
**Road vehicles — Multi-core connecting
cables —**

Part 1:

**Test methods and requirements for basic
performance sheathed cables**

iTeh STANDARD PREVIEW
*Véhicules routiers — Câbles de raccordement multiconducteurs —
Partie 1: Méthodes d'essai et exigences pour les câbles gainés à
performance de base*
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ISO 4141-1:2005

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 4141-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second edition cancels and replaces the first edition (ISO 4141-1:1998), which has been technically revised.

ISO 4141 consists of the following parts, under the general title *Road vehicles — Multi-core connecting cables*:

- *Part 1: Test methods and requirements for basic performance sheathed cables*
- *Part 2: Test methods and requirements for high-performance sheathed cables*
- *Part 3: Construction, dimensions and marking of unscreened sheathed low-voltage cables*
- *Part 4: Articulation test method and requirements for coiled cable assemblies*

Road vehicles — Multi-core connecting cables —

Part 1: Test methods and requirements for basic performance sheathed cables

1 Scope

This part of ISO 4141 specifies the test methods and requirements of basic performance multi-core sheathed cables for the connection of towing and towed vehicles, suitable for a temperature range of $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$.

2 Normative references

The following referenced documents are indispensable for the application 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 1817, *Rubber, vulcanised — Determination of the effect of liquids*

ISO 4141-3 *Road vehicles — Multi-core connecting cables — Part 3: Construction, dimensions and marking of unscreened sheathed low-voltage cables*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc sources*

ISO 4892-4, *Plastics — Methods of exposure to laboratory light sources — Part 4: Open-flame carbon-arc lamps*

ISO 6722, *Road vehicles — 60 V and 600 V single-core cables — Dimensions, test methods and requirements*

ISO 7638-1, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — Part 1: Connectors for braking systems and running gear of vehicles with 24 V nominal supply voltage*

ISO 7638-2, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — Part 2: Connectors for braking systems and running gear of vehicles with 12 V nominal supply voltage*

ISO 12098, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — 15-pole connector for vehicles with 24 V nominal supply voltage*

ISO 14572, *Road vehicles — Round, screened and unscreened, 60 V and 600 V multi-core sheathed cables — Test methods and requirements for basic and high performance cables*

ISO/PAS 16553, *Road vehicles — Data cables — Test methods and requirements*

IEC 60811-1-1, *Common test methods for insulating and sheathing materials of electric cables and optical cables — Part 1-1: Methods for general application — Measurement of thickness and overall dimensions — Tests for determining the mechanical properties*

EN 14214, *Automotive fuels — Fatty acid methyl esters (FAME) for diesel engines — Requirements and test methods*

DIN V 70070, *Diesel engines — NO_x-reduction additives AUS 32 — Requirements and test methods*

3 Terms and definitions

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

3.1 basic performance

⟨cable⟩ meeting basic requirements for general automotive applications

3.2 screen

conductive material intended to reduce the penetration and/or radiation of a varying electromagnetic field into an assigned region

3.3 unscreened

absence of a screen

3.4 core

an assembly comprising a conductor with its own insulation (and screens, if there are any)

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4 General

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Single core identification shall conform to ISO 4141-3. The single components of multi-core sheathed cables shall comply with ISO 6722 for single cores, and with ISO/PAS 16553 for data cables, with the exception of the capacitance test of unscreened twisted pair cores for which 6.3 shall apply.

The general test conditions and the ovens used shall be in accordance with ISO 6722.

If a visual examination is required, the sheath shall be smooth, even and free from surface imperfections, e.g. lumps, voids and particles.

The test sequence for each sample group shall be in accordance with Table 1. (Sequences are indicated with an "X", ordered from top to bottom.)

