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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Rubber — Coolant hoses and tubing for use on private cars and light commercial vehicles — Specification

Caoutchouc — Tubes et tuyaux pour liquide de refroidissement des moteurs d'automobiles et de véhicules commerciaux légers — Spécifications

Reference number
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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4081 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Rubber — Coolant hoses and tubing for use on private cars and light commercial vehicles — Specification

1 Scope and field of application

This International Standard specifies the requirements for vulcanized compounds and rubber hoses and tubing for use in pressurized and unpressurized cooling circuits containing 1,2-ethanediol-based anti-freeze in internal combustion engines for private vehicles and commercial vehicles with an unladen weight (as defined in ISO 1176) of 3.5 t or less.

For the purposes of this International Standard, three different types related to design working temperatures are specified:

Type 1: Tubing and hoses for operating temperatures up to 100 °C

Type 2: Tubing and hoses for operating temperatures up to 125 °C

Type 3: Tubing and hoses for operating temperatures up to 150 °C

Two classes for each type related to the operating environment are also specified:

Class A: Tubing and hoses for use in positions where they are not likely to be subjected to outside surface contamination by fuel and lubricating oils.

Class B: Tubing and hoses for use in positions where they are likely to be subjected to outside surface contamination by fuel and lubricating oils.

This International Standard covers tubing and hoses whether supplied pre-formed or in straight lengths.

It does not cover tubing and hoses made from staple fibre reinforced compounds.

2 References

ISO 37, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 48, Vulcanized rubbers — Determination of hardness (Hardness between 30 *and* 85 IRHD*).*

ISO 188, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 815, *Vulcanized rubbers — Determination of compression set under constant deflection at normal and high temperatures.*

ISO 1176, *Road vehicles — Weights — Vocabulary.*

ISO 1307, *Rubber and plastics hoses — Bore diameters and tolerances on length.*

ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing.*

ISO 1653, *Vulcanized rubbers — Determination of compression set under constant deflection at low temperatures.*

ISO 1746, *Rubber or plastics hoses and tubing — Bending test.*

ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 7233, *Rubber and plastics hoses and hose assemblies — Vacuum resistance — Methods of test.*

ISO 7326, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions.*

ISO 8033, *Rubber and plastics hoses — Determination of adhesion between components.*

SAE J20e, *Coolant system hoses.*

3 Tubing and hose bores

The bore of all tubing and hoses shall be clean and free from any contamination when examined under the naked eye.

4 Size and tolerances

Bore sizes and tolerances shall be in accordance with ISO 1307.

5 Physical tests and specifications

The following tests shall be carried out on finished products where possible (or as agreed between manufacturer and user) with the exception of compression set, which shall be carried out on standard test slabs.

5.1 Hardness

Hardness, determined in accordance with the procedure specified in ISO 48 (normal test), shall comply with the values shown in the table.

5.2 Tensile strength and elongation at break

Tensile strength and elongation at break, determined in accordance with the procedure specified in ISO 37 on a No. 2 dumbbell, shall comply with the values shown in the table.

5.3 Change in properties after accelerated ageing

Accelerated ageing shall be carried out in accordance with ISO 188 in a ventilated drying oven under the following conditions using test pieces as described in 5.1 and 5.2.

— Type 1: 7 days at 100 °C

— Type 2: 7 days at 125 °C

— Type 3: 7 days at 150 °C

In all cases, the change in hardness, tensile strength and elongation at break shall not exceed the values shown in the table.

5.4 Compression set

Compression set, determined in accordance with the procedure specified in ISO 815, using a large test piece, shall comply with the values shown in the table.

5.5 Resistance to coolant

This test applies only to tubing and the hose lining compounds. The test liquid shall be made up of equal volumes of 1,2-ethanediol and distilled water. Test pieces, as specified in 5.1 and 5.2 shall be left for 7 days in the test liquid at 100 ± 1 °C as specified in ISO 1817 after which they shall be tested for hardness, tensile strength, elongation at break and change in volume. The values obtained shall not exceed those shown in the table.

