INTERNATIONAL STANDARD

ISO 14572

Second edition
2006-11-15

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

Véhicules routiers — Câbles multiconducteurs sous gaine, ronds, blindés et non blindés, de 60 V et 600 V — Méthodes d'essai et exigences pour les câbles à performances de base et à hautes performances

Reference number
ISO 14572:2006(E)

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 14572 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 14572:2001), which has been technically revised.

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

1 Scope

This International Standard specifies test methods and requirements for basic and high-performance round, screened and unscreened, multi-core sheathed cables, intended for use in road vehicle applications.

The unscreened, single-core cables must be in accordance with ISO 6722. Other cores may be used but, in these cases, the construction and tests required to ensure functionality of these cores must be agreed between the customer and supplier. See ISO 6722 for temperature classes.

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 4892-2:2006, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 6722:2006, *Road vehicles — 60 V and 600 V single-core cables — Dimensions, test methods and requirements*

IEC 60811-1-1:2001, *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*

IEC 61196-1-100:2005, *Coaxial communication cables — Part 1-100: Electrical test methods — General requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
basic performance cable
cable meeting basic requirements for general automotive applications

3.2
core
assembly comprising a conductor (and screens if any) with its own insulation

3.3
high-performance cable
cable meeting all basic requirements and having enhanced mechanical and/or environmental performance (as defined by the customer)

3.4
screen
conductive material intended to reduce the penetration and/or radiation of a varying electromagnetic field into an assigned region

3.5
unscreened
absence of a screen

4 General

4.1 Rating of cables

4.1.1 Voltage rating

The voltage rating is established by the rating of the cores. 60 V and 600 V cores shall not be mixed in the same multi-core cable.

4.1.2 Temperature-class rating

The temperature-class rating is established by the rating(s) of the cores and sheath. The rating of the cable shall be equal to the lowest rating of the individual cores and sheath.

4.2 600 V cables

Special care shall be taken for cables used for voltages above 600 V d.c. to protect the cables from mechanical stress and to avoid an electric-shock hazard.

The 600 V cable sheath shall be visually identified with a permanent orange colour.

4.3 Tests

The cables shall be submitted to the tests as specified in Table 1.

4.4 General test conditions

According to 4.4 of ISO 6722:2006.

4.5 Ovens

According to 4.5 of ISO 6722:2006.

4.6 Visual appearance

On visual examination, the sheath shall be smooth, even and free from surface imperfections, such as lumps, voids, particles, or other imperfections.

Table 1 — Tests

Clause, subclause	Test description	Tests in process [a]	Certification		If required [c]	
			initial	periodic [b]	initial	periodic [c]
4	**General**					
4.6	Visual appearance	—	X	X	—	—
5	**Dimensions**					
5.2	Outside cable diameter	—	X	X	—	—
5.3	Ovality of sheath	—	—	—	X	X
5.4	Thickness of sheath	—	X	X	—	—
6	**Electrical characteristics**					
6.1	Continuity	X	X	X	—	—
6.2	Withstand voltage	X	X	X	—	—
6.3	Screening effectiveness	—	—	—	X	X
7	**Mechanical characteristics**					
7.1	Pressure test at high temperature	—	X	X	—	—
7.2	Adhesion of sheath	—	—	—	X	X
7.3	Cyclic bending	—	—	—	X	—
8	**Low temperature characteristics**					
8.1	Winding	—	X	X	—	—
8.2	Impact	—	—	—	X	X
9	**Resistance to abrasion**	—	—	—	X	X
10	**Heat ageing**					
10.1	Long term ageing, 3 000 h	—	X	—	—	—
10.2	Short term ageing, 240 h	—	X	X	—	—
10.3	Thermal overload	—	—	—	X	X
10.4	Shrinkage by heat of sheath	—	X	X	—	—
11	**Resistance to chemicals**					
11.1	Fluid compatibility of sheath	—	[d]	—	[d]	—
11.2	Durability of sheath marking	—	—	—	X	X
11.3	Resistance to ozone	—	—	—	X	—
11.4	Temperature and humidity cycling	—	—	—	X	—
12	**Resistance to flame propagation**	—	X	X	—	—
13	**Artificial weathering**	—	—	—	X	—

X to be applied
— not applicable

[a] A test made on all cables during or after manufacture.
[b] The frequency of periodic testing shall be established by agreement between the customer and supplier.
[c] The usage of "if required" tests shall be established by agreement between the customer and supplier.
[d] Some fluids are for “certification” and others are “if required”. See 11.1 for details.

