INTERNATIONAL STANDARD

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Fourth edition
2017-11

Gas cylinders — Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning

Bouteilles à gaz — Raccords de sortie de robinets de bouteilles à gaz et mélanges de gaz — Choix et dimensionnement

Reference number
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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).

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For an explanation on the voluntary nature of standards, 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.

This document was prepared by Technical Committee ISO/TC 58 *Gas cylinders*, Subcommittee SC 2 *Cylinder fittings*.

This fourth edition cancels and replaces the third edition (ISO 5145:2014), which has been technically revised.

This edition includes the following significant changes with respect to the previous edition:

— reference to ISO 14456 has been added;

— former Annex A on gas groups and FTSC codes has been removed.

Introduction

At the beginning of the 1960s, the members of ISO/TC 58/SC 2 were charged with the task of drafting an International Standard on gas cylinder valve outlets.

It soon became obvious that millions of different types of valve outlets are in use and the various countries concerned were not ready to give up their own systems. It was, therefore, only possible to draw up a list of the existing provisions, either standardized or in use, which was published as ISO/TR 7470. The number and variety of such provisions give an idea of the complexity and scope of the task.

Towards the end of the 1970s, ISO/TC 58/SC 2 realized that the task at hand could only be achieved by adopting a long-term solution; this was to create an ideal system of valve outlets which would not be interchangeable with the existing systems. This system would be based on the four fundamental criteria of safety, simplicity, compactness, and tightness.

Two key actions were then undertaken in parallel:

— a classification and grouping of gases and gas mixtures;

— a practical definition of an original and non-interchangeable connection system.

This document represents a synthesis of these two actions. It is a practical guide for the selection of cylinder valve outlets for gases and gas mixtures. In view of the fact that no country seemed ready to give up their national standards and to adopt an International Standard specifying the dimensions of gas cylinder valve outlets, it was agreed that this document need not be complied with where a national standard predates it.

This document presents a logical system for determining valve outlets for gas cylinders for all gases or gas mixtures. It is of special interest for those countries that have no national standards or regulations. Its provisions can be called for in the future in cases where a new gas or gas mixture is developed industrially.

The main purpose in standardizing valve outlets is to prevent the interconnection of non-compatible gases. The user is cautioned to ensure that a particular outlet connection when used is compatible with any other connections or gases that might be connected to that outlet. Because of the multiplicity of connections in use and the existence of many national standards, this concern cannot be overstated.

This document thus represents a basis for international agreement in the more or less remote future.

Gas cylinders — Cylinder valve outlets for gases and gas mixtures — Selection and dimensioning

1 Scope

This document establishes practical criteria for determining valve outlet connections for gas cylinders.

It applies to the selection of gas cylinder valve outlet connections and specifies the dimensions for a number of them.

This document is not applicable to connections used for cryogenic gas withdrawal or gases for breathing equipment, which are the subjects of other International Standards.

NOTE Other safeguard provisions like labelling or colour coding are not affected by this document.

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 10156, *Gas cylinders — Gases and gas mixtures — Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets*

ISO 10298, *Gas cylinders — Gases and gas mixtures — Determination of toxicity for the selection of cylinder valve outlets*

ISO 13338, *Gas cylinders — Gases and gas mixtures — Determination of tissue corrosiveness for the selection of cylinder valve outlets*

ISO 14456, *Gas cylinders — Gas properties and associated classification (FTSC) codes*

3 Terms and definitions

No terms and definitions are listed in this document.

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 https://www.iso.org/obp

4 Principle of the determination of valve outlets

4.1 Basic principle

ISO 14456 establishes a method of allocating to any gas or gas mixtures contained in cylinders a four-digit code (FTSC). This numerical code categorizes the gas or gas mixture in terms of its physical-chemical properties and/or flammability, toxicity, state of the gas (compressed gas and pressure rating, liquefied, etc.), and corrosiveness, as specified in ISO 14456. FTSC is the abbreviation of these properties.

The FTSC code enables a gas or gas mixture to be assigned to one of the 15 “compatible” gas groups (see ISO 14456). Valve outlet connections are allocated to each group (see Clause 6).

NOTE 1 Attention is drawn to the fact that the only purpose of the numerical code is to group compatible gases together in order that the particular valve outlet assigned to each group can be selected. The code is only applicable for the valve outlet selection used in this International Standard and is not intended as an identification code.