5.6 Resistance to oil No. 3

This test applies only to Class B tubing and hose covers.

When tested in accordance with ISO 1817 for 72 h in oil No. 3 at a temperature of 100 °C, volumetric changes shall not exceed the values shown in the table.

5.7 Resistance to ozone

This test applies only to tubing and hose cover compounds. The test shall be carried out in accordance with ISO 7326 under the following conditions:

Concentration	:	50 ± 5 pphm*
Duration	:	70 $^{+2}_{0}$ h
Elongation	:	20 %
Temperature	:	40 °C

After exposure, the test pieces shall show no cracks under a magnification of X 2.

5.8 Minimum burst pressure

When tested in accordance with ISO 1402 at ambient laboratory temperature (ISO 471), the tubing and hose shall have burst pressures not less than the values shown in the table.

5.9 Adhesion

This test applies only to hose. The adhesion between components, when tested in accordance with ISO 8033 in the "as manufactured" condition and after ageing in air for 72 h at the operating temperature for the Type, shall comply with the values shown in the table.

5.10 Vacuum resistance

This test applies only to tubing and hoses of bore sizes 25 mm and over and shall be carried out in accordance with ISO 7233.

When subjected to a vacuum of 0.03 MPa at 100 °C for a period of 10 min, the sample shall not collapse by more than the value shown in the table.

5.11 Compression set

5.11.1 Compression set at −30 °C

A circular sample cut from the wall of the tubing or hose shall be tested. The ratio of diameter to thickness of the test piece shall be between 2 and 2,3.

When tested in accordance with ISO 1653, at a temperature of −30 °C and after 30 min recovery, the compression set shall not exceed the value shown in the table.

5.11.2 Compression set at the Type temperature

This test and the requirement will be defined a later date.

5.12 Resistance to kinking

This test applies only to straight tubing and hoses of bore sizes of 19,5 mm or less.

* Parts per hundred million by volume.

When tested in accordance with ISO 1746 around mandrel diameters equal to the values shown in the table dependent on the bore size, the maximum coefficient of deformation (T/D) shall not exceed 0,7.

5.13 Mechanical fatigue strength

When tested in accordance with annex A, tubing or hose shall not rupture before the number of cycles shown in the table is exceeded.

5.14 Low-temperature flexibility

When tested in accordance with annex B, tubing or hose shall not fracture nor show any cracks or breaks.

6 Marking

Except by agreement between manufacturer and user, the tubing and hose shall be marked with the following information :

a) the number of this International Standard;

b) the manufacturer's name or trade mark;

c) the type and class;

d) the month and year of manufacture.

Table — Requirements for slabs and finished products

Sub-clause	Characteristic	Unit	Tubing	Hose	
				Lining	Cover
5.1	Nominal hardness	IRHD	70	70	70
	Nominal hardness tolerance	IRHD	± 5	+ 5 − 10	+ 5 − 10
5.2	Tensile strength, min.	MPa	10	8	8
5.2	Elongation of break, min.	%	250	250	250
5.3	Accelerated ageing				
	— Change in hardness, max.	IRHD			
	Types 1 and 2		+10 0	+10 0	+10 0
	Type 3		+15 0	+15 0	+15 0
	— Change in tensile strength, max.	%			
	Type 1		+10 0	+10 0	+10 0
	Type 2		+20 0	+20 0	+20 0
	Type 3		+25 0	+25 0	+25 0
	— Change in elongation at break, max.	%			
	Type 1		0 −25	0 −25	0 −25
	Type 2		0 −40	0 −40	0 −40
	Type 3		0 −65	0 −65	0 −65
5.4	Compression set, max.	%			
	— Type 1 : 24 h at 100 °C		35	35	35
	— Type 2 : 24 h at 125 °C		—	50	50
	— Type 3 : 24 h at 150 °C		—	50	50
5.5	Resistance to coolant				
	— Change in hardness, max.	IRHD	± 5	± 5	—
	— Change in tensile strength, max.	%	±10	±10	—
	— Change in elongation, max.	%	0 −25	0 −25	— —
	— Change in volume, max.	%	+10 − 2	+10 − 2	— —
5.6	Resistance to oil No. 3				
	Change in volume, max.	%			
	Class B		75	—	75
5.7	Ozone resistance	—	No cracks at X 2 magnification	—	No cracks at X 2 magnification