5 Dimensions

5.1 General

Due to the variety of constructions, the requirements for dimensions shall be established by agreement between the customer and supplier (see 5.2.4, 5.3.5 and 5.4.4).

5.2 Outside cable diameter

5.2.1 Test sample

Follow 5.1.1 of ISO 6722:2006.

5.2.2 Apparatus

Follow 5.1.2 of ISO 6722:2006.

5.2.3 Procedure

Follow 5.1.3 of ISO 6722:2006.

5.2.4 Requirement

The outside cable diameter shall be within the limits established by agreement between the customer and supplier.

5.3 Ovality of sheath

5.3.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

5.3.2 Test sample

Follow 5.1.1 of ISO 6722:2006.

5.3.3 Apparatus

Follow 5.1.2 of ISO 6722:2006.

5.3.4 Procedure

Follow 5.1.3 of ISO 6722:2006. Measure the maximum (d_{max}) and the minimum (d_{min}) outside cable diameters. Then calculate the ovality as follows:

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

where

O is the ovality, amount the sheath is “out of round”, in %;

d_{max} is the maximum outside cable diameter, in mm;

d_{min} is the minimum outside cable diameter, in mm.

5.3.5 Requirement

Ovality shall be within the limits established by agreement between the customer and supplier.

5.4 Thickness of sheath

5.4.1 Test samples

Follow 5.2.1 of ISO 6722:2006.

5.4.2 Apparatus

Follow 5.2.2 of ISO 6722:2006.

5.4.3 Procedure

Follow 5.2.3 of ISO 6722:2006.

5.4.4 Requirement

The thickness of the sheath shall be within the limits established by agreement between the customer and supplier.

6 Electrical characteristics

6.1 Continuity

6.1.1 Test sample

Remove 100 mm of sheath from each end of a complete cable and 25 mm of insulation from each end of the cores.

6.1.2 Apparatus

Use an appropriate source connected in series with an indicator such as an ohmmeter, light or buzzer.

6.1.3 Procedure

Connect the apparatus to one of the cores. Repeat the procedure until all cores have been tested. If a screen is present, test the continuity using the same procedure for a core. As an alternative, all of the cores shall be tested at once, by connecting them in series. Take care to select a current which shall not damage the individual conductors.

6.1.4 Requirement

The indicator shall show continuity.

6.2 Withstand voltage

6.2.1 Test sample

Remove 100 mm of sheath from one end of the cable and remove 25 mm of insulation from each core. For the test, connect the conductors of all the cores together at one end, except for the core being tested. If a screen is present, it shall be connected in the same manner as a core.

6.2.2 Apparatus

Use a 50 Hz or 60 Hz voltage source capable of applying 2 kV a.c. for a minimum of 3 s.

6.2.3 Procedure

Apply 2 kV a.c. between a core and the remaining core(s) for a minimum of 3 s. Repeat the procedure until all the cores have been tested. If a screen is present, it shall be tested in the same way as one of the cores.

6.2.4 Requirement

Breakdown shall not occur between cores. If a screen is present, breakdown shall not occur between the core(s) and screen.

6.3 Screening effectiveness

6.3.1 Test usage

This test is only used for screened cables. The usage of this test shall be established by agreement between the customer and supplier.

6.3.2 D.C. Resistance of the screen

This test is intended for cables working at frequencies equal to or less than 1 MHz.

6.3.2.1 Test sample

Follow 6.1.1 of ISO 6722:2006. Remove 100 mm of sheath from each end of a complete cable.

6.3.2.2 Apparatus

Follow 6.1.2 of ISO 6722:2006.

6.3.2.3 Procedure

Follow 6.1.3 of ISO 6722:2006.

6.3.2.4 Requirements

The requirements for the d.c. resistance of the screen shall be established by agreement between the customer and supplier.

