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Rubber and plastics hoses for marine-engine wet-exhaust systems — Specification

Tuyaux d'échappement en caoutchouc et en plastique pour moteurs de bateaux de plaisance — Spécifications

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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 13363 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Hoses (rubber and plastics)*.

Rubber and plastics hoses for marine-engine wet-exhaust systems — Specification

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate health and safety practices and to ensure compliance with any national regulatory conditions.

1 Scope

This International Standard specifies requirements for three types and two classes of hose. The hoses are intended for use in marine-engine wet-exhaust systems (where the exhaust gases are mixed with the discharge of cooling water).

The three types are:

— type 1: a softwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement;

— type 2: a hardwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement with a helical wire embedded in it;

— type 3: a hose or tube (flexible connector), made of oil-resistant material, with or without a reinforcement or cover, intended for use in short lengths in locations where the connector is protected from mechanical damage.

The two classes are:

— class A intended for diesel engines;

— class B intended for petrol engines, and for diesel engines with a very high exhaust temperature.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 176:1976, *Plastics — Determination of loss of plasticizers — Activated carbon method*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*

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

ISO 1746:1998, *Rubber or plastics hoses and tubing — Bending tests*

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

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of dimensions*

ISO 6945, *Rubber hoses — Determination of abrasion resistance of the outer cover*

ISO 7326:1991, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

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

ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

ISO 11758:1995, *Rubber and plastics hoses — Exposure to a xenon arc lamp — Determination of changes in colour and appearance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 apply.

4 Classification

Hoses shall be one of the types and classes specified in Table 1.

Table 1 — Types and classes of hose

Type	Class	Description
1	A	A softwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement. When tested in accordance with Annex A, the hose shall withstand 2 min of exhaust gas at 370 °C.
	B	A softwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement. When tested in accordance with Annex A, the hose shall withstand 2 min of exhaust gas at 580 °C.
2	A	A hardwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement with a helical wire embedded in it. When tested in accordance with Annex A, the hose shall withstand 2 min of exhaust gas at 370 °C.
	B	A hardwall hose, made of oil-resistant material, with a synthetic-fabric reinforcement with a helical wire embedded in it. When tested in accordance with Annex A, the hose shall withstand 2 min of exhaust gas at 580 °C.
3	A	A hose or tube (flexible connector), made of oil-resistant material, with or without a reinforcement or cover, intended for use in short lengths in locations where the connector is protected from mechanical damage. When tested in accordance with Annex A, the hose or tube shall withstand 2 min of exhaust gas at 370 °C.
	B	A hose or tube (flexible connector), made of oil-resistant material, with or without a reinforcement or cover, intended for use in short lengths in locations where the connector is protected from mechanical damage. When tested in accordance with Annex A, the hose or tube shall withstand 2 min of exhaust gas at 580 °C.

5 Materials and construction

The hose shall consist of:

— a smooth-bore water- and heat-resistant rubber or plastics tube;

— an oil- and fuel-resistant rubber or plastics tube (oil and fuel resistance not necessary for class B hoses);

— one or more layers of synthetic-fabric reinforcement (not necessary for type 3 hoses);

— one or more helical wires embedded within the rubber or plastics material (for type 2 hoses only);

— an ozone-, heat- and abrasion-resistant rubber or plastics cover (not necessary for type 3 hoses).

6 Dimensions and tolerances

When measured in accordance with ISO 4671, the internal diameter and minimum bend radius shall conform to the values given in Table 2.

Table 2 — Bore diameters and minimum bend radii

Nominal bore	Internal diameter mm Type 1, type 2 and type 3	Minimum bend radius mm	
		Type 1	Type 2
32	32 ± 1	385	200
40	40 ± 1,5	480	260
45	45 ± 1,5	540	285
50	50 ± 1,5	600	305
53	53 ± 1,5	640	310
57	57 ± 1,5	685	325
63	63 ± 1,5	755	355
76	76 ± 2	915	455
89	89 ± 2	1 070	535
102	102 ± 2	1 225	610
127	127 ± 2	1 525	760

7 Physical properties

7.1 General

Test pieces for these tests shall be prepared from sheets of the same compound and using the same curing conditions as the lining and the cover of the hose tested.

7.2 Tensile strength and elongation at break

The material used for the lining and cover, when tested in accordance with ISO 37, shall have a tensile strength and elongation at break not less than the values given in Table 3.

Table 3 — Tensile strength and elongation at break

	Minimum tensile strength MPa	Minimum elongation at break %
Lining	8	200
Cover	7	200

7.3 Accelerated ageing

After ageing for 70 h at a temperature of 100 °C in accordance with ISO 188, the tensile strength, elongation at break and hardness of the lining and cover (the hardness being determined in accordance with ISO 48) shall not vary by more than the values given in Table 4.

Table 4 — Accelerated ageing requirements

Property	Maximum variation from initial value
Tensile strength	$^{+10}_{-25}$ %
Elongation at break	±30 %
Hardness	$^{+10}_{-5}$ IRHD

7.4 Compression set (only rubber hoses)

When determined in accordance with the procedure specified in ISO 815, using a large test piece, the compression set of the lining and cover shall not exceed 45 % after 24 h at 100 °C.

