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**Diesel engines — Fuel injection  
pumps and fuel injector low-pressure  
connections —**

Part 2:  
**Non-threaded (push-on) connections**

*Moteurs diesels — Raccords basse pression pour pompes d'injection  
de combustible et porte-injecteurs de combustible complets —*

*Partie 2: Raccords non filetés (à pression)*

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ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
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.

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](http://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](http://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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This third edition cancels and replaces the second edition (ISO 13948-2:2012), which has been technically revised with the following changes:

— a normative reference has been made to ISO 4288 for the measurement of surface texture.

A list of all the parts in the ISO 13948 series can be found on the ISO website.

## Introduction

It is recognized that a large variety of low-pressure connections exist on fuel injection equipment, using different sealing principles, as well as designs. This document attempts to provide the user with a common set of preferred types.

This document is divided into two parts, covering threaded connections (ISO 13948-1) and non-threaded (push-on) connections (ISO 13948-2) for use with low-pressure fuel supply and return, boost air pressure and lubricating oil supply and return.

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# Diesel engines — Fuel injection pumps and fuel injector low-pressure connections —

## Part 2: Non-threaded (push-on) connections

### 1 Scope

This document specifies requirements for the connection ends of push-on connections used with fuel injection equipment.

Three types of push-on connections (types A, B and C) are described in this document.

NOTE Low-pressure connections to fuel filters are covered in other International Standards; see the bibliography. High-pressure end-connections for pumps and injectors are covered in ISO 2974 and ISO 13296.

### 2 Normative references

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 4288, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture*.

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7876 (all parts) apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

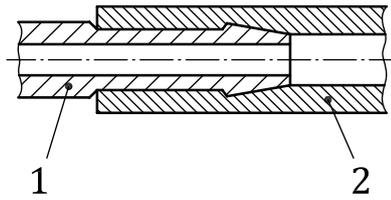
### 4 Connection designs and applications

#### 4.1 Type A: nipple connection

EXAMPLE See [Figure 1](#).

This design is intended for use directly with the mating hose (2) or in conjunction with a retaining clip around the hose (not shown) for a more secure connection.

The nipple (1) can be machined (see [Figure 4](#)), formed (see [Figure 5](#) and [Figure 6](#)) or moulded (see [Figure 7](#)).



- Key**
- 1 nipple
  - 2 hose

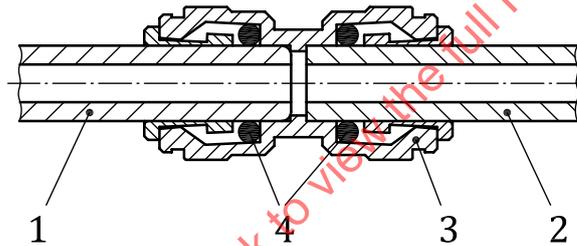
**Figure 1 — Type A connection (principle)**

**4.2 Type B: stand pipe connection**

EXAMPLE See [Figure 2](#).

This design is used in conjunction with proprietary push-on connections (3) attached to the mating hose (2) that seals by compressing ring seals (4) around the outside diameters of the stand pipe (1) and of the mating hose (2).

An identification may be applied to indicate to the user that the hose is fully engaged (see [Figure 10](#)).



- Key**
- 1 stand pipe
  - 2 hose
  - 3 push-on connection
  - 4 ring seals

**Figure 2 — Type B connection (principle)**

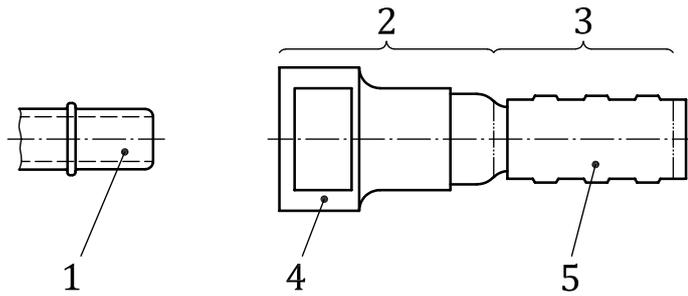
**4.3 Type C: “quick connector coupling” connection**

NOTE As specified in SAE J2044[9].

EXAMPLE See [Figure 3](#).