6.3.3 Line injection method

Allowable frequency ranges according to “Surface transfer impedance, Line injection method” of IEC 61196-1-100.

6.3.3.1 Test sample

Follow “Surface transfer impedance, Line injection method” of IEC 61196-1-100.

6.3.3.2 Apparatus

Follow “Surface transfer impedance, Line injection method” of IEC 61196-1-100.

6.3.3.3 Procedure

Follow “Surface transfer impedance, Line injection method” of IEC 61196-1-100.

6.3.3.4 Requirements

The requirements for surface transfer impedance shall be established by agreement between the customer and supplier.

6.3.4 Tri-axial method

Allowable frequency ranges according to “Surface transfer impedance, Tri-axial method” of IEC 61196-1-100.

6.3.4.1 Test sample

Follow “Surface transfer impedance, Tri-axial method” of IEC 61196-1-100.

6.3.4.2 Apparatus

Follow “Surface transfer impedance, Tri-axial method” of IEC 61196-1-100.

6.3.4.3 Procedure

Follow “Surface transfer impedance, Tri-axial method” of IEC 61196-1-100.

6.3.4.4 Requirements

The requirements for surface transfer impedance shall be established by agreement between the customer and supplier.

6.3.5 Absorbing clamp method

Allowable frequency ranges according to “Screening attenuation, Absorbing clamp method” of IEC 61196-1-100.

6.3.5.1 Test sample

Follow “Screening attenuation, Absorbing clamp method” of IEC 61196-1-100.

6.3.5.2 Apparatus

Follow “Screening attenuation, Absorbing clamp method” of IEC 61196-1-100.

6.3.5.3 Procedure

Follow “Screening attenuation, Absorbing clamp method” of IEC 61196-1-100.

6.3.5.4 Requirements

The requirements for screening attenuation shall be established by agreement between the customer and supplier.

7 Mechanical characteristics

7.1 Pressure test at high temperature

7.1.1 Test samples

Follow 7.1.1 of ISO 6722:2006.

7.1.2 Apparatus

Follow 7.1.2 of ISO 6722:2006. Apply the force F to the test sample using the blade, as given by the formula:

$$F = 0{,}8\sqrt{i\,(2D - i)}$$

where

F is the total vertical force exerted on the test sample, in N;

0,8 is a coefficient, in N/mm;

D is the appropriate maximum outside cable diameter (see 5.2), in mm, according to Table 4 of ISO 6722:2006;

i is the appropriate nominal value of the insulation thickness, in mm, according to Table 4 of ISO 6722:2006.

The calculated force may be rounded off to the lower digit, but not beyond 3 %.

7.1.3 Procedure

Follow 7.1.3 of ISO 6722:2006. Measure the thickness of the sheath immediately, at the point of impression, and at points 10 mm on both sides of the impression, by means of a measuring device that does not cause deformation. Omit the withstand-voltage test.

7.1.4 Requirement

For basic performance cables, the thickness within the area of the impression shall not be less than 40 % of the mean of the other two values.

For high-performance cables, the thickness within the area of the impression shall not be less than 60 % of the mean of the other two values.

7.2 Adhesion of sheath

7.2.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

7.2.2 Test sample

Follow 7.2.2 of ISO 6722:2006. Prepare three test samples of 150 mm from a cable sample that is 3 m in length. Take the test samples at 1 m intervals. The undisturbed length of sheath shall be 100 mm.

7.2.3 Apparatus

Follow 7.2.3 of ISO 6722:2006. A metal plate is provided with a round hole equal to the approximate inside diameter of the sheath.

7.2.4 Procedure

Follow 7.2.4 of ISO 6722:2006. If the 100 mm section of sheath buckles when sliding, prepare new test samples with the undisturbed length of sheath equal to 50 mm, and repeat the procedure.

7.2.5 Requirements

The undisturbed section of sheath shall be able to be removed without damage to the interior cores. The strip force shall be within the limits established by agreement between the customer and supplier.

7.3 Cyclic bending

7.3.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

7.3.2 Test samples

Take two test samples of 600 mm length from points separated by at least 1 m.

7.3.3 Apparatus

The apparatus shall be similar to the one shown in Figure 1. Any apparatus is acceptable, as long as it meets the following.