NOTE 2 For example, for pressure rating subdivision 5 corresponds to working pressure between 35 bar and 250 bar.

4.2 Single gases

Single gases are assigned to one of the first 14 gas groups, group 15 being reserved for specific gas mixtures. It is recognized that a “pure gas” can contain some impurities, but it is intended that this should not affect the valve outlet selection.

Five of these groups only contain one single gas and are assigned to individual named gases from which mixtures and other gases are excluded. These five groups are as follows:

a) group 2 - carbon dioxide;

b) group 5 - air;

c) group 10 - oxygen;

d) group 11 - nitrous oxide;

e) group 14 - acetylene.

4.3 Gas mixtures

4.3.1 Definition

For the purposes of this document, a gas mixture is defined as an intentional combination of two or more gases, which can be either in the gaseous phase or liquefied under pressure when in a gas cylinder.

NOTE This document does not attempt to identify gas mixtures which can be safely and satisfactorily prepared; this is the responsibility of the gas manufacturer. It does not describe any methods or techniques for preparing gas mixtures.

4.3.2 Assignment of a gas mixture to a group

The principle of allocation of a FTSC code to gas mixtures is the same as that for single gases. The allocation of the FTSC code to a gas mixture, which allows the assignment of this mixture to one of the group of gases and gas mixtures (see ISO 14456), depends on the flammability, oxidizing ability, toxicity, and corrosiveness of the final mixture. For the determination of flammability and oxidizing ability, ISO 10156 shall be used, for toxicity, ISO 10298 shall be used, and for corrosiveness, ISO 13338 shall be used.

Mixtures containing spontaneously flammable gases (i.e. pyrophoric gases such as silane in ISO 14456:2015, Table 10) shall be considered as spontaneously flammable gas mixtures if the content of the pyrophoric gas(es) is more than 1,4 %.

5 Determination of connection

5.1 Connection

A connection is a mechanical device which conveys gas via a gas cylinder valve to a filling or use system without leakage to the atmosphere. It shall be robust and able to withstand repeated connection and

disconnection. It shall be designed such that it can only be used for the group of gases to which it is allocated.

A connection comprises a minimum of three parts (see Figure 1):

a) a valve outlet — the part of the cylinder valve through which gas is discharged;

b) a connector — the part of the filling or use system through which the gas is conveyed;

c) a union nut — the means by which the connector is secured to the valve outlet and by which the seal is ensured.

Annex B specifies requirements and provides recommendations regarding the use of union nuts requiring tools.

The design of the double-recess type of connection is derived from the "step index principle".

The step index system comprises a double recess (faucet) into the valve outlet into which a spigot of two different diameters is designed to fit (see the figure in Table 1). The lengths of the recesses and spigots are the same for each connection but the diameters vary depending on the group of gases for which the recess or spigot is designed. The form, dimensions, and tolerances are illustrated in Table 1, which provides 42 non-interchangeable connections.

Three nominal diameters (24 mm, 27 mm, and 30 mm) have been adopted for the connections (specified in Annex A). The thread is a Whitworth thread with a pitch of 2 mm (see Figure 2).

NOTE Internal "double-recess step index connections" are not used because of their excessive size.

The dimensions in Figure 2 shall be toleranced according to the general principles for thread dimensioning. The tolerances shall be chosen from applicable national standards, or if they do not exist, use the example provided in Figure 2. Bilateral tolerancing systems, such as those in ISO 2768 (all parts), shall not be used. The dimensions are given in Table 2.

5.2 Leak tightness

Leak tightness is achieved by sealing the end of the connector bearing on the conical part of the valve outlet connection. This seal is maintained by the union nut (see Annex A).

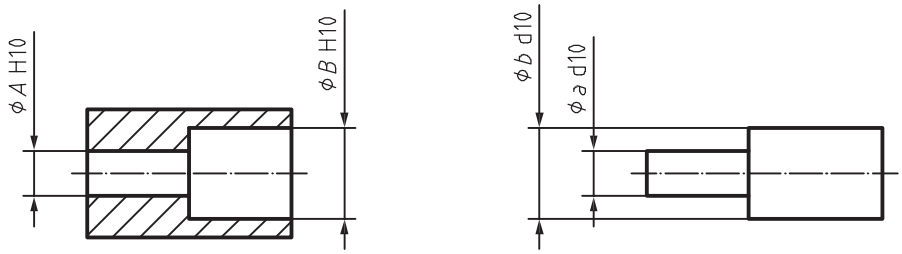
Other methods of sealing can be adopted provided the non-interchangeability between connector types is maintained.