This design is used in conjunction with proprietary push-on “quick connector couplings” attached to the mating male tube end form. The quick connector coupling contains one or more O-ring seals to seal along the male tube end outer surface, and a latching device to engage with the collar diameter feature.

The male tube end form is shown in [Figure 11](#) and the dimensions are defined in [Table 4](#) and [Table 5](#).



**Key**

- 1 male tube end
- 2 female connection end
- 3 stem
- 4 quick connector coupling
- 5 section of hose or tube

**Figure 3 — Type C connection (principle)**

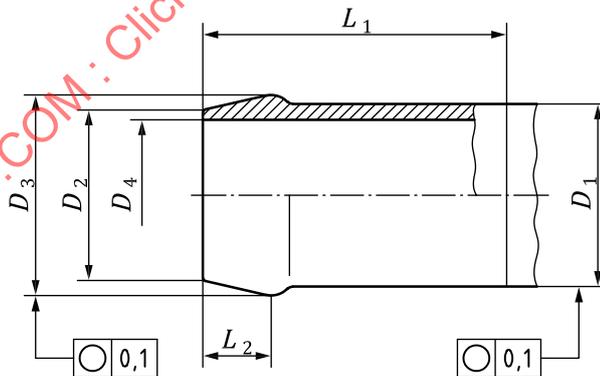
**5 Dimensions and surface quality**

**5.1 Type A connection ends**

**5.1.1 Nipple types**

**5.1.1.1 Nipple, machined, type A.1**

Dimensions in millimetres



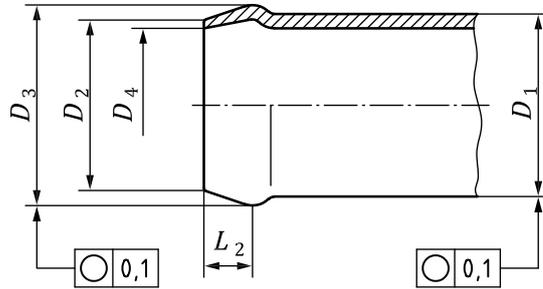
NOTE For the parameters, see [Table 1](#).

**Figure 4 — Nipple, type A.1**

5.1.1.2 Nipple, formed, types A.2

5.1.1.2.1 Nipple, bulge type A.2.1

Dimensions in millimetres

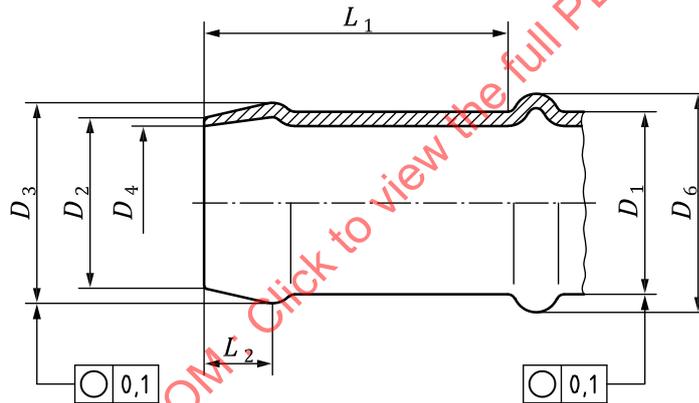


NOTE For the parameters, see [Table 1](#).

Figure 5 — Nipple, type A.2.1

5.1.1.2.2 Nipple, bulge and spool type, A.2.2

Dimensions in millimetres



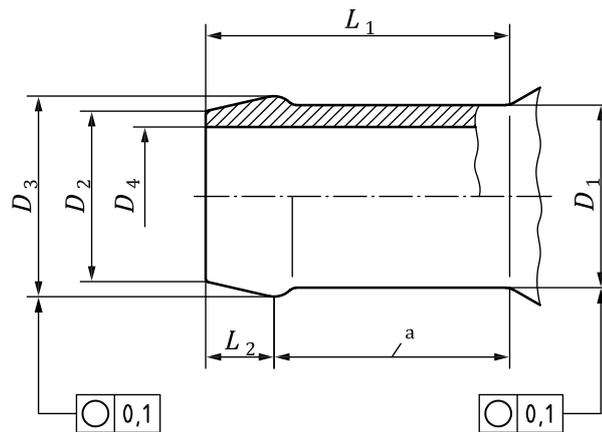
NOTE For the parameters, see [Table 1](#).

