 3](#).

Unintended direct contact of aluminium wire with any other metal shall not occur with any of the test methods.



#### 4.5 General test conditions

If not otherwise specified, the device under test (DUT) shall be preconditioned for at least 16 h at a room temperature (RT) of  $(23 \pm 5)$  °C and a relative humidity (RH) of 45 % to 75 %. Unless otherwise specified, all tests other than “in-process” tests shall be conducted at these conditions.

Where no tolerance is specified, all values shall be considered to be approximate.

When a.c. tests are performed, these shall be carried out at 50 Hz or 60 Hz. Applications at higher frequencies may require additional testing.

#### 4.6 Ovens

An oven with air exchange, either natural or by pressure, should be used. The air shall enter the oven in such a way that it flows over the surface of the test pieces and leaves near the top of the oven. The oven shall have not less than 8 and not more than 20 complete air changes per hour at the specified ageing temperature.

Forced air circulation, e.g. by a fan, inside the oven may be used. However, in case of dispute, an oven without forced air circulation shall be used.

Table 3 — Tests

Subclause	Test description	Mandatory			If required <sup>c</sup>	
		In-process <sup>a</sup>	Initial	Periodic <sup>b</sup>	Initial	Periodic <sup>b</sup>
	<b>Dimensions</b>					
<a href="#">5.1</a>	Outside cable diameter	–	X	X	–	–
<a href="#">5.2</a>	Insulation thickness	–	X	X	–	–
<a href="#">5.3</a>	Conductor diameter and cross-sectional area	–	X	X	X	X
	<b>Electrical characteristics</b>					
<a href="#">5.4</a>	Conductor resistance	–	X	X	–	–
<a href="#">5.5</a>	Withstand voltage	–	X <sup>d</sup>	X <sup>d</sup>	–	–
<a href="#">5.6</a>	Insulation faults	X <sup>d</sup>	–	–	–	–
<a href="#">5.7</a>	Insulation volume resistivity	–	–	–	X	X
	<b>Mechanical characteristics</b>					
<a href="#">5.8</a>	Pressure test at high temperature	–	X	X	–	–
<a href="#">5.9</a>	Strip force	–	–	–	X	X
	<b>Low temperature characteristics</b>					
<a href="#">5.10</a>	Winding	–	X	X	–	–
<a href="#">5.11</a>	Impact	–	–	–	X	X
<a href="#">5.12</a>	Resistance to abrasion	–	X <sup>e</sup>	X <sup>e</sup>	–	–
	<b>Heat ageing</b>					
<a href="#">5.13</a>	Long term ageing, 3 000 h	–	X	–	–	–
<a href="#">5.14</a>	Short-term ageing, 240 h	–	X	X	–	–
<a href="#">5.15</a>	Thermal overload	–	–	–	X	X
<a href="#">5.16</a>	Shrinkage by heat	–	X	X	–	–
	<b>Resistance to chemicals</b>					
<a href="#">5.17</a>	Fluid compatibility	–	X <sup>f,g</sup>	–	X <sup>f,g</sup>	–

Table 3 (continued)

Subclause	Test description	Mandatory			If required <sup>c</sup>	
		In-process <sup>a</sup>	Initial	Periodic <sup>b</sup>	Initial	Periodic <sup>b</sup>
<a href="#">5.18</a>	Durability of cable marking	–	–	–	X <sup>g</sup>	X <sup>g</sup>
<a href="#">5.19</a>	Resistance to ozone	–	–	–	X <sup>g</sup>	–
<a href="#">5.20</a>	Resistance to hot water	–	X <sup>g</sup>	–	–	–
<a href="#">5.21</a>	Temperature and humidity cycling	–	–	–	X <sup>g</sup>	–
<a href="#">5.22</a>	Resistance to flame propagation	–	X	X	–	–

X applicable test  
 – not applicable  
 a A test made on entire cable length during or after manufacture.  
 b The frequency of periodic testing shall be established by the agreement between the customer and the supplier.  
 c The usage of “if required” tests shall be established by the agreement between the customer and the supplier.  
 d Some cables are rated at 60 V and others at 600 V. See ISO 6722-1 for details.  
 e See ISO 6722-1 for details.  
 f Some fluids are for “certification” and others are “if required”. See ISO 6722-1 for details.  
 g Compliance for a cable family may be demonstrated by testing the examples of large and small conductor sizes only (see [4.7](#)).