Table 1 — Test sequences and requirements

Test	Test sample group / sequence																			
	Subclause	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	
Visual examination	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Outside cable diameter	5.1	X																		
Ovality	5.2	X																		
Thickness of the sheath	5.3		X																	
Lay length	5.4			X																
Continuity	6.1				X															
Withstand voltage	6.2					X				X			X	X						
Cyclic bending	7.3					X														
Winding	8.1									X										
Impact	8.2										X									
Long-term ageing	10.1												X							
Short-term ageing	10.2													X						
Visual examination	4					X				X	X		X	X						
Withstand voltage	6.2					X				X			X	X						
Capacitance	6.3						X													
Pressure at high temperature	7.1							X												
Adhesion of the sheath	7.2								X											
Resistance to abrasion	9											X								
Fluid compatibility of the sheath	11.1														X					
Durability of sheath marking	11.2															X				
Resistance to ozone	11.3																X			
Resistance to flame propagation	12																	X		
Artificial weathering	13																			X
Visual examination	4								X						X	X	X	X	X	X

5 Dimensions

5.1 Outside cable diameter

5.1.1 Test sample

Prepare a test sample of 600 mm length.

5.1.2 Apparatus

See ISO 6722.

5.1.3 Procedure

Determine the maximum and minimum outside cable diameter by taking three sets of measurements separated by 200 mm and recording the highest (d_{\max}) and lowest (d_{\min}) values of the measurements at each of the three positions.

5.1.4 Requirement

Each diameter measured shall be between the limits agreed between customer and supplier for the cable under test, which shall be within the limits according to ISO 4141-3.

5.2 Ovality

5.2.1 Test sample and apparatus

Use the measurements of 5.1.

5.2.2 Procedure

Calculate the ovality, for each set of measurements, as follows:

$$\text{Ovality (\%)} = \frac{d_{\max} - d_{\min}}{0,5(d_{\max} + d_{\min})} \times 100$$

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5.2.3 Requirement

Each ovality calculated shall be within the limits, as specified in ISO 4141-3.

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5.3 Thickness of the sheath

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5.3.1 Test samples, apparatus, procedure

See ISO 6722, insulation thickness.

5.3.2 Requirement

Each value measured shall not be less than the minimum wall thickness, as specified in ISO 4141-3.

5.4 Lay length

5.4.1 General

This test is intended for twisted pair cores only.

5.4.2 Test samples

Prepare a test sample of 1 000 mm length.

5.4.3 Apparatus

Use a measuring device with an accuracy of 1 mm.

5.4.4 Procedure

Remove (500 ± 25) mm of the sheath without allowing the ends to untwist. Fasten the test sample at its ends. Measure the length over five consecutive lays, where one lay is the axial length of one complete turn of the helix of a core in the twisted pair.

5.4.5 Requirement

The length measured shall not exceed 250 mm for five lays.

6 Electrical characteristics

6.1 Continuity

See ISO 14572.

6.2 Withstand voltage

See ISO 14572.

6.3 Capacitance

6.3.1 General

This test is intended for unscreened twisted pair cores used for data communication only.

6.3.2 Test samples

Prepare a test sample of 5 m length, remove 50 mm of sheath from one end and remove 12 mm of insulation from each of the cores.

6.3.3 Apparatus

Use a standard capacitance measuring device with alternating current and a frequency of 1 kHz.

6.3.4 Procedure

Cores a and b are cores for data transmission of the connecting cable, e.g. cores 6 and 7 of a cable in accordance with ISO 7638-1 or ISO 7638-2, or cores 14 and 15 of a cable in accordance with ISO 12098.

Subject cores a and b to the two different capacitance measurements A and B, as described below (see also Figure 1).

Measurement A:

Short circuit cores a and b. Set the short-circuit bridge at that cable end, where the measuring device is connected. Measure the capacitance C_A between these cores and all other cores connected in parallel.

The measured value is: $C_A = 2 C_i$ (1a)

$$C_i = \frac{1}{2} C_A \quad (1b)$$

Measurement B:

Remove the short circuit between core a and core b. Measure the capacitance C_B between core a and core b.

The measured value is: $C_B = C_d + \frac{1}{2} C_i$ (2a)

$$C_d = C_B - \frac{1}{2} C_i \quad (2b)$$