Figure 6 — Nipple, type A.2.2

5.1.1.3 Nipple, moulded, type A.3

See [Figure 7](#).

Dimensions in millimetres



a Within this area:

- moulded joint misalignment: 0,05 mm max.;
- moulded joint parting height: 0,05 mm max.

NOTE For the parameters, see [Table 1](#).

Figure 7 — Nipple, type A.3

### 5.1.2 Basic dimensions and tolerances

See [Table 1](#).

Table 1 — Basic dimensions and tolerances for nipples, types A

Dimensions in millimetres

Type	$L_1$ nom.	$L_2$	$D_1$	$D_2$	$D_3$	$D_4$ max.	$D_5$ min.
A.1 (machined)	20 to 24	$3,2 \pm 0,5$	$\emptyset 12,1 \pm 0,1$	$\emptyset 11,3 \pm 0,2$	$\emptyset 13,3 \pm 0,1$	$\emptyset 10$	—
		$3,2 \pm 0,5$	$\emptyset 10,1 \pm 0,1$	$\emptyset 9,3 \pm 0,2$	$\emptyset 11,1 \pm 0,1$	$\emptyset 8$	—
		$3,2 \pm 0,5$	$\emptyset 8,1 \pm 0,1$	$\emptyset 7,3 \pm 0,2$	$\emptyset 9,1 \pm 0,1$	$\emptyset 6$	—
	16	$2,8 \pm 0,5$	$\emptyset 6,35 \pm 0,1$	$\emptyset 6,2 \pm 0,2$	$\emptyset 7,4 \pm 0,1$	— <sup>a</sup>	—
	12	$2,2 \pm 0,5$	$\emptyset 4,0 \pm 0,1$	$\emptyset 3,8 \pm 0,2$	$\emptyset 5 \pm 0,1$	$\emptyset 2,6$	—
A.2.1 (formed) bulge type	—	$3,2 \pm 0,5$	$\emptyset 12,1 \pm 0,1$	$\emptyset 11,3 \pm 0,2$	$\emptyset 13,3 \pm 0,3$	$\emptyset 10,2$	—
		$3,2 \pm 0,5$	$\emptyset 10,1 \pm 0,1$	$\emptyset 9,3 \pm 0,2$	$\emptyset 11,1 \pm 0,3$	$\emptyset 8,2$	—
		$3,2 \pm 0,5$	$\emptyset 8,1 \pm 0,1$	$\emptyset 7,3 \pm 0,2$	$\emptyset 9,1 \pm 0,3$	$\emptyset 6,2$	—
		$2,8 \pm 0,5$	$\emptyset 6,35 \pm 0,1$	$\emptyset 6,1 \pm 0,2$	$\emptyset 7,4 \pm 0,3$	$\emptyset 5$	—
		$2,2 \pm 0,5$	$\emptyset 4,76 \pm 0,1$	$\emptyset 4,6 \pm 0,2$	$\emptyset 5,6 \pm 0,3$	$\emptyset 3,5$	—
A.2.2 (formed) bulge and spool type	20 to 24	$3,2 \pm 0,5$	$\emptyset 12,1 \pm 0,1$	$\emptyset 11,3 \pm 0,2$	$\emptyset 13,3 \pm 0,3$	$\emptyset 10,2$	$\emptyset 13,2$
		$3,2 \pm 0,5$	$\emptyset 10,1 \pm 0,1$	$\emptyset 9,3 \pm 0,2$	$\emptyset 11,1 \pm 0,3$	$\emptyset 8,2$	$\emptyset 11,2$
		$3,2 \pm 0,5$	$\emptyset 8,1 \pm 0,1$	$\emptyset 7,3 \pm 0,2$	$\emptyset 9,1 \pm 0,3$	$\emptyset 6,2$	$\emptyset 9$
	28	$2,8 \pm 0,5$	$\emptyset 6,35 \pm 0,1$	$\emptyset 6,1 \pm 0,2$	$\emptyset 7,4 \pm 0,3$	$\emptyset 5$	$\emptyset 7,1$
	28	$2,2 \pm 0,5$	$\emptyset 4,76 \pm 0,1$	$\emptyset 4,6 \pm 0,2$	$\emptyset 5,6 \pm 0,3$	$\emptyset 3,5$	$\emptyset 5,3$