No details of the external dimensions of the union nut are given since this will be subject to the method adopted for applying the sealing force (e.g. with a wrench or by hand).

This document does not specify the choice of materials; however, it is necessary to employ materials for the O-ring, valve, and valve connector which are compatible with the gas content in the cylinder and the service for which they are intended.

Table 1 — Non-interchangeable combinations *A* + *B*

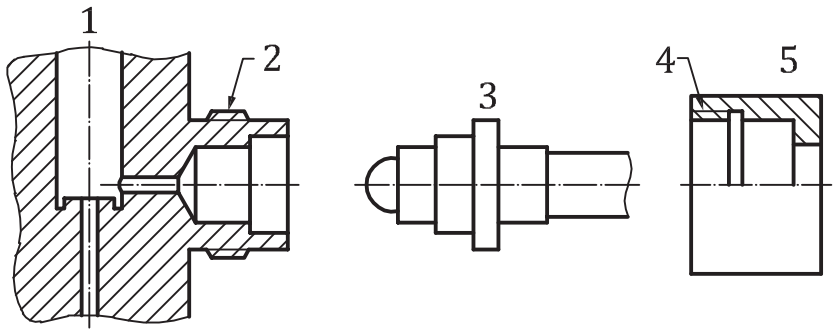
Dimensions in millimetres



Female Male

Nominal diameter of the connection = nominal thread diameter *D*, *d*	Constant *A* + *B*						Available combinations		
	28		32		36				
	A	*B*	*A*	*B*	*A*	*B*	Right-hand thread	Left-hand thread	Total of right- and left-hand threads
24	11,2 11,9 12,6 13,3 14	16,8 16,1 15,4 14,7 14	—	—	—	—	5	5	10
27	—	—	11,8 12,5 13,2 13,9 14,6 15,3 16	20,2 19,5 18,8 18,1 17,4 16,7 16	—	—	7	7	14
30	—	—	—	—	12,4 13,1 13,8 14,5 15,2 15,9 16,6 17,3 18	23,6 22,9 22,2 21,5 20,8 20,1 19,4 18,7 18	9	9	18
Total number of combinations							21	21	42

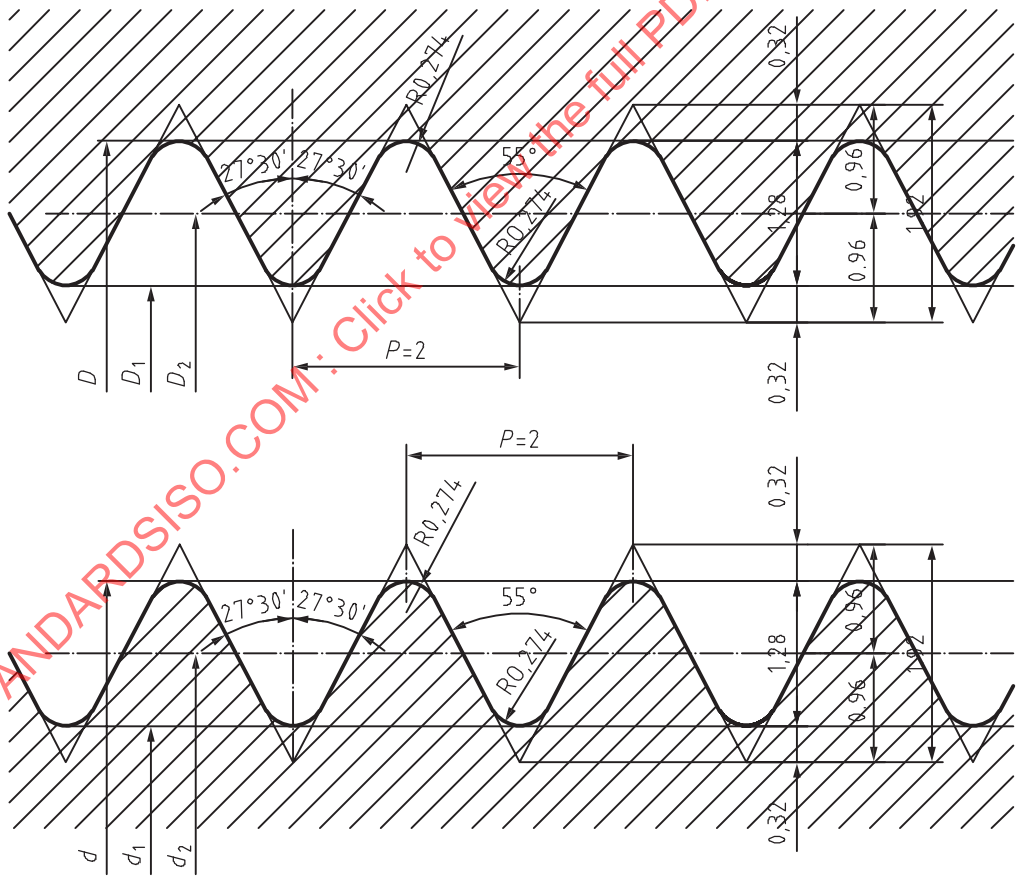
NOTE For the tolerances, see ISO 286-1 and ISO 286-2.