Table (*concluded*)

Sub-clause	Characteristic	Unit	Tubing	Hose
5.8	Burst pressure, min	MPa		
	— Tubing		0,2	—
	— Hose : diameter ⩽ 20 mm		—	1,2
	— Hose : diameter greater than 20 mm up to and including 40 mm		—	0,9
	— Hose : diameter > 40 mm		—	0,5
5.9	Adhesion — separation force, min.	kN/m		
	— In "as manufactured" condition		—	1,5
	— After ageing for 72 h at the appropriate environmental operating temperature		—	1,5
5.10	Vacuum resistance			
	Maximum collapse	%	30	30
5.11.1	Compression set at −30 °C, max.	%	90	90
5.11.2	Compression set at the type temperature, max.		to be defined	
5.12	Kink test			
	— Diameter 7,8 to 10,5 mm inclusive	mm	140	140
	— Diameter over 10,5 up to and including 16,5 mm	mm	220	220
	— Diameter over 16,5 up to and including 19,5 mm	mm	300	300
5.13	Mechanical fatigue test, number of cycles			
	— Type 1, min.	—	50 000	50 000
	— Type 2, min.	—	50 000	50 000
	— Type 3, min.	—	50 000	50 000

Annex A

Mechanical fatigue test

(This annex forms an integral part of the Standard.)

A.1 Principle

Circulation of coolant liquid at a temperature of 90 ± 5 °C by means of a circulating pump to pressures alternating between 0 and 0,2 MPa at a cycling rate as detailed in clause A.2.

A.2 Apparatus

Test bench, allowing

a) a continuous coolant (anti-freeze) flow through the tubing and hoses;

b) a constant temperature of 90 ± 5 °C to be maintained;

c) the pressure cycle as specified below to be applied:

— raise the pressure from 0 to 0,2 MPa : 2 s

— hold the pressure at 0,2 MPa : 5 s

— reduce the pressure from 0,2 to 0 MPa : 3 s

Total cycle time : 10 s

d) the recording of the number of cycles.

The test bench shall be fitted with all the safety equipment necessary to ensure that the test can be interrupted instantly in the event of a leak, burst or other fault.

A.3 Procedure

Set up the tubes and hoses on the apparatus. Hose clips and torque settings shall be such as will ensure a good seal.

Raise the temperature of the anti-freeze liquid to 90 ± 5 °C. Switch on the circulating pump. Bleed off any air in the circuit. Set the pressure cycle to the specified values.

In the event of failure of the tube or hoses under test, note the number of cycles completed.

Items which have completed the number of cycles specified shall be examined for any sign of possible weakness.

No account shall be taken of any results obtained during a test in which leaks are discovered at any of the hose clips.

A minimum of three test pieces shall be examined.

A.4 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) identification of the tubing or hoses tested;

c) the number of cycles completed without deterioration of the tubing or the hoses;

d) conformity of the tubing or hoses with the specification;

e) any incident which may have had a bearing on the outcome of the tests.

Annex B

Cold flexibility test (−40 °C)[1)]

(This annex forms an integral part of the Standard.)

B.1 For hoses and tubing 25,4 mm ID and below

The specimen shall consist of a complete hose of length sufficient to perform the flex test described as follows.

Place hose in a cold box for 5 h at −40 °C. Then flex the hose through 180° in the cold chamber from the centreline to a diameter of 10 times the maximum outside diameter of the hose. The flexing shall take place within 4 s.

B.2 For hoses and tubing over 25,4 mm ID

The specimen shall be a 25,4 mm wide section of the complete hose.

Place the specimen in a cold box for 5 h at −40 °C. Then compress it between parallel plates to 50 % of its original inside diameter within 4 s. The testing fixture shall be in a cold box during the entire test.

1) This procedure is based on the Standard SAE J20e.