**Table 1** (continued)

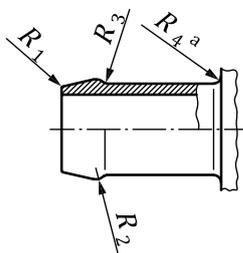
Type	$L_1$ nom.	$L_2$	$D_1$	$D_2$	$D_3$	$D_4$ max.	$D_5$ min.
A.3 (moulded)	20 to 24	$3,2 \pm 0,5$	$\varnothing 12,1 \pm 0,1$	$\varnothing 11,3 \pm 0,2$	$\varnothing 13,3 \pm 0,1$	$\varnothing 9,2$	—
		$3,2 \pm 0,5$	$\varnothing 10,1 \pm 0,1$	$\varnothing 9,3 \pm 0,2$	$\varnothing 11,1 \pm 0,1$	$\varnothing 7,2$	—
		$3,2 \pm 0,5$	$\varnothing 8,1 \pm 0,1$	$\varnothing 7,3 \pm 0,2$	$\varnothing 9,1 \pm 0,1$	$\varnothing 5,2$	—
	16	$2,8 \pm 0,5$	$\varnothing 6,35 \pm 0,1$	$\varnothing 6,2 \pm 0,2$	$\varnothing 7,4 \pm 0,1$	— <sup>a</sup>	—
	12	$2,2 \pm 0,5$	$\varnothing 4,0 \pm 0,1$	$\varnothing 3,8 \pm 0,2$	$\varnothing 5 \pm 0,1$	$\varnothing 2,6$	—

<sup>a</sup> Bore size specified by manufacturer.

**5.1.3 Radii**

Dimensions of the nipple radii are given in [Table 2](#).

Positions of the nipple radii are shown in [Figure 8](#).



<sup>a</sup> Only for moulded nipples.

NOTE For the parameters, see [Table 2](#).

**Figure 8** — Nipple radii

**Table 2** — Dimensions of radii for nipples, types A

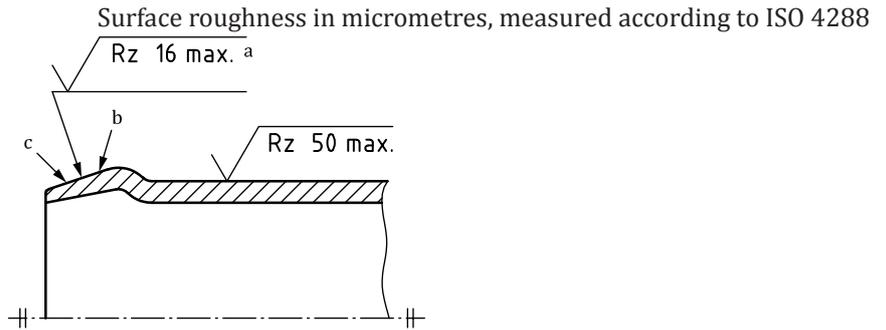
Dimensions in millimetres

Nipple type	$R_1$ min.	$R_2$ nom.	$R_3$ nom.	$R_4^a$ min.
Machined	0,2	1 to 1,5	0,5 to 1	—
Formed	0,2	1 to 1,5	0,5 to 1	—
Moulded	0,2	1 to 1,5	—	1

<sup>a</sup> Only for moulded nipples.

**5.1.4 Surface quality**

The outside surface quality requirements (roughness and imperfections) are given in [Figure 9](#).

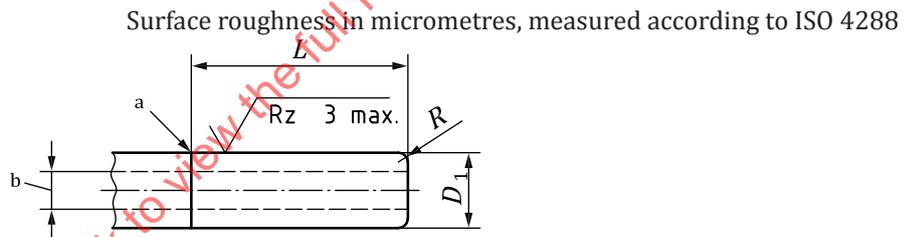


- a Measured lengthwise and crosswise.
- b No longitudinal marks are permitted.
- c Single imperfections with a depth up to 0,05 mm and a length up to 0,5 mm are permitted.