— The bend radius (R) is 2,5 times the outside cable diameter.

— A force F which produces a tension of 5 N/mm^2 in the copper of the conductors.

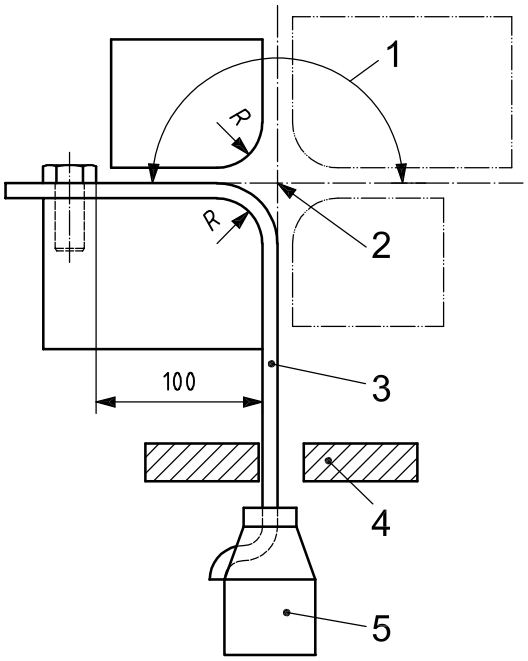
— A fixture that bends the test sample ± 90° at a rate of 15 cycles/min.

— If a mass is used, a guide may be applied to stop the mass from swinging.

7.3.4 Procedure

Mount the test sample with one end attached to the flexing member and the other end loaded by the force F. Flex the test sample at a speed of 15 cycles/min for the number of cycles specified by agreement between the customer and supplier. Repeat the procedure for the other test sample.

Dimensions in millimetres



Key

1 1 cycle (90° to each side)
2 Pivot
3 Cable
4 Fixed guide (optional)
5 Mass giving force F

Figure 1 — Apparatus for cyclic bending

7.3.5 Requirement

The requirement(s) for the cyclic bending shall be established by agreement between the customer and supplier.

8 Low-temperature characteristics

8.1 Winding

8.1.1 Test sample

Follow 8.1.1 of ISO 6722:2006. Remove 100 mm of sheath from one end of the cable and remove 25 mm of insulation from each core.

8.1.2 Apparatus

Follow 8.1.2 of ISO 6722:2006. A freezing chamber at (-40 ± 2) °C [(-25 ± 2) °C may be used when agreed between the customer and supplier]. See Table 2 for the mandrel diameter.

Table 2 — Outside cable diameter, mandrel diameter and mass, and winding around the mandrel

Outside cable diameter D mm	Mandrel diameter	Mass, if rotating mandrel is used kg	Winding: minimum number of turns around the mandrel
$D \leqslant 2{,}5$	$\leqslant$ 5 times the outside cable diameter	0,5	3
$2{,}5 < D \leqslant 5$		2,5	3
$5 < D \leqslant 10$		5	2
$10 < D \leqslant 15$		10	0,5
$15 < D \leqslant 25$		20	0,5
$25 < D$		30	0,5

8.1.3 Procedure

Follow 8.1.3 of ISO 6722:2006.

For this test, apply a winding speed of 0,2 r/s (revolutions per second) for all cable sizes and a number of turns according to Table 2. After winding, the outer sheath shall be visually examined. If there is no sign of cracks in the sheath, perform the withstand-voltage test as in 6.2.

If required by the customer, strip the sheath without damage to the inner cores, visually examine them, and if there is no sign of cracks, perform a 1 kV a.c. withstand-voltage test with the separate cores as in ISO 6722.

8.1.4 Requirements

The test samples shall show no signs of cracks. Breakdown shall not occur during the different withstand-voltage tests.

8.2 Impact

8.2.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

8.2.2 Test samples

Prepare three samples of a minimum length of 150 mm. Unless otherwise specified, a sample shall contain the complete sheath, including any existing multiple layers.

8.2.3 Apparatus

Follow 8.2.3 of ISO 6722:2006. The mass of the hammer is specified in Table 3.