Key

1 valve
2 thread according to Figure 2
3 connector
4 thread according to Figure 2
5 union nut

Figure 1 — Principles for male and female connection



Nominal diameter = major diameter	D_t d	24	27	30
Pitch diameter	D_2 d_2	22,72	25,72	28,72
Minor diameter	D_1 d_1	21,44	24,44	27,44

Figure 2 — Basic dimensions of Whitworth threads with pitch *P* equal to 2 mm

Table 2 — Basic dimensions of Whitworth threads with pitch *P* equal to 2 mm

	Internal thread (union nut)	External thread (valve)
Nominal diameter = major diameter = D, d	D minimal (tolerances optional)	–38 –280
Pitch diameter = D_2, d_2	+224 +0	–38 –170
Minor diameter = D_1, d_1	+375 +0	D maximum (tolerances optional)

6 Marking

The outlets and the connections shall be marked with the number of the corresponding outlet as indicated in Table 3.

Table 3 — Marking of connections

Nominal diameter	A	B	Mark number	
			Left hand	Right hand
24	11,2	16,8	6	1
	11,9	16,1	7	2
	12,6	15,4	8	3
	13,3	14,7	9	4
	14	14	10	5
27	11,8	20,2	18	11
	12,5	19,5	19	12
	13,2	18,8	20	13
	13,9	18,1	21	14
	14,6	17,4	22	15
	15,3	16,7	23	16
	16	16	24	17
30	12,4	23,6	34	25
	13,1	22,9	35	26
	13,8	22,2	36	27
	14,5	21,5	37	28
	15,2	20,8	38	29
	15,9	20,1	39	30
	16,6	19,4	40	31
	17,3	18,7	41	32
	18	18	42	33

7 Allocation of connections

The allocation of 33 connections from the 42 that are available is shown in Table 4. Table 5 shows that each group of gases has been established in accordance with

a) the FTSC code,

b) the gases for other groups which can be component parts of the mixture of which the final properties are similar to those of that group, and

c) the connection(s) which is (are) allocated to the group.

In Table 4, the numbers of the outlets are added in bold font. To refer to one of these outlets, use e.g. ISO 5145 N°2 for oxygen (4050).

NOTE Annex C gives examples of allocation of cylinder valve outlets for the use of medical gases.

Table 4 — Allocation of valve outlets for gases and gas mixtures by connection mark number

