ISO/FDIS 11424:2023(E)

ISO TC 45/SC 1/WG 2

Secretariat: DIN

Rubber hoses and tubing for air and vacuum systems for internal-combustion engines — Specification

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Third edition

Date: 2023-03-30

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Contents

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/FDIS 11424
https://standards.iteh.ai/catalog/standards/sist/6d521f0f-944b-4fda-a666-4fcd8a69a157/iso-fdis-11424

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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~~document 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~~ISO draws attention to the possibility that ~~some of~~ the ~~elements~~implementation of this document may ~~be~~involve the ~~subject~~use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents~~.~~. 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).~~

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This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, ~~Hoses (~~*Rubber and plastics*~~).~~ *hoses and hose assemblies.*

This third edition cancels and replaces the second edition (ISO 11424:2017), of which it constitutes a minor revision. The ~~main changes are~~change is that the ~~following:~~

~~—~~ normative references have been updated.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Rubber hoses and tubing for air and vacuum systems for internal-combustion engines — Specification

1 Scope

This document specifies requirements for rubber hoses and tubing for use in the various air and vacuum systems found on internal combustion engines. This document does not cover hoses used for direct power-brake actuation in trucks and trailers, nor for air intakes and ducting within the passenger compartment. The highest-temperature hoses are generally used for turbocharger applications. All hoses and tubing remain serviceable down to −40 °C.

NOTE Although the term vacuum is generally used, in reality the application is one of reduced air pressure used for the purposes of actuation or monitoring of the various engine-system components. The air carried by the tubing or hoses ~~may~~can be clean and free of contaminants but ~~may~~can also contain oil, fuel and their vapours as contamination, due to the particular installation and application.

2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 37:2017, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48-2, *Rubber, vulcanized or thermoplastic — Determination of hardness ~~(~~— Part 2: Hardness between 10 IRHD and 100 IRHD~~)~~*

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

ISO 815-1:2019, *Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

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

ISO 1629, *Rubber and latices — Nomenclature*

ISO 1817:~~2015~~2022, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 3302-1, *Rubber — Tolerances for products — Part 1: Dimensional tolerances*

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

ISO 7233:2021, *Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum*

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

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

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

ISO 10619--1:2017, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

ISO 10619--2:2021, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 2: Bending tests at sub-ambient temperatures*

ISO 19013--1:2019, *Rubber hoses and tubing for fuel circuits for internal combustion engines — Specification — Part 1: Diesel fuels*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 and the abbreviated terms given in ISO 1629 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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4 Classification

4.1 Types

Type A —refers to internally reinforced hose with a working pressure up to 0,3 MPa (3 bar).

Type B —refers to homogeneous tube with a working pressure up to 0,12 MPa (1,2 bar).

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4.2 Classes

Class 1 —refers to long-term working temperature up to 70 °C; maximum working temperature up to 100 °C. It is not recommended for applications where resistance to oils, fuel and their vapours is required.

NOTE 1 Typically, styrene-butadiene rubber (SBR) can be used.

Class 2 —refers to long-term working temperature up to 100 °C; maximum working temperature up to 125 °C. It is resistant to oils and their vapours.

NOTE 2 Typically, chloroprene rubber (CR) can be used.

Class 3 —refers to long-term working temperature up to 100 °C, maximum working temperature up to 125 °C. It is resistant to oils, fuels and their vapours.

NOTE 3 Typically, acrylonitrile-butadiene rubber (NBR) can be used.

Class 4 —refers to long-term working temperature up to 125 °C, maximum working temperature up to 150 °C. It is not recommended for applications where resistance to oils, fuels and their vapours is required.

NOTE 4 Typically, ethylene-propylene rubber (EPM or EPDM) can be used.

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Class 5 —refers to long-term working temperature up to 125 °C, maximum working temperature up to 150 °C. It is resistant to oils and their vapours.

NOTE 5 Typically, chlorinated or chlorosulfonated polyethylene (CM or CSM) can be used.

Class 6 —refers to long-term working temperature up to 125 °C, maximum working temperature up to 150 °C. It is resistant to oils, fuels and their vapours.

NOTE 6 Typically, epichlorohydrin or hydrogenated nitrile rubbers (CO, ECO or HNBR) can be used.

Class 7 —refers to long-term working temperature up to 150 °C, maximum working temperature up to 175 °C. It is not recommended for applications where resistance to oils, fuels and their vapours is required.

NOTE 7 Typically, silicone rubber (VMQ) can be used.

