INTERNATIONAL STANDARD

ISO 4141-2

Second edition
2006-07-01

Road vehicles — Multi-core connecting cables —

Part 2: Test methods and requirements for high performance sheathed cables

Véhicules routiers — Câbles de raccordement multiconducteurs —

Partie 2: Méthodes d'essai et exigences pour les câbles gainés à hautes performances

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Foreword

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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 4141-2 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 4141-2:1998), 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*

The following part is under preparation:

— *Part 4: Test methods and requirements for coiled cable assemblies* [Revision of ISO 4141-4:2001]

Road vehicles — Multi-core connecting cables —

Part 2:
Test methods and requirements for high performance sheathed cables

1 Scope

This part of ISO 4141 specifies the test methods and requirements for high performance sheathed multi-core cables for the connection of towing and towed vehicles, suitable for a temperature range of −40 °C to +85 °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, vulcanized — Determination of the effect of liquids*

ISO 4141-1, *Road vehicles — Multi-core connecting cables — Part 1: Test methods and requirements for basic performance sheathed cables*

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

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

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*

3 General requirements

High performance sheathed multi-core cables shall be in accordance with ISO 4141-1 and shall meet the additional test and requirements or modified test conditions specified in Clause 4.

Coiled multi-core cables shall in addition meet the tests and requirements specified in Clause 5.

4 Tests and requirements

4.1 Impact

See ISO 4141-1 but use a freezing temperature of (-20 ± 2) °C.

4.2 Pressure at high temperature

See ISO 14572 and apply the requirements for high performance cables.

4.3 Cyclic bending

See ISO 4141-1 but use 10 000 cycles.

4.4 Fluid compatibility of the sheath

4.4.1 General

For each test, use three samples each of 300 mm minimum length at least 1 m apart on the cable.

Bend each test sample 180° min. to a radius of five times the outside diameter and secure it.

4.4.2 Tests

4.4.2.1 Resistance against ethanol

See ISO 6722 but use a time frame of 168 h.

4.4.2.2 Resistance against sulphuric acid

Immerse the bent test samples for 48 h in dilute battery acid of density 1 275 g/cm^3 at a temperature of (23 ± 5) °C.

Remove the test samples from the test liquid, rinse and wipe them thoroughly, straighten them, and then examine them visually.

4.4.2.3 Resistance against lubrication oil

Immerse the bent test samples for 168 h in lubrication oil No. 1 as specified in ISO 1817 at a temperature of (23 ± 5) °C.

Remove the test samples from the test liquid, wipe them thoroughly, straighten them, and then examine them visually.

4.4.2.4 Resistance against zinc chloride

Immerse the bent test samples in an aqueous solution of zinc chloride, 50 % mass fraction, for 168 h at a temperature of (23 ± 5) °C.

Remove the test samples from the test liquid, wipe them thoroughly, straighten them and then examine them visually.

4.4.3 Requirement

The sheath shall show no evidence of fracture or cracking.

5 Specific tests and requirements for coiled multi-core cables

5.1 Elongation by cable weight

5.1.1 Test

Measure the initial block length of the complete coil at rest and in horizontal position.

Then hang the cable vertically. After at least 60 s, measure the extended coil length.

5.1.2 Requirement

The extended coil length shall not be more than twice the initial block length.

5.2 Resistance against cyclic extension

5.2.1 Test

This test may be performed with the sample used in 5.1. Position the sample horizontally in a test apparatus and subject it to the two test sequences specified in Table 1.

Table 1 — Cyclic extension test, number of cycles

Test sequence	Extension	Number of cycles[a]
1	To max. value of working length (L_A)[b]	200 000
2	To max. admitted extension length (L_{Amax})[b]	20 000

[a] One cycle consists of:

— extension of the sample to its working length (test sequence 1) or to its maximum admitted extension length (test sequence 2);

— contraction to its original block length including the uncoiled cable lengths.

[b] According to ISO 4141-3.

The test shall be carried out at a frequency of (10 ± 5) cycles/min.

Conductor breakage shall be monitored by applying a current $(5 \pm 0{,}5)$ A to all conductors during the entire test phase. If breakage occurs, the test procedure shall stop automatically.

5.2.2 Requirement

No conductor shall break during the test. At the end, under visual examination, the sheath shall show no evidence of fracture or cracking.

5.3 Restoring force

5.3.1 Test

Precondition the cable:

— by one extension to its max. admitted extension length;

— 5 minutes rest, unstretched, at room temperature;

— rest for 4 h in a freezing chamber at (-40 ± 2) °C.