Nominal diameter of the connection														
24					27					30				
A-B combination mm	Left-hand thread		Right-hand thread		*A-B* combination mm	Left-hand thread		Right-hand thread		*A-B* combination mm	Left-hand thread		Right-hand thread	
	Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)		Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)		Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)
11,2–16,8	8 (M)[a]	Medical cyclopropane (2100) **N°6**	3 (M)	Helium (0150) and Xenon (0110) **N°1**	11,8–20,2		**N°18**	3 (M) (I)	Nitrogen (0150) **N°11**	12,4–23,6		**N°34**	3 (M)	Helium-oxygen or Nitrogen – oxygen mixtures (O_2 < 20 %) **N°25**
11,9–16,1		**N°7**	10 (I)	Oxygen (4050) **N°2**	12,5–19,5		**N°19**	12 (I)	(4153 ; 4203; 4300; 4301; 4303; 4330; 4343;4350) **N°12**	13,1–22,9		**N°35**	15 (M)	O_2 + N_2 (O_2 > 23,5 %) or O_2 + He (O_2 ≥ 20 %) mixtures **N°26**
12,6–15,4		**N°8**	15 (M)	Medicinal air and synthetic medicinal air (20 % ≤ O_2 ≤ 23,5 %) (1050) **N°3**	13,2–18,8		**N°20**	15 (M)	50 % O_2-50 % N_2O mixture **N°13**	13,8–22,2		**N°36**	15 (M)	O_2-CO_2 mixture (CO_2 ≤ 7 %) **N°27**
13,3–14,7	6 (I)	(2150) except H_2 **N°9**	3 (I) (M)	Inert gases and gas mixtures (0150) except for He and N_2 **N°4**	13,9–18,1	13 (I)	(5100; 5200; 5300; 5301; 5350) **N°21**	5 (I)	Air (1050) **N°14**	14,5–21,5		**N°37**	15 (M)	O_2-CO_2 mixture (CO_2 > 7 %) Air + He + CO (CO < 1 %) mixture **N°28**

[a] I for industrial applications; M for medical applications.

Table 4 *(continued)*

Nominal diameter of the connection															
24					27					30					
***A-B* combination** mm	**Left-hand thread**		**Right-hand thread**		***A-B* combination** mm	**Left-hand thread**		**Right-hand thread**		***A-B* combination** mm	**Left-hand thread**		**Right-hand thread**	
	Group (utilization)[a]	**Gas or gas mixture (FTSC code)**	**Group (utilization)[a]**	**Gas or gas mixture (FTSC code)**		**Group (utilization)[a]**	**Gas or gas mixture (FTSC code)**	**Group (utilization)[a]**	**Gas or gas mixture (FTSC code)**		**Group (utilization)[a]**	**Gas or gas mixture (FTSC code)**	**Group (utilization)[a]**	**Gas or gas mixture (FTSC code)**
14–14	6 (I)[a]	Hydrogen (2150) **N°10**	10 (M)	Oxygen (4050) **N°5**	14,6–17,4	9 (I)	(3300; 3310; 3150) **N°22**	4 (I)	(0200; 0201; 0203; 0213; 0300; 0303; 0253) **N°15**	15,2–20,8	6 (I)	(2170) **N°38**	3 (M)	N + NO mixture (100 < NO < 1 000 ppm) **N°29**
					15,3–16,7	8 (I)	Carbon monoxide (2250) **N°23**	11 (M)	Nitrous oxide (4110) **N°16**	15,9–20,1	8 (I)	(2200; 2201;2203; 2300; 2301) **N°39**	3 (I)	(0170) **N°30**
					16–16	6 (I)	Commercial butane and propane (2100) **N°24**	2 (M)	Carbon dioxide (0110) **N°17**	16,6–19,4	7 (I)	(2102) **N°40**	5 (I) (M)	(1070) **N°31**

[a] I for industrial applications; M for medical applications.

Table 4 *(continued)*

Nominal diameter of the connection															
24					27					30					
A-B combination mm	Left-hand thread		Right-hand thread		*A-B* combination mm	Left-hand thread		Right-hand thread		*A-B* combination mm	Left-hand thread		Right-hand thread	
	Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)		Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)		Group (utilization)[a]	Gas or gas mixture (FTSC code)	Group (utilization)[a]	Gas or gas mixture (FTSC code)
										17,3–18,7	6 (I)	(2100; 2110) (except commercial butane and propane) **N°41**	10 (I) (M)	(4070) **N°32**
										18–18	14 (I)	Acetylene (5130)	1 (M)	SF_6, C_2F_6, C_3F_8
												N°42	1 (I)	(0100) **N°33**

[a] I for industrial applications; M for medical applications.