Class 8 —refers to long-term working temperature up to 150 °C, maximum working temperature up to 175 °C. It is resistant to oils and their vapours.

NOTE 8 Typically, acrylic rubber (ACM or AEM) can be used.

Class 9 —refers to long-term working temperature up to 150 °C, maximum working temperature up to 175 °C. It is resistant to oils, fuels and their vapours.

NOTE 9 Typically, fluoroelastomer or fluorosilicone rubbers (FKM or FVMQ) can be used.

Class 10 —refers to long-term working temperature up to 175 °C, maximum working temperature up to 200 °C. It is resistant to oils and their vapours.

NOTE 10 Typically, fluoroelastomer or fluorosilicone rubbers (FKM or FVMQ) can be used.

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ISO/FDIS 11424

Hoses are thus designated with a two-character descriptor such as type A4 or type B6, etc.

In cases where type A hose cover and lining are manufactured from materials of different classes, a three-character descriptor shall be used thus: Type A9/5 where the second character describes the lining material and the third character describes the cover material.

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ISO/FDIS 11424

Similarly, where type B tubing is of a composite construction, a three-character descriptor is also used thus: Type B3/2.

5 Hose and tubing bores

The bore of all hoses and tubing shall be clean and free from any contamination when examined visually.

6 Dimensions and tolerances

6.1 Hoses

When determined by the methods described in ISO 4671, the dimensions and tolerances shall comply with the values given in Table 1.

6.2 Tubing

When determined by the methods described in ISO 4671, bore diameters and wall thicknesses shall be as given in Table 2. Tolerances shall be selected from the appropriate categories given in ISO 3302-1.

Table 1 — Hose dimensions and tolerances

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Nominal bore	Inside diameter (ID) ~~mm~~ mm	Tolerance on ID ~~mm~~ mm	Wall thickness ~~mm~~ mm	Outside diameter (OD) ~~mm~~ mm	Tolerance on OD ~~mm~~ mm
3,5	3,5	±0,3	3,0	9,5	±0,4
4	4,0		3,0	10,0	
5	5,0		3,0	11,0	
6	6,0		3,0	12,0	
7	7,0		3,0	13,0	
7,5	7,5		3,0	13,5	
8	8,0		3,0	14,0	
9	9,0		3,0	15,0	
11	11,0		3,5	18,0	
12	12,0		3,5	19,0	

Table 2 — Nominal bore diameters and wall thickness of tubing

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Nominal bore	Nominal wall thickness mm
2	2
2,5	3
4	3,5
5	4
7 to 13	4,5

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7 Requirements for physical properties

7.1 Rubber compounds

7.1.1 Selection of test pieces

Tests shall be carried out where possible on test pieces cut from finished products. Where this is not possible, test pieces shall be cut from standard test slabs with a state of cure equivalent to that of the finished product. Compression set determination shall always be carried out on standard test slabs for both cover and lining of hoses and on the compound used for the tubing.

7.1.2 Hardness

Hardness, determined in accordance with the procedure in ISO 48-2, shall comply with the values given in Table 3.

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7.1.3 Tensile strength and elongation at break

Tensile strength and elongation at break, determined in accordance with ISO 37:2017 using a Type 2 dumb-bell test piece, shall comply with the values given in Table 3.

7.1.4 Change in properties after heat-ageing

The change in hardness, tensile strength and elongation at break, after heat-ageing in accordance with ISO 188 in a ventilated drying oven under the conditions given in a) and b) below, using test pieces as described in 7.1.2 and 7.1.3, shall comply with the values given in Table 3:

— Class 1:

  a) (70^{+2}_{0}) h at 100 °C;

  b) 1 000 h ± 5 h at 70 °C;

— Classes 2 and 3:

  a) (70^{+2}_{0}) h at 125 °C;

  b) 1 000 h ± 5 h at 100 °C;

— Classes 4, 5 and 6:

  a) (70^{+2}_{0}) h at 150 °C;

  b) 1 000 h ± 5 h at 125 °C;

— Classes 7, 8 and 9:

  a) (70^{+2}_{0}) h at 175 °C;

  b) 1 000 h ± 5 h at 150 °C;

— Class 10:

  a) (70^{+2}_{0}) h at 200 °C;

  b) 1 000 h ± 5 h at 175 °C.

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7.1.5 Compression set

Compression set, when determined in accordance with ISO 815-1:2019, using the Type A test piece and the following conditions, shall comply with the values given in Table 3:

— Class 1: (70^{+2}_{0}) h at 70 °C;

— Classes 2 and 3: (70^{+2}_{0}) h at 100 °C;

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