**Figure 9 — Outside surface quality requirements**

## 5.2 Type B connection end

See [Figure 10](#).



- a Identification (optional).
- b Bore size specified by manufacturer.

NOTE 1 Materials can be different, for example plastics.

NOTE 2 For the parameters, see [Table 3](#).

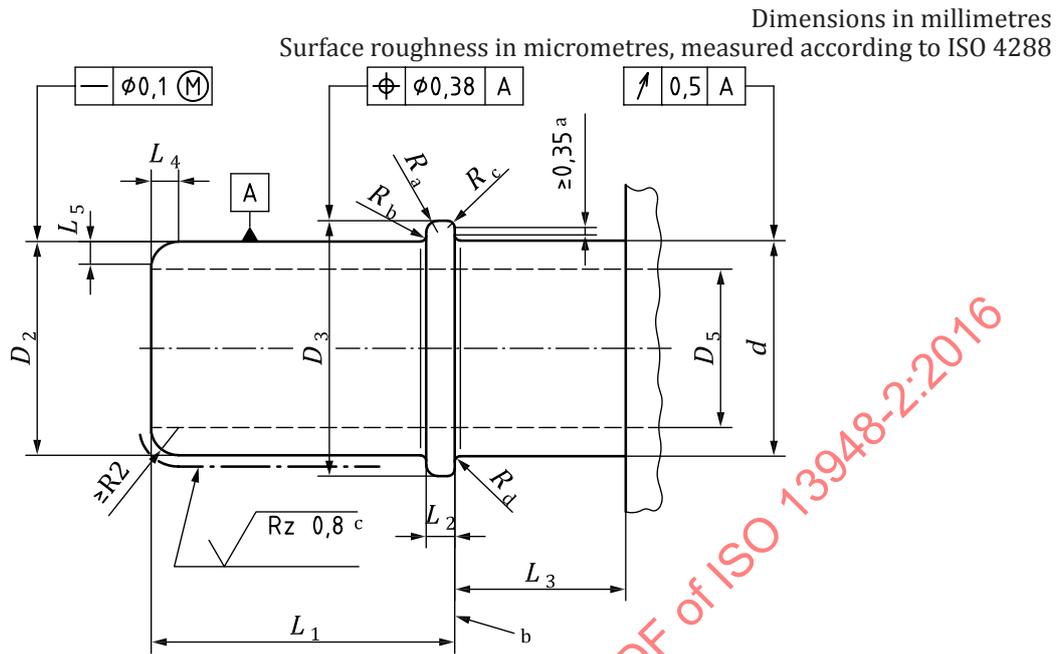
**Figure 10 — Stand pipe, type B**

**Table 3 — Dimensions and tolerances for type B**

Dimensions in millimetres

$D_1$	$L$	$R$
$\varnothing 8 \pm 0,05$	$28,5 \pm 0,5$	$1,2^{+0,5}_{-0,3}$
$\varnothing 10 \pm 0,05$	$28,5 \pm 0,5$	$1,2^{+0,5}_{-0,3}$

5.3 Type C connection end



Key

- $d$  nominal diameter
- $D_2$  seal diameter
- $D_3$  collar diameter
- $D_5$  minimum inner diameter
- $L_1$  length
- $L_2$  collar width
- $L_3$  clearance
- a Minimum 0,35 annular surface perpendicular to tube.
- b Collar to start of bend: see connector drawings for minimum distance.
- c Measure across lay, tool marks or weld seams. No flows to exceed  $30 \mu\text{m}$   $R_z$ .

NOTE For the parameters, see [Table 4](#) and [Table 5](#).

Figure 11 — Male tube end form, type C

Table 4 — Dimensions and tolerances for type C (except for polyamide-coated end forms)