Table 5 — Allocation of valve outlets by gas group

Group no.	Gas and gas mixture characteristics at 15 °C	Allocation of outlet connections							
		Single gases, main FTSC codes	Right-hand (RH) or left-hand (LH) thread	Nominal diameter of the connection					
				24		27		30	
				A-B **combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B*** **combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B*** **combination** mm	**Gases and gas mixtures and/or FTSC code**
1	Non-flammable and non-toxic gases; less stable thermally than group 3	0100	RH					18–18 **N°33**	0100 SF6, C2F6, C3F8
2	Carbon dioxide	0110	RH			16–16 (M) **N°17**	0110		
3	Non-flammable, non-toxic, and thermally stable gases (except carbon dioxide)	0150 0170 0110 (xenon)	RH	11,2–16,8 **N°1**	Helium and Xenon	11,8–20,2 **N°11**	Nitrogen (M) (I)	12,4–23,6 **N°25**	Helium-oxygen or Nitrogen – oxygen mixtures (O_2 < 20 %)
				13,3–14,7 **N°4**	Inert gas and gas mixtures			15,9–20,1 30	0170
								15,2–20,8 **N°29**	N_2 + NO mixture (100 < NO < 1 000 ppm)
4	Non-flammable, toxic, and corrosive or corrosive by hydrolysis gases	0200; 0201; 0203; 0213; 0300; 0303; 0253	RH			14,6–17,4 **N°15**	0200; 0201; 0203; 0213; 0300; 0303; 0253		
5	Air only[b]	1050 1070	RH			13,9–18,1 **N°14**	1050 Air (I)	16,6–19,4 **N°31**	1070 Air (I) (M)
6	Flammable and non-toxic gases	2100; 2110; 2150; 2170	LH	14–14 **N°10**	H_2 ≤ 250 bar	16–16 **N°24**	Commercial butane, and propane 2100	15,2–20,8 **N°38**	2170
				13,3–14,7 **N°9**	2150 (except H_2)			17,3–18,7 **N°41**	2100; 2110 except commercial butane and propane
7	Flammable and corrosive (basic gases)	2102	LH					16,6–19,4 **N°40**	2102

[a] Caution: This valve outlet is used for two different applications (oxidising, toxic and/or corrosive gases, and medicinal breathable application). However, these applications are so different that this is found acceptable (toxic gas will never be distributed in a hospital).

[b] For medical application, see group 15.

Table 5 *(continued)*

Group no.	Gas and gas mixture characteristics at 15 °C	Allocation of outlet connections							
		Single gases, main FTSC codes	Right-hand (RH) or left-hand (LH) thread	Nominal diameter of the connection					
				24		27		30	
				A-B **combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B*** **combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B*** **combination** mm	**Gases and gas mixtures and/or FTSC code**
8	Flammable, toxic, and corrosive (acidic) or non-corrosive gases	2200	LH	11,2–16,8 **N°6**	Medical Cyclopropane	15,3–16,7 **N°23**	Carbon monoxide 2250	15,9–20,1 **N°39**	2200; 2201; 2203; 2300; 2301
9	Spontaneously flammable gases	3150; 3300; 3310	LH			14,6–17,4 **N°22**	3150; 3300; 3310		
10	Oxygen	4050 4070	RH	14–14 **N°5**	4050 (M)			17,3–18,7 **N°32**	4070 (I) (M)
				11,9–16,1 **N°2**	4050 (I)				
11	Nitrous oxide	4110	RH			15,3–16,7 **N°16**	4110 (M)		
12	Oxidant, toxic, and corrosive gases	4203; 4300; 4301; 4303; 4330; 4343; 4351	RH			12,5–19,5 **N°12**[a]	4203; 4300; 4301; 4303; 4330; 4343; 4351		
13	Flammable gases subject to decomposition or polymerization	5100; 5200; 5300; 5301; 5350	LH			13,9–18,1 **N°21**	5100; 5200; 5300; 5301; 5350		
14	Acetylene only	5130	LH					18–18 **A.1.1 N°42**	5130 (Acetylene)

[a] Caution: This valve outlet is used for two different applications (oxidising, toxic and/or corrosive gases, and medicinal breathable application). However, these applications are so different that this is found acceptable (toxic gas will never be distributed in a hospital).

[b] For medical application, see group 15.

Table 5 *(continued)*

Group no.	Gas and gas mixture characteristics at 15 °C	Allocation of outlet connections							
		Single gases, main FTSC codes	Right-hand (RH) or left-hand (LH) thread	Nominal diameter of the connection					
				24		27		30	
				***A-B* combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B* combination** mm	**Gases and gas mixtures and/or FTSC code**	***A-B* combination** mm	**Gases and gas mixtures and/or FTSC code**
15	Oxidant, non-toxic, and non-corrosive gas mixtures		RH	12,6–15,4 **N°3**	Medicinal air and synthetic medicinal air (M)	13,2–18,8 **N°13**	50 % N_2O-50 % O_2 mixture (M)	13,1–22,9 **N°26**	$O_2 + N_2$ or O_2- + He mixtures
						12,5–19,5 **N°28**[a]	Air and breathable gases with oxygen content of more than 20 % and less than 23,5 % +He+CO (CO < 1 %) mixture (M)	13,8–22,2 **N°27**	O_2-CO_2 (CO_2 ≤ 7 %) (M)
								14,5–21,5 **N°28**	CO_2-O_2 (CO_2 > 7 %) (M)