7.5 Resistance to liquids (only class A hoses)

After immersion in the following liquids, which are described in ISO 1817, test pieces from the lining shall show no shrinkage and the increase in volume shall not exceed 100 % when determined in accordance with the gravimetric method specified in ISO 1817:

— for oil resistance: oil No. 3 at 100 °C ± 1 °C for 72^{0}_{-2} h;

— for fuel resistance: liquid No. 4 at 23 °C ± 1 °C for 72^{0}_{-2} h.

7.6 Loss in mass on heating (only plastics hoses)

When tested in accordance with ISO 176:1976, method B, the materials of the lining and cover shall have a loss in mass not greater than 4 %.

8 Physical tests on finished hose or tubing

8.1 Minimum burst pressure

When determined in accordance with ISO 1402, the burst pressure shall not be less than 2,5 bar.

8.2 Flexibility (for type 1 and 2 only)

When determined in accordance with ISO 1746:1998, method A, using the minimum bend radius as specified in Table 2, the deformation shall not exceed 0,2 times the outside diameter of the hose.

8.3 Ozone resistance (rubber hoses only)

The hose shall be tested in accordance with method 1 of ISO 7326:1991 at an ozone concentration of 50 pphm ± 5 pphm at 40 °C ± 2 °C for 72 h. After exposure, the hose shall be examined under a magnification of ×2 and shall show no evidence of cracking.

8.4 Ultraviolet (UV) resistance (plastics hoses only)

The hose shall be tested in accordance with ISO 11758:1995, method A. After exposure, the hose shall be examined under a magnification of ×2 and shall show no evidence of cracking.

8.5 Adhesion

When tested in accordance with ISO 8033, the minimum adhesion between adjacent components shall be 1,5 kN/m.

8.6 Abrasion resistance

When tested in accordance with ISO 6945, the loss in mass, after 2 000 cycles with a vertical force of 50 N on the abrading tool, shall not exceed 1 g.

8.7 Heat resistance

When tested in accordance with Annex A, at the relevant temperature given in Table 5, the hose shall withstand the test without leakage that would release exhaust gas, flame or burning particles to the atmosphere, and the hose shall exhibit no delamination or exposure of the reinforcement.

Table 5 — Gas flow temperature

Type	Temperature
Type 1 class A hose (softwall)	370 °C ± 20 °C
Type 1 class B hose (softwall)	580 °C ± 30 °C
Type 2 class A hose (hardwall)	370 °C ± 20 °C
Type 2 class B hose (hardwall)	580 °C ± 30 °C
Type 3 class A hose (flexible connector)	370 °C ± 20 °C
Type 3 class B hose (flexible connector)	580 °C ± 30 °C

8.8 Ageing

Age four 1-m test pieces of hose in air for 1 000 h at a temperature of 85 °C ± 1 °C as described in ISO 188.

After ageing, subject three of the test pieces to the burst test as described in 8.1. The burst pressure shall not be less than 2,5 bar. In addition, the mean of the burst pressure test results obtained after ageing shall not be more than 25 % less than the initial mean burst pressure before ageing.

Use the remaining test piece for an adhesion test in accordance with 8.5. It shall meet the requirements given in 8.5.

NOTE There is no limitation on the increase in the value of these properties. It is recommended that the test pieces for this test be taken from the part of the hose adjacent to the area where the original burst and adhesion test pieces were taken.

9 Application of tests

The tests required for type approval and routine testing are specified in Annex B.

Type approval is obtained by the manufacturer supplying evidence that all requirements of this International Standard are met for the particular method of manufacture and hose design. The tests shall be repeated at a maximum of five-year intervals, or whenever a change in the method of manufacture or materials used occurs.

Routine tests shall be carried out on each finished length of hose or hose assembly prior to despatch.

Production acceptance tests are those tests, specified in Annex C, which should be carried out by the manufacturer to control the quality of their products. The frequencies specified in Annex C are given for guidance purposes only.

10 Marking

The hose shall be legibly and durably marked at least once every 0,5 m with the following information:

a) the manufacturer's name or trade mark;

b) the number and year of publication of this International Standard, i.e. ISO 13363:2004;

c) the type and class of hose (in accordance with the classification given in Table 1);

d) the nominal bore, e.g. 32;

e) the quarter and year of manufacture, e.g. 3Q04.

EXAMPLE MAN-ISO 13363:2004-type 2-class A-32-3Q04

Annex A
(normative)

Heat-resistance test

A.1 General

Exhaust hoses shall withstand high temperatures (due e.g. to an interruption in the flow of cooling water) for a certain period of time.

A.2 Procedure

Connect a 2 m $\pm$ 0,5 m piece of hose to an actual or simulated engine exhaust system. Unless the hose is a shaped moulding, install it as a straight section. Subject the test hose to 2 min of exhaust gas flow at not less than the relevant temperature in Table 5. The exhaust gas flow rate Q, in m^3/min, shall not be less than that given by the formula:

$$Q = 0{,}054\,5\,d + 0{,}001\,9\,d^2$$

where d is the internal diameter of the hose, in mm.

At the end of the 2 min, allow the hose to cool to room temperature and then subject it to an internal pressure of 0,75 bar in accordance with ISO 1402 for 1 min. There shall be no leakage.

NOTE The test may be conducted on a representative size of hose to qualify other sizes of similar construction with equal or greater wall thicknesses.