
Rubber hoses for automotive turbochargers — Specification

*Tuyaux en caoutchouc pour turbocompresseurs automobiles —
Spécifications*

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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.

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*.

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Rubber hoses for automotive turbochargers — Specification

1 Scope

This International Standard specifies requirements of rubber hoses used in the automotive turbocharger system to connect turbocharger, intercooler, and internal combustion engine at the working temperatures from -40°C to $+250^{\circ}\text{C}$ and the working pressures from $-0,01\text{MPa}(-0,1\text{bar})$ to $0,5\text{MPa}(5\text{bar})$. Hoses covered by this International Standard may be straight or shaped.

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

ISO 812, *Rubber, vulcanized or thermoplastic — Determination of low-temperature brittleness*

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

ISO 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1629, *Rubber and latices — Nomenclature*

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 7233:2006, *Rubber and plastics hoses and hose assemblies — Determination of resistance to vacuum*

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

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

ISO 8331, *Rubber and plastics hoses and hose assemblies — Guidelines for selection, storage, use and maintenance*

ISO 28702, *Rubber and plastics hoses and tubing — Textile-reinforced types — Sub-ambient temperature crush test*

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.

4 Classification

4.1 Types and classes

The hoses are classified into three types as per the intended operating conditions.

- Type A: hose for connecting air filter and turbocharger, to transfer filtered atmospheric air. Working temperature from -40°C to $+100^{\circ}\text{C}$, and vacuum pressure low to $-0,01\text{MPa}(-0,1\text{bar})$.
- Type B: hose for connecting turbocharger and intercooler, to transfer the pressurized and heated air. Working temperature from -40°C to $+250^{\circ}\text{C}$.

Type B is subdivided into three subtypes as per working temperature and further classified into classes as per maximum working pressures. The subtypes and classes are shown in [Table 1](#).

Table 1 — Subtypes and classes for Type B

Type	Working temperature $^{\circ}\text{C}$	Class		
		1	2	3
		Maximum working pressure MPa(bar)		
B1	-40 approximately $+180$	0,16(1,6)	0,22(2,2)	0,28(2,8)
B2	-40 approximately $+220$	0,20(2,0)	0,28(2,8)	0,34(3,4)
B3	-40 approximately $+250$	0,30(3,0)	0,40(4,0)	0,50(5,0)

- Type C: hose for connecting intercooler and internal combustion engine, to transfer the pressurized and cooled air. Working temperature from -40°C to $+140^{\circ}\text{C}$ and maximum working pressure 0,3 MPa (3bar).

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4.2 Grades

Type B and C of hose are classified into 2 grades as per fatigue resistance:

- Grade 200 — 200 000 impulse cycles;
- Grade 400 — 400 000 impulse cycles.

5 Materials and construction

5.1 Materials

The typical materials for the types of hoses are listed in [Table 2](#).

Table 2 — Hose type and typical material

Dimensions in millimetres

Type	Lining	Reinforcement	Cover
A/C	EPDM	PET ^a PA ^b wire	EPDM
	CM		CM
	CR		CR
	ECO		ECO
	AEM		AEM
	ACM		ACM
	VMQ		VMQ
B1	AEM	PET ^a AR ^c	AEM
	ACM		ACM
	VMQ		VMQ
B2/B3	FKM	AR ^c	VMQ
	FVMQ		VMQ

NOTE — All the abbreviated words are defined in ISO 1629 excluded PET, PA, and AR.

a PET — poly(ethylene terephthalate) fibre

b PA — polyamide

c AR — Aramid

5.2 Construction

The hoses shall consist of:

- a flexible polymeric elastomers <https://standards.iteh.ai/catalog/standards/sist/6c676c4d-27d7-41cd-a5e7-4dabfiso-17324-2014> lining;
- a synthetic textile reinforcement or other reinforcements, applied by any suitable technique;
- a flexible polymeric elastomers cover.

Hose body may have a smooth or corrugated finish, and be further reinforced with wire at suitable positions, and may be covered with glass fibre cloth with aluminium-foil paper, or heat insulation or abrasion resistant jacket made of thermoplastic material on suitable position.

NOTE Type A may be rubber tubing without reinforcement.

6 Dimensions and tolerances

6.1 Inside diameter, wall thickness, and length tolerance

Unless otherwise specified, when measured in accordance with ISO 4671, inside diameters and wall thicknesses tolerances are given in [Table 3](#) and length tolerances are given in [Table 4](#).

Table 3 — Inside diameter, wall thickness tolerance

Dimensions in millimetres

Inside diameter and tolerance		Tolerance of wall thickness	
Inside diameter	Tolerance	Extruded hose	Wrapped hose ^a
≤ 35	+0,5 -1,3	±0,3	±0,5
> 35 and ≤ 50			
> 50 and ≤ 80	+0,5 -1,3	±0,8	±1,0
> 80 and ≤ 110	+0,8 -1,7		
> 110 and ≤ 150	+1,2 -2,0	±1,0	±1,2
> 150	+1,6 -2,5		

^a Overlap zone excluded.

