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

道路车辆 多芯连接电缆 第1部分:普通护套电缆的性能要求和
试验方法

(ISO 4141-1:2019, MOD)

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Road vehicles - Multi-core connecting cables - Part 1: Test methods and requirements for basic performance sheathed cables

1 Scope

This document specifies the performance requirements for general-purpose multi-core sheathed cables used for electrical connections between tractors and trailers and describes the corresponding test methods.

This document applies to the design, production and testing of general-purpose sheathed cables, whose temperature range is Class A and Class B defined in ISO 19642 (all parts).

2 Normative references

The provisions of the following documents constitute the essential clauses of this document through normative references in this text. Among them, for any dated reference, only the version corresponding to that date applies to this document; for any undated reference, the latest version (including all amendments) applies to this document.

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

NOTE: GB/T 5054.3-2024 Road vehicles - Multi-core connecting cables - Part 3: Construction, dimensions and marking of unscreened sheathed low-voltage cables (ISO 4141-3:2019, IDT)

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

NOTE: GB/T 16422.2-2022 Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc (ISO 4892-4:2013, IDT)

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

NOTE: GB/T 16422.4-2022 Plastics - Methods of exposure to laboratory light sources - Part 4: Open-flame carbon-arc lamps (ISO 4892-4:2013, IDT)

electric and optical cables - Part 11: Methods for general application - Measurement of thickness and overall dimensions - Tests for determining the mechanical properties (IEC 60811-1-1:2001, IDT)

3 Terms and definitions

For this document, the terms and definitions defined in ISO 19642 (all parts) and the following apply.

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

- ISO online browsing platform: <https://www.iso.org/obp>;
- IEC Encyclopedia of Electronic Engineering: <https://www.electropedia.org/>.

3.1 cable basic performance

The cable's performance that meets the basic requirements of general automotive applications.

3.2 core

A component consisting of conductors with separate insulation and/or self-insulated and screened.

3.3 screen

The conductive material that is used to reduce the penetration and/or radiation of electromagnetic fields into a specified area.

3.4 unscreened

No shielding material.

4 General requirements

The marking of a single core shall comply with the provisions of ISO 4141-3. The single core of multi-core sheathed cables shall meet the requirements of ISO 19642 (all parts).

The basic test conditions and the oven used in the test shall meet the requirements of ISO 19642 (all parts).

During visual inspection, the sheath shall be smooth and uniform, the surface shall be intact, and there shall be no defects such as ridges, holes, or particles.

5 Dimensions

5.1 Cable outer diameter

5.1.1 Test specimen

The test specimen length is 600 mm.

5.1.2 Test equipment

The test equipment is in accordance with the requirements of ISO 19642 (all parts).

5.1.3 Test procedure

Measure the maximum and minimum values of the cable outer diameter on the test specimen at three sampling points with an interval of 200 mm, and record the maximum measured value ($d_{\max}$) and minimum measured value ($d_{\min}$) at the three positions.

5.1.4 Requirements

The outer diameter dimension measured at each time during the test shall be between the limits agreed upon by the cable user and supplier and shall meet the limit requirements of ISO 4141-3.

5.2 Ellipticity

5.2.1 Test specimen and equipment

It is the same as 5.1.1 and 5.1.2.

5.2.2 Test procedure

For each sample, the ellipticity a is calculated according to formula (1):

$$a = \frac{d_{\max} - d_{\min}}{d_{\max} + d_{\min}} \times 100 \quad \dots\dots\dots (1)$$

Where

a -- ellipticity, %;

$d_{\max}$ -- the maximum value of the cable outer diameter, in millimeters (mm);

$d_{\min}$ -- the minimum value of the cable outer diameter, in millimeters (mm).

5.2.3 Requirements

The calculated ellipticity shall meet the limit requirements of ISO 4141-3.

5.3 Sheath thickness

5.3.1 Test specimen, equipment and procedures

The test shall be carried out according to the insulation thickness requirements of ISO 19642 (all parts).

5.3.2 Requirements

Each measurement value shall not be less than the minimum thickness required by ISO 4141-3.

5.4 Pitch

5.4.1 General

The test is only applicable to twisted pairs in the core.

5.4.2 Test specimen

The test specimen length is 1000 mm.

5.4.3 Test equipment

The test equipment shall be a measuring device with an accuracy of 1 mm.

5.4.4 Test procedure

Strip off the sheath (500±25) mm, ensuring the ends of the twisted pairs do not unravel. Secure the ends of the test specimen. Measure five consecutive pitches. A pitch is the axial length of a single core in a twisted-pair cable that spirals one full turn.

5.4.5 Requirements

The sum of the 5 pitches shall not exceed 250 mm.

6 Electrical characteristics

6.1 Continuity test

The test shall be carried out in accordance with ISO 19642 (all parts).

6.2 Withstanding voltage test

The test shall be carried out in accordance with ISO 19642 (all parts).

6.3 Capacitance test

6.3.1 General

The test is only applicable to twisted pairs in unscreened cores for data communications.

6.3.2 Test specimen

Take a 5 m long test specimen, strip off 50 mm of the sheath from one end, and then remove 12 mm of the insulation layer of each core.

6.3.3 Test equipment

Use an AC standard capacitance measuring device with a frequency of 1 kHz.

6.3.4 Test procedure

7 Mechanical properties

7.1 High-temperature pressure test

The test shall be carried out in accordance with ISO 19642 (all parts).

7.2 Sheath adhesion test

The test shall be carried out in accordance with ISO 19642 (all parts).

7.3 Cyclic bending test

7.3.1 General

The test is only applicable to non-coiled cables.

7.3.2 Test specimens

7.3.4 Test procedure

Mount one end of the test specimen on the bendable part of the test equipment and apply force F to the other end. Perform a 5000-cycle bending test on the test specimen at a rate of 0.25 Hz (15 cycles/min).

7.3.5 Requirements

The conductor shall not break during the test. After the test, the test specimen shall not show any cracks by visual inspection. If the test specimen meets the requirements, proceed to the withstanding voltage test required by 6.2.

8 Low temperature characteristics

8.1 Winding test

8.1.1 Test specimen

Proceed according to ISO 19642 (all parts), stripping off 100 mm of sheath from one end of the cable and 25 mm of insulation layer from each core.

8.1.2 Test equipment

The test is carried out in accordance with ISO 19642 (all parts) in a low temperature chamber at a temperature of (-40 ± 2) °C. The mandrel of the test equipment has a diameter of 80 mm, and the mass of the heavy hammer is 20 kg, see Figure 3.

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