Then within 60 s of removing the sample from the freezing chamber, measure the restoring force of the cable when extended to its max. admitted extension length.

5.3.2 Requirement

The restoring force shall not exceed 180 N.

5.4 Cable sag

5.4.1 Test

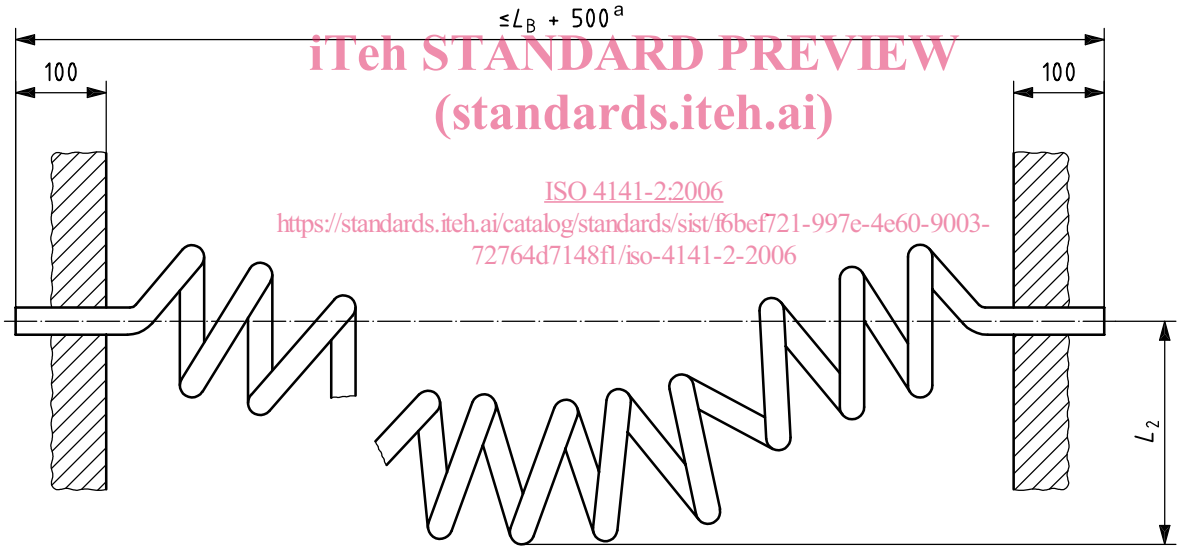
Mount one cable as shown in Figure 1 and measure its sag successively after each of the following conditions:

a) one extension to its max. admitted extension length, and subsequently 60 s rest unstretched;

b) 2 h conditioning in a heating chamber at (80 ± 2) °C, one extension to its max. admitted extension length within 15 s after removing from the heating chamber, and subsequently 60 s rest at room temperature, unstretched;

c) the cyclic extension test in 5.2, and subsequently 5 minutes rest, unstretched.

Dimensions in millimetres



[a] See ISO 4141-3.

Figure 1 — Measurement of cable sag

5.4.2 Requirement

The measured cable sag shall not exceed the values specified in Table 2.

Table 2 — Maximum cable sag

Measurement taken with cable at rest after conditioning according to	Cable sag, L_2 mm max.
5.4.1 a)	400
5.4.1 b)	450
5.4.1 c)	650

5.5 Permanent elongation

5.5.1 Test

Measure the block length of the cable as delivered and after each of the following conditioning procedures:

a) one extension to its max. admitted extension length and subsequently 30 s rest in restored condition at room temperature;

b) 2 h conditioning at a temperature of (-40 ± 2) °C, one extension to its max. admitted extension length within 15 s after removing from the temperature chamber, and subsequently 120 s rest in restored condition at room temperature;

c) as b), but 2 h conditioning at (60 ± 2) °C;

d) as b), but 2 h conditioning at (80 ± 2) °C.

Measurement shall be taken with a sample positioned horizontally on a plane surface of low friction. The released sample may be lifted and allowed to fall, to reduce the effect of friction.

5.5.2 Requirement

The measured change of block lengths shall not exceed the values specified in Table 3.

Table 3 — Extension of block length

Measurements taken after conditioning as in	Change of block length %[a] max.
5.5.1 a)	10
5.5.1 b)	15
5.5.1 c)	20
5.5.1 d)	50

[a] Percentage of the block length of the coiled cable as delivered.