Table 4 — Length tolerance

Dimensions in millimetres

Length	Tolerance
≤ 300	±3
> 300 and ≤ 600	±4,5
> 600	±1 %

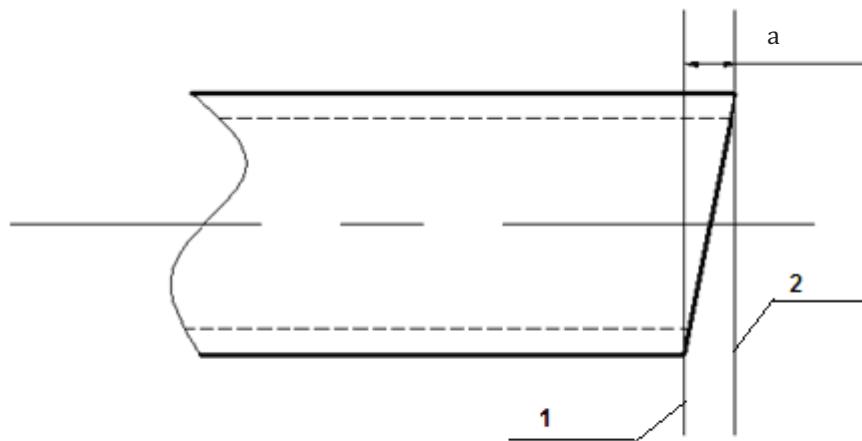
6.2 Hose end squareness

All the points on the end surface of a hose shall be in the tolerance zone, given in [Table 5](#), which is defined by two planes vertical to the longitudinal axis of the hose (see [Figure 1](#)).

Table 5 — Hose end squareness

Dimensions in millimetres

I.D.	Tolerance zone
< 25,4	2,5
≥ 25,4	10 % of I.D.

**Key**

- 1 plane
- 2 plane
- a Tolerance zone.

Figure 1 — Hose end squareness

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7 Physical properties

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7.1 Rubber compounds

Physical properties of rubber compounds used for the lining, cover and tubing shall conform to the values given in [Table 6](#), [Table 7](#), [Table 8](#), [Table 9](#), and [Table 10](#). Tests shall be carried out on samples (taken from the hose or from moulded sheets of rubber compound, 2 mm thick or moulded test pieces) in all cases vulcanized to the same cured state as the production hose.

Table 6 — Lining, cover, and tubing for type A

Property	Requirement	Test method
Heat aging resistance, 100 °C × 168 h		
Change in hardness, shore A	±10	ISO 188
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Oil resistance ^a , IRM 901 Oil, 100 °C × 70 h		
Change in hardness, shore A	±10	ISO 1817
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Change in volume, %	±10	
Brittleness temperature, at -40 °C	No brittleness	ISO 812
Ozone resistance, 100pphm × 40 °C × 72 h × 20 %	No cracks	ISO 1431-1
^a not applicable for EPDM		

Table 7 — Lining, cover, and tubing for type B1

Property	Requirement	Test method
Heat aging resistance, 180 °C × 168 h		
Change in hardness, shore A	±10	ISO 188
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Oil resistance, IRM 901 Oil, 150 °C × 70 h		
Change in hardness, shore A	±10	ISO 1817
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Change in volume, %	±10	
Brittleness temperature, at -40 °C,	No brittleness	ISO 812
Ozone resistance, 100pphm × 40 °C × 72 h × 20 %	No cracks	ISO 1431-1

Table 8 — Lining, cover, and tubing for type B2

Property	Requirement	Test method
Heat aging resistance, 220 °C × 168 h		
Change in hardness, shore A	±10	ISO 188
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Oil resistance, 150 °C × 70 h, IRM 901 Oil excluding lining IRM 903 Oil for lining		
Change in hardness, shore A	±10	ISO 1817
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Change in volume, %	±10	
Brittleness temperature, at -40 °C	No brittleness	ISO 812
Ozone resistance, 100pphm × 40 °C × 72 h × 20 %	No cracks	ISO 1431-1

Table 9 — Lining, cover, and tubing for type B3

Property	Requirement	Test method
Heat aging resistance, 250 °C × 168 h		
Change in hardness, shore A	±10	ISO 188
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Oil Resistance, 150 °C × 70 h, IRM 901 Oil excluding lining IRM 903 Oil for lining		

Table 9 (continued)

Property	Requirement	Test method
Change in hardness, Shore A	±10	ISO 1817
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Change in volume, %	±10	
Brittleness temperature, at -40 °C	No brittleness	ISO 812
Ozone resistance, 100pphm × 40 °C × 72 h × 20 %	No cracks	ISO 1431-1

Table 10 — Lining, cover, and tubing for type C

Property	Requirement	Test method
Heat aging resistance, 140 °C × 168 h		
Change in hardness, shore A	±10	ISO 188
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Oil resistance ^a , IRM 901 Oil, 100 °C × 70 h		
Change in hardness, shore A	±10	ISO 1817
Change in tensile strength, %	±30	
Change in elongation at break, %	±40	
Change in volume, %	±10	
Brittleness temperature, at -40 °C	No brittleness	ISO 812
Ozone resistance, 100pphm × 40 °C × 72 h × 20 %	No cracks	ISO 1431-1
^a not applicable for EPDM		

7.2 Hose

7.2.1 Appearance

When checked with 1x magnification, hose cover and bore surface shall show no visible defects such as kinking, porosity, blister, foreign inclusions, damages, and scratches. Marks such as wrapper marks on the cover surface may be acceptable. Reinforcement shall not be exposed other than on the end surfaces of hose.

Delivery hoses shall be clean and qualified, free from impurity, grease, or any contamination that may affect the function of the hose.

7.2.2 Vacuum resistance (only for Type A)

When tested in accordance with method C in ISO 7233:2006, the change in hose length (ΔL_t) shall be 0~5 %, and the change in OD (ΔD_t) shall be 0~-8 %, measured while vacuum pressure maintained at -0,015 MPa for 10 min.

The lines A and B should be at 25 mm apart from ends of the hose if the length of the hose to be tested is less than 500 mm.

7.2.3 Proof pressure (for Type B and C)

When tested in accordance with ISO 1402 at the proof pressures given in [Table 11](#), no leakage or other signs of weakness nor abrupt twisting shall be shown.