Table 3 — Impact

Outside diameter of cable D mm	Mass of the hammer g
$D \leqslant 15$	300
$15 < D \leqslant 25$	400
$25 < D \leqslant 35$	500
$35 < D$	600

8.2.4 Procedure

Follow 8.2.4 of ISO 6722:2006. After impact, allow the test samples to return to room temperature, and make a visual examination of the sheath.

If a screen is present, perform the withstand-voltage test between the screen and salt-water bath; however, make the following changes to the procedure in 6.2.3 of ISO 6722:2006.

— Immerse the test sample in the salt-water bath for a minimum of 10 min, prior to the application of the voltage.

— Apply the 1 kV a.c. voltage for 1 min.

— Do not “ramp up” the voltage after the application of the 1 kV a.c. voltage.

8.2.5 Requirements

The test sample shall show no sign of cracks. If a screen is present during the withstand-voltage test, breakdown shall not occur.

9 Resistance to abrasion

9.1 Test usage

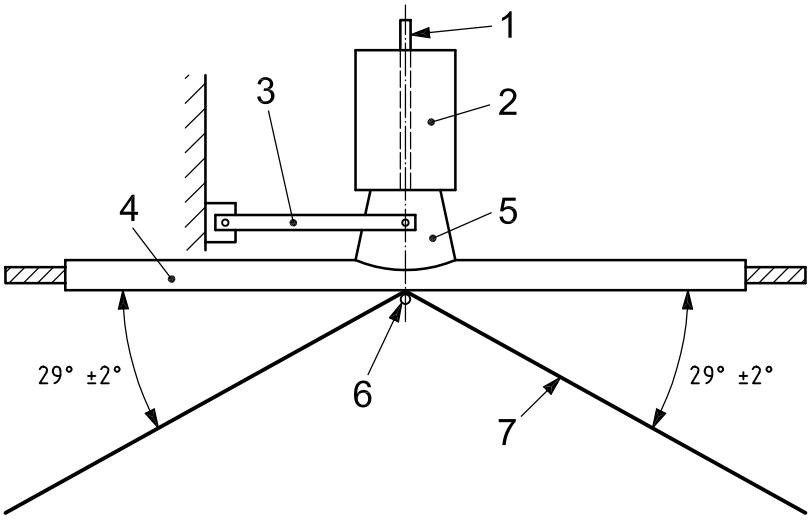
The usage of this test shall be established by agreement between the customer and supplier.

9.2 Test sample

Prepare a sample of 1 m length. Remove 100 mm of sheath from each end of the cable, and 25 mm of the insulation from each core. Twist stripped ends of the cores together. If a screen is present, it shall be twisted together with the cores.

9.3 Apparatus

Measure the resistance to abrasion using 80 J garnet sandpaper, with 10 mm conductive strips perpendicular to the edge of the sandpaper spaced a maximum of every 75 mm. Mount a suitable bracket to the pivoting arm (see Figure 2) to maintain the test sample position over an unused portion of the sandpaper. Exert a force of (0,63 ± 0,05) N on the test sample by the combination of the bracket, support rod and pivoting arm. The total vertical force exerted on the test sample shall be the combination of the force exerted by the bracket, pivoting arm, support rod and additional mass. A 2 kg mass may substitute the 4 kg mass, if this is found necessary.



Key

1 Support rod
2 4 kg additional mass
3 Pivoting arm
4 Test sample
5 Bracket
6 Tape supporting pin, diameter = 6,9 mm
7 80 J, garnet-sandpaper abrasion tape

Figure 2 — Apparatus for “sandpaper abrasion”

9.4 Procedure

Mount the cable in a horizontal position as shown in Figure 2. Use an area of the abrasion tape not previously used. Place the mass and bracket on top of the cable. Draw the sandpaper under the specimen at a rate of (1 500 ± 75) mm/min, and record the length of sandpaper necessary to expose a conductor or screen. Move the test sample 20 mm and rotate the test sample clockwise by 90°. Repeat the procedure for a total of 4 readings. The mean of the readings shall determine the resistance to abrasion.

9.5 Requirement

The resistance to abrasion shall meet or exceed the limits established by agreement between the customer and supplier.

10 Heat ageing

10.1 Long-term ageing, 3 000 h

10.1.1 Purpose

This test is intended to confirm the temperature-class rating.