Dimensions in millimetres

<i>D</i> inch	<i>D</i> <sub>1</sub> <sup>a</sup> nom.	<i>D</i> <sub>2</sub>	<i>D</i> <sub>3</sub>	<i>D</i> <sub>5</sub> min.	<i>L</i> <sub>1</sub>	<i>L</i> <sub>2</sub>	<i>L</i> <sub>3</sub> min.	<i>R</i> <sub>a</sub> min.	<i>R</i> <sub>b</sub> max.	<i>R</i> <sub>c</sub> max.	<i>R</i> <sub>d</sub> max.	<i>L</i> <sub>4</sub>	<i>L</i> <sub>5</sub> min.
3/16	4,78	4,63 ± 0,06	7,1 ± 0,15	2,2	19,93 ± 0,25	1,75 ± 0,15	8	0,8	0,3	0,5	0,25	2 ± 0,20	0,8
1/4	6,35	6,3 ± 0,06	8,75 ± 0,15	3,6	21,25 ± 0,25	1,6 ± 0,15	7	0,8	0,3	0,5	0,25	2 ± 0,20	0,9
5/16	8	7,89 ± 0,06	10,98 ± 0,15	4,7	21,45 ± 0,25	1,6 ± 0,15	6	1	0,4	0,45	0,35	2,1 ± 0,20	0,9
	8	8 ± 0,08	11 ± 0,15	5	21 ± 0,25	1,75 ± 0,15	6	1	0,35	0,6	0,35	2,1 ± 0,20	0,9
3/8	9,5	9,49 ± 0,06	12,94 ± 0,15	6,3	21,85 ± 0,25	1,6 ± 0,15	6,5	1	0,6	0,45	0,5	2,1 ± 0,20	1,1
7/16	10	9,89 ± 0,06	13,42 ± 0,2	6,6	24,95 ± 0,25	1,75 ± 0,20	6	1	0,6	0,5	0,6	2,1 ± 0,20	1,1
	10	10 ± 0,08	13,5 ± 0,2	6,4	24 ± 0,25	1,75 ± 0,20	6	1	0,6	0,5	0,6	2,1 ± 0,20	1,1
	12	11,8 ± 0,08	16,5 ± 0,25	7,5	26,62 ± 0,25	2,5 ± 0,20	8	1	1	0,6	0,6	2,2 ± 0,20	1,5
1/2	12,7	12,61 ± 0,1	16,51 ± 0,25	8,1	26,62 ± 0,25	2,5 ± 0,20	8	1	0,8	0,6	0,6	2,2 ± 0,20	1,5
5/8	16	15,82 ± 0,1	19,18 ± 0,25	11,1	26,62 ± 0,25	2,5 ± 0,20	8	1	0,5	0,6	0,5	2,2 ± 0,20	1,75
3/4	19	18,9 ± 0,1	22,33 ± 0,25	13,2	26,62 ± 0,25	2,5 ± 0,20	8	1	0,5	0,6	0,5	2,2 ± 0,20	1,75
57/64	23	22,7 ± 0,15	25,7 ± 0,25	16	29,5 ± 0,25	2,5 ± 0,20	9,5	1	0,3	0,6	0,3	2,2 ± 0,20	1,75
1	25,4	25,5 ± 0,15	28,2 ± 0,25	19	29,5 ± 0,25	2,5 ± 0,20	9,5	1	0,15	0,6	0,2	2,2 ± 0,20	1,75

<sup>a</sup> Tube diameter (nominal coupling size); not shown in Figure 11.

Table 5 — Dimensions and tolerances for type C (polyamide-coated end forms)

D inch	D <sub>1</sub> <sup>a</sup> nom.	D <sub>2</sub>	D <sub>3</sub>	D <sub>5</sub> min.	L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub> min.	R <sub>a</sub> min.	R <sub>b</sub> max.	R <sub>c</sub> max.	R <sub>d</sub> max.	L <sub>4</sub>	L <sub>5</sub> min.
1/4	6,35	6,3 ± 0,06	8,75 ± 0,15	3,6	21,25 ± 0,25	2,0 ± 0,20	7	0,8	0,3	0,5	0,25	2 ± 0,20	0,9
5/16	8	7,89 ± 0,06	10,98 ± 0,15	4,7	21,45 ± 0,25	2,0 ± 0,20	6	1	0,4	0,45	0,35	2,1 ± 0,20	0,9
3/8	9,5	9,49 ± 0,06	12,94 ± 0,15	6,3	21,85 ± 0,25	2,0 ± 0,20	6,5	1	0,6	0,45	0,5	2,1 ± 0,20	1,1
7/16	10	9,89 ± 0,06	13,42 ± 0,2	6,6	24,95 ± 0,25	2,0 ± 0,25	6	1	0,6	0,5	0,6	2,1 ± 0,20	1,1
a Tube diameter (nominal coupling size); not shown in Figure 11.													

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