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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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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This second edition cancels and replaces the first edition (ISO 13363:2004), which has been technically revised with the following changes:

— class B hoses to be of rubber materials only;

— the abrasion test has been removed until a new abrasion test standard has been developed and the corresponding International Standard published.

It also incorporates the Technical Corrigendum ISO 13363:2004/Cor.1:2008.

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 International 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). It does not apply to outboard motor/personal water craft.

The three types are the following:

— 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 the following:

— 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 176:2005, *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*

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

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

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

ISO 7326:2006, *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 10619-1:2011, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

ISO 30013:2011, *Rubber and plastics hoses — Methods of exposure to laboratory light sources — Determination of changes in colour, appearance and other physical properties*

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 rubber 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 rubber 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 rubber 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 the following:

— a smooth-bore water- and heat-resistant rubber or plastics tube (plastics are not suitable for class B hoses);

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

6 Dimensions and tolerances

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

Table 2 — Bore diameters and minimum bend radii

Nominal bore	Inside 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 or the same processing 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^{-1} °C ± 1 °C for 72 $^{0}_{-2}$ h.

7.6 Loss in mass on heating (only plastics hoses)

When tested in accordance with ISO 176:2005, 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 0,25 MPa (2,5 bar).

8.2 Flexibility (for type 1 and type 2 only)

When determined in accordance with ISO 10619-1:2011, method A1 and 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 ISO 7326:2006, method 1 at an ozone concentration of 50 mPa ± 5 mPa 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 30013:2011, 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 Heat resistance

When tested in accordance with Annex A and 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 (for class A hoses) 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

8.7 Ageing

Age for 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.

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 Frequency of tests

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

Type testing is carried out in order to confirm that all the materials, construction, and test requirements of this International Standard have been met by the 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 dispatch.

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 13363:2015;

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. 2Q15.

EXAMPLE MAN-ISO 13363:2015-type 2-class A-32-2Q15

Annex A
(normative)

Heat-resistance test

A.1 General

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

A.2 Procedure

Connect a 2 m ± 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 Formula (A.1):

$$Q = 0{,}054\ 5\ d + 0{,}001\ 9\ d^2 \qquad \text{(A.1)}$$

where

d is the inside 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.