10.1.2 Test samples

Follow 10.1.2 of ISO 6722:2006. Remove 25 mm of sheath from each end of the cable.

10.1.3 Apparatus

Follow 10.1.3 of ISO 6722:2006. See Table 2 for the mandrel diameter and mass.

10.1.4 Procedure

Follow 10.1.4 of ISO 6722:2006. After winding, visually examine the outer sheath. If there is no sign of cracks in the sheath, perform the withstand-voltage test as in 6.2.

If required by the customer, strip the sheath without damage to the inner cores, visually examine them, and if there is no sign of cracks, perform a 1 kV a.c. withstand-voltage test with the separate cores as in ISO 6722.

10.1.5 Requirements

Follow 10.1.5 of ISO 6722:2006. The test samples shall show no signs of cracks in the sheath. Breakdown shall not occur during the different withstand-voltage tests.

10.2 Short-term ageing, 240 h

10.2.1 Purpose

This test is intended to simulate thermal excursions.

10.2.2 Test samples

Follow 10.2.2 of ISO 6722:2006. Remove 25 mm of sheath from each end of the cable.

10.2.3 Apparatus

Follow 10.2.3 of ISO 6722:2006. See Table 2 for the mandrel diameter and mass.

10.2.4 Procedure

Follow 10.2.4 of ISO 6722:2006. After winding, visually examine the outer sheath. If there is no sign of cracks in the sheath, perform the withstand-voltage test as in 6.2.

If required by the customer, strip the sheath without damage to the inner cores, visually examine them, and if there is no sign of cracks, perform a 1 kV a.c. withstand-voltage test with the separate cores as in ISO 6722.

10.2.5 Requirements

Follow 10.2.5 of ISO 6722:2006. The test samples shall show no signs of cracks. Breakdown shall not occur during the different withstand-voltage tests.

10.3 Thermal overload

10.3.1 Purpose

This test is intended to simulate thermal variations of the cable.

10.3.2 Test samples

Follow 10.3.2 of ISO 6722:2006. Remove 25 mm of sheath from each end of the cable.

10.3.3 Apparatus

Follow 10.3.3 of ISO 6722:2006. See Table 2 for the mandrel diameter and mass.

10.3.4 Procedure

Follow 10.3.4 of ISO 6722:2006. After winding, visually examine the outer sheath. If there is no sign of cracks in the sheath, perform the withstand-voltage test according to 6.2.

If required by the customer, strip the sheaths without damage to the inner cores, visually examine them, and if there is no sign of cracks, perform a 1 kV a.c. withstand-voltage test with the separate cores as in ISO 6722.

10.3.5 Requirements

Follow 10.3.5 of ISO 6722:2006. The test samples shall show no signs of cracks. Breakdown shall not occur during the different withstand-voltage tests.

10.4 Shrinkage caused by heating the sheath

10.4.1 Test sample

Prepare three test samples of 200 mm length.

10.4.2 Apparatus

Follow 10.4.2 of ISO 6722:2006.

10.4.3 Procedure

Follow 10.4.3 of ISO 6722:2006. Measure the shrinkage of the sheath.

10.4.4 Requirement

The requirement shall be as agreed between the customer and supplier.

11 Resistance to chemicals

11.1 Fluid compatibility of sheath

11.1.1 Test samples

Follow 11.2.2.1 of ISO 6722:2006.

11.1.2 Apparatus

Follow 11.2.2.2 of ISO 6722:2006. During immersion, the bend diameter of the cable shall be a minimum of ten times its outside diameter. See Table 2 for the mandrel diameter and mass.

NOTE Sources for reference materials are shown in Table A.1.

11.1.3 Procedure

Follow 11.2.2.3 of ISO 6722:2006, but omit the withstand-voltage test.

11.1.4 Requirements

After winding, the sample shall show no cracks. Other requirements shall be by agreement between the customer and supplier.

11.2 Durability of sheath marking

The usage of this test according to 11.3 of ISO 6722:2006 shall be established by agreement between the customer and supplier.

11.3 Resistance to ozone

11.3.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

11.3.2 Test sample

Follow 11.4.2 of ISO 6722:2006.

