
**Diesel engines — High-pressure fuel
injection pipe assemblies — General
requirements and dimensions**

*Moteurs diesels — Lignes assemblées d'injection de carburant à haute
pression — Exigences générales et dimensions*

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Published in Switzerland

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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.

ISO 13296 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 7, *Injection equipment and filters for use on road vehicles*.

This second edition cancels and replaces the first edition (ISO 13296:1997), which has been technically revised. It also incorporates the Technical Corrigendum ISO 13296:1997/Cor.1:2000.

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Introduction

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this International Standard may involve the use of a patent concerning an apparatus to measure the inside diameter of the pipe assembly, as described in Annex B.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO that he is willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from:

DaimlerChrysler AG
70322 Stuttgart
Germany

This information is given for the convenience of the users of this International Standard and does not constitute an endorsement of the apparatus for which a patent is held by the above-mentioned company. Other apparatus may be used if it can be shown to lead to the same results.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights other than those identified above. ISO shall not be held responsible for identifying any or all such patent rights.

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Diesel engines — High-pressure fuel injection pipe assemblies — General requirements and dimensions

1 Scope

This International Standard specifies dimensions and requirements for high-pressure fuel injection pipe assemblies and assembled pipe sets used on diesel (compression-ignition) engines.

NOTE High-pressure pipes for use on test benches are specified in ISO 4093.

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 2974, *Diesel engines — High-pressure fuel injection pipe end-connections with 60° female cone*

ISO 7876-4, *Fuel injection equipment — Vocabulary — Part 4: High-pressure pipes and end-connections*

ISO 8535-1, *Compression-ignition engines — Steel tubes for high-pressure fuel injection pipes — Part 1: Requirements for seamless cold-drawn single-wall tubes*

ISO 8535-2, *Compression-ignition engines — Steel tubes for high-pressure fuel injection pipes — Part 2: Requirements for composite tubes*

ISO 12345, *Diesel engines — Cleanliness assessment of fuel injection equipment*

3 Definitions

For the purposes of this document, the definitions given in ISO 7876-4 apply.

4 Dimensions and tolerances

The requirement and configuration drawing for a pipe assembly shall include at least the following:

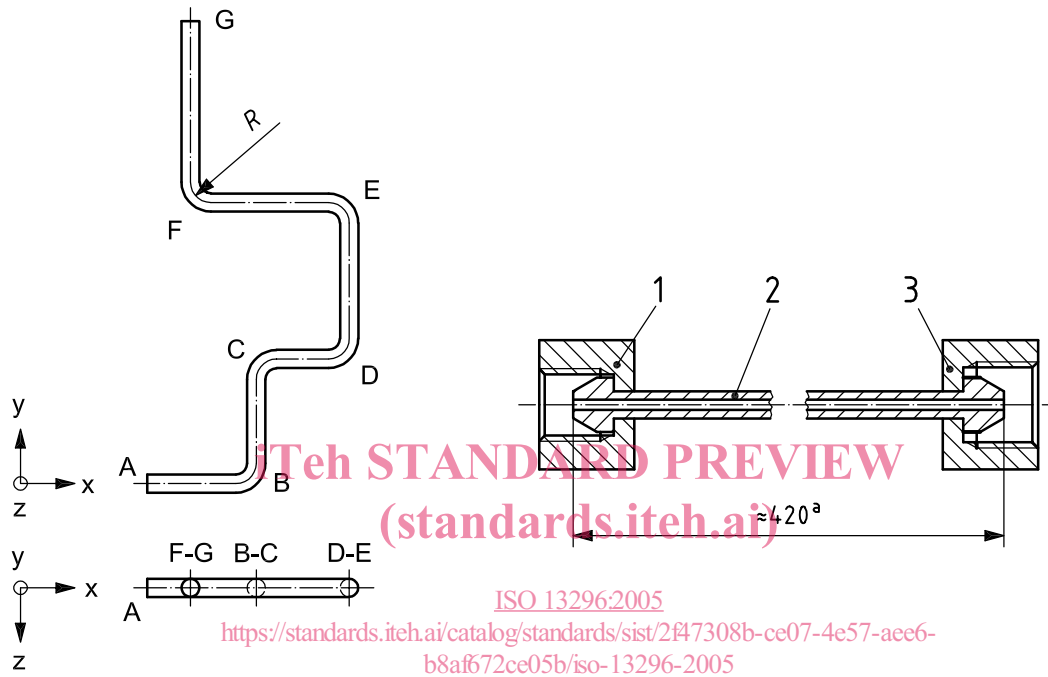
- indication of compliance with this International Standard;
- the outside diameter and inside diameter of the pipe and indication of compliance with ISO 8535-1 or ISO 8535-2; and
- a graphic representation of the centreline of the pipe with the connection ends and each bend intersection labelled as a point, with each point listed in a table with Cartesian coordinates x , y and z with the orthogonal distance from the axis and the bend radius;

NOTE The coordinates are used to specify the theoretical exact centreline of the pipe. See the example given in Figure 1.

- d) the developed length of the pipe as an approximated value; and
- e) the surface finish requirements of the pipe and connector nuts.

The dimensional tolerance of a pipe assembly shall be stated in terms of the actual outside contour of the tube in relation to the specified maximum outside contour and the variance of the actual connection end from specified position, as agreed upon between supplier and customer.

Dimensions in millimetres



Key

- 1 connector nut M12
- 2 pipe
- 3 connector nut M14

a developed length

Point	x	y	z	Radius
A	0	0	0	0
B	65	0	0	15,75
C	65	100	0	15,75
D	140	100	0	15,75
E	140	150	0	15,75
F	40	150	0	15,75
G	40	185	0	0

Figure 1 — Example of a requirement and configuration drawing

5 Cleanliness

The bore of a high-pressure fuel injection pipe assembly shall be clean, and this shall be assessed in accordance with ISO 12345. Unless otherwise agreed between manufacturer and client, cleanliness of pipe assemblies shall be designated using the Fuel Injection Equipment Cleanliness Code (FIECC), as defined in ISO 12345.

6 Minimum bend radii

The radius of any bend made in fabricating high-pressure pipe assemblies shall be not less than two and one-half times ($2,5 \times$) the outside diameter of the pipe as measured from the pipe centreline. Bends shall be a sufficient distance from the end-connections so as to allow easy fitting of the pipe assembly for its intended use. Bends shall be a sufficient distance from one another so as not to impair fabrication. Bend radii shall be of uniform size in each pipe assembly whenever possible.

7 End-connections

The dimensional characteristics of the high-pressure pipe end-connections with 60° female cone are specified in ISO 2974. The preferred hexagon size for the connector nuts are listed in Table 1.

Table 1 — Connector nut hexagon size
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Dimensions in millimetres

Tube outside diameter	ISO 13296:2005 Thread	Hexagon across flats (preferred)
4,5	M10 × 1,25	14
	M12 × 1,5	17
6	M12 × 1,5	17
	M14 × 1,5	19
7	M14 × 1,5	19
8	M16 × 1,5	24
	M18 × 1,5	24
	M22 × 1,5	32
10	M20 × 1,5	30
	M22 × 1,5	32
	M24 × 1,5	36
12	M22 × 1,5	32
	M26 × 1,5	36

The tube connection end and bore configuration shall be chosen such that, after final assembly, the inside diameter of the tube is not less than that which is shown in Figure 2. After manufacture, the connection ends of the pipe shall comply with the dimensional characteristics given in Figure 2. This figure also determines any internal distortion limits. If, by agreement between supplier and customer, a chamfer is to be put in the bore, the maximum tolerance of d_1 at the front of the male sealing face may be increased.