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**4.7 Representative conductor sizes for testing**

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When a test is required, all combinations of conductor size, wall thickness, and insulation formulation shall meet the appropriate requirements. However, if the testing of representative conductor sizes is permitted (see [Table 3](#)), compliance for a cable family may be demonstrated by testing the examples of large and small conductor sizes only. Permission to show compliance for a cable family by testing “representative conductor sizes” shall be established by the agreement between the customer and the supplier.

**4.8 Recommended colours**

For a list of recommended colours, see ISO 6722-1.

**5 Tests**

**5.1 Outside cable diameter**

**5.1.1 Purpose, test sample, and test**

ISO 6722-1 applies.

**5.1.2 Requirement**

No single value shall be larger than the appropriate values specified in [Table 4](#).

NOTE See [Table A.2](#) for the minimum outside cable diameters.

## 5.2 Insulation thickness

### 5.2.1 Purpose, test sample, and test

ISO 6722-1 applies.

### 5.2.2 Requirement

No single value shall be less than the appropriate minimum insulation thickness specified in [Table 4](#).

**Table 4 — Dimensions**

ISO conductor <sup>a</sup>		Thick wall			Thin wall			Ultrathin wall		
Size mm <sup>2</sup>	Diameter mm	Insulation thickness mm		Outside cable diameter mm	Insulation thickness mm		Outside cable diameter mm	Insulation thickness mm		Outside cable diameter mm
		max.	nominal		min.	max.		nominal	min.	
0,75	1,30	0,60	0,48	2,50	0,30	0,24	1,90	0,20	0,16	1,60
1	1,50	0,60	0,48	2,70	0,30	0,24	2,10	0,20	0,16	1,75
1,25	1,70	0,60	0,48	2,95	0,30	0,24	2,30	0,20	0,16	2,00
1,5	1,80	0,60	0,48	3,00	0,30	0,24	2,40	0,20	0,16	2,10
2	2,00	0,60	0,48	3,30	0,35	0,28	2,80	0,25	0,20	2,40
2,5	2,20	0,70	0,56	3,60	0,35	0,28	3,00	0,25	0,20	2,70
3	2,40	0,70	0,56	4,10	0,40	0,32	3,40			
4	2,80	0,80	0,64	4,40	0,40	0,32	3,70			
5	3,10	0,80	0,64	4,90	0,40	0,32	4,20			
6	3,40	0,80	0,64	5,00	0,40	0,32	4,30			
8	4,30	0,80	0,64	5,90	0,40	0,32	5,00			
10	4,50	1,00	0,80	6,50	0,60	0,48	6,00			
12	5,40	1,00	0,80	7,40	0,60	0,48	6,50			
16	5,80	1,00	0,80	8,30	0,65	0,52	7,20			
20	6,90	1,10	0,88	9,10	0,65	0,52	7,80			
25	7,20	1,30	1,04	10,40	0,65	0,52	8,70			
30	8,30	1,30	1,04	10,90	0,80	0,64	9,60			
35	8,50	1,30	1,04	11,60	0,80	0,64	10,40			
40	9,60	1,40	1,12	12,40	0,90	0,71	11,10			
50	10,50	1,50	1,20	13,50	0,90	0,71	12,20			
60	11,60	1,50	1,20	14,60	1,00	0,80	13,30			
70	12,50	1,50	1,20	15,50	1,00	0,80	14,40			
85	13,60	1,60	1,28	16,80	1,10	0,90	15,80			
95	14,80	1,60	1,28	18,00	1,10	0,90	16,70			
120	16,50	1,60	1,28	19,70						
160	19,00	1,60	1,28	22,50						

<sup>a</sup> The maximum cable diameter listed in the table is calculated for bunched conductors. Different maximum conductor diameters for rope and other strandings may be allowed as agreed upon by the customer and the supplier. This change may affect the maximum outside cable diameters dimensions in the table.