

Road vehicles — Multi-core connecting cables —

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

ICS 43.040.10

National foreword

This British Standard reproduces verbatim ISO 4141-2:2006 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee AUE/16, Electrical and electronic equipment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii and iii, a blank page, pages 1 to 5 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2006

© BSI 2006

ISBN 0 580 48649 4

Amendments issued since publication

Amd. No.	Date	Comments

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*



Reference number
ISO 4141-2:2006(E)

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 4141-2 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 $-40\text{ }^{\circ}\text{C}$ 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, 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 $(-20 \pm 2)\text{ }^{\circ}\text{C}$.

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/cm³ 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: <ul style="list-style-type: none"> — 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.

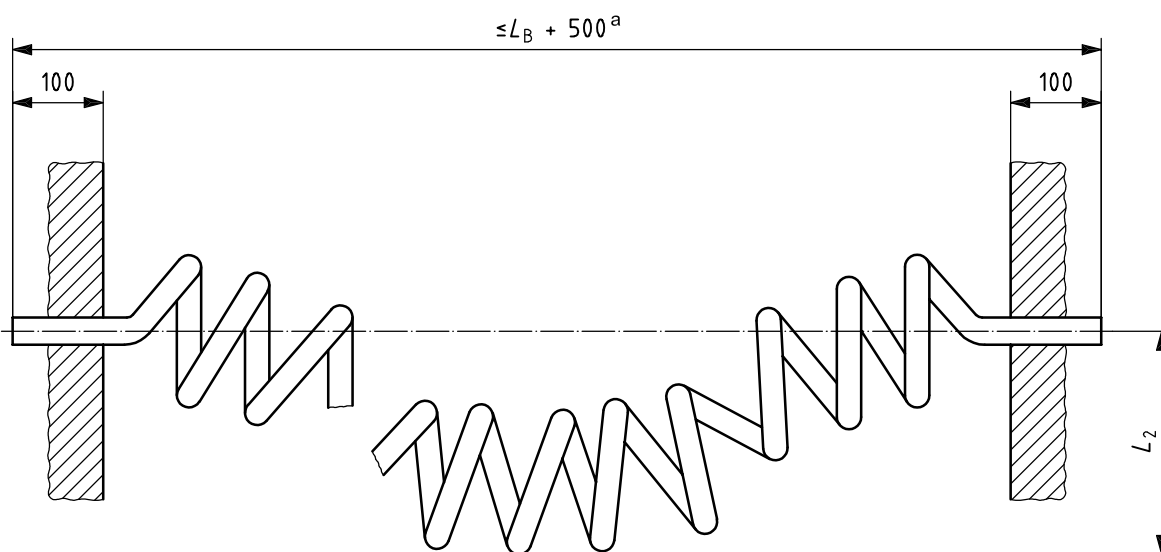
5.4 Cable sag

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 $(80 \pm 2) ^\circ\text{C}$, 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:

- one extension to its max. admitted extension length and subsequently 30 s rest in restored condition at room temperature;
- 2 h conditioning at a temperature of $(-40 \pm 2) ^\circ\text{C}$, 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;
- as b), but 2 h conditioning at $(60 \pm 2) ^\circ\text{C}$;
- as b), but 2 h conditioning at $(80 \pm 2) ^\circ\text{C}$.

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.

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.
Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at <http://www.bsi-global.com>.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.
Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained.

Details and advice can be obtained from the Copyright & Licensing Manager.
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.
Email: copyright@bsi-global.com.