11.3.3 Apparatus

Follow 11.4.3 of ISO 6722:2006. See Table 2 for the mandrel diameter and mass.

11.3.4 Procedure

Follow 11.4.4 of ISO 6722:2006. Wind samples equal to or less than 10 mm in diameter 3 turns, and samples greater than 10 mm half a turn, around the mandrel.

11.3.5 Requirement

Follow 11.4.5 of ISO 6722:2006. Only the outer sheath shall be examined.

11.4 Temperature and humidity cycling

11.4.1 Test usage

The usage of this test shall be established by agreement between the customer and supplier.

11.4.2 Test samples

Prepare two samples, each of approximately 600 mm length.

11.4.3 Apparatus

Follow 11.6.3 of ISO 6722:2006 for the test chamber. See Table 2 for the mandrel diameter.

11.4.4 Procedure

Wind samples equal to or less than 10 mm in diameter 3 turns, and samples greater than 10 mm half a turn, around the mandrel and secure the ends. See ISO 6722 for the procedure to condition the test samples. Make a visual examination of the sheath. Ignore any damage caused by the clamps which secure the ends.

11.4.5 Requirements

The test samples shall show no cracks.

12 Resistance to flame propagation

12.1 Test sample

Follow 12.1 of ISO 6722:2006.

12.2 Apparatus

Follow 12.2 of ISO 6722:2006.

12.3 Procedure

Follow 12.3 of ISO 6722:2006. Apply the flame for 30 s for all cables.

12.4 Requirement

Follow 12.4 of ISO 6722:2006.

13 Artificial weathering

The usage of this test shall be established by agreement between the customer and supplier.

13.1 Test sample

Take ten tensile test samples, according to IEC 60811-1-1, from the sheath of the cable to be tested.

13.2 Apparatus

Use an ultraviolet-radiation cabinet, according to ISO 4892-2, with a xenon arc lamp at (55 ± 3) °C, water-spray cycles (5 min water spray and 25 min dry interval, or 12 min and 180 min, respectively) and a relative humidity of (50 ± 5) % for the dry intervals.

13.3 Procedure

Condition five of the samples in the test cabinet for 750 h. After removal from the test cabinet, allow the samples to attain room temperature and then subject them to the tensile test according to IEC 60811-1-1, together with the remaining five samples.

13.4 Requirement

After exposure to the artificial weathering, the elongation shall not lose more than 50 % of the original measured value.

Annex A
(informative)

Source for reference material

Table A.1 — Reference materials and sources [1)]

Reference material	Supplier
Engine Oil ASTM D471, IRM 902 Oil ISO 1817, Oil No. 2 and Power Steering ASTM D471, IRM 903 Oil ISO 1817, Oil No. 3	R. E. Carroll, Inc. P. O. Box 5806 Trenton, NJ 08638-0806, USA Phone: +1 800-257-9365 Fax: +1 609-695-0102URL: http://www.recarroll.com
	Penreco 4426 East Washington Blvd. Los Angeles, CA 90023, USA Phone: +1 888-227-5448 Fax: +1 323-268-7972 URL: http://www.penreco.com
	Swedish National Testing and Research Institute Box 857 SE-501 15 Borås, SE Phone: +46 33 16 50 00 Fax: +46 33 10 33 88 http://www.sp.se/eng/default.htm
Automatic Trans Fluid SAE J311, Dexron III Citgo Part No. 33123	Citgo Petroleum 699 Heights Rd. Lake Orion, MI 48362, USA Phone: +1 800-331-4068 URL: http://www.citgo.com
Sandpaper Abrasion Tape and Sandpaper Abrasion Tester	Glowe Industrial Sales, Inc. 812 Youngstown Kingsville Rd. Vienna, Ohio 44473, USA Phone: +1 330 539-5085 Fax: +1 330 539-9308

1) This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the source. Equivalent products may be used if they can be shown to lead to the same results.

Bibliography

[1] ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

[2] IEC 60757, *Code for designation of colours*

[3] IEC 60811 (all parts), *Common test methods for insulating and sheathing materials of electric cables and optical cables*

[4] IEC 61196 (all parts), *Coaxial communication cables*

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