[a] Caution: This valve outlet is used for two different applications (oxidising, toxic and/or corrosive gases, and medicinal breathable application). However, these applications are so different that this is found acceptable (toxic gas will never be distributed in a hospital).

[b] For medical application, see group 15.

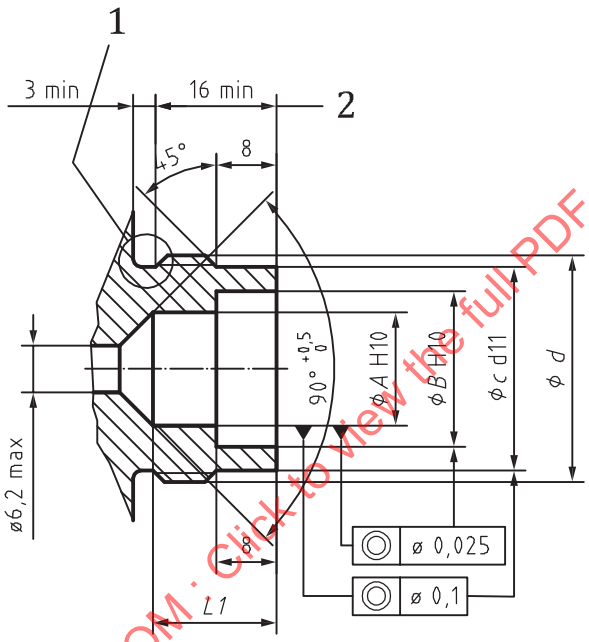
Annex A
(normative)

Connections

A.1 Valve outlets

See Figure A.1 and Table A.1.

Dimensions in millimetres



Key

1 with/without undercut
2 fully formed thread

NOTE The tolerance on lengths is ± 0,1 mm.

Figure A.1 — Valve outlet

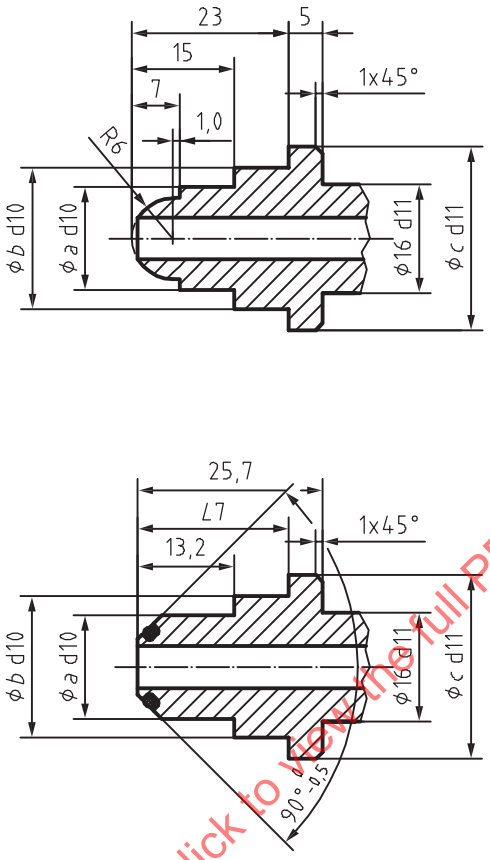
Table A.1 — Dimensions of valve outlets

Thread, left and right hand (*d*)	(*A*/*a*) - (*B*/*b*) mm	**Constant**	(*C*/*c*) mm	*L*1 mm
*W*24x2	11,2–16,8	28	21	17,6
	11,9–16,1			17,3
	12,6–15,4			17
	13,3–14,7			16,6
	14–14			16,3
*W*27x2	11,8–20,2	32	24	17,4
	12,5–19,5			17
	13,2–18,8			16,7
	13,9–18,1			16,3
	14,6–17,4			16
	15,3–16,7			15,6
	16–16			15,3
*W*30x2	12,4–23,6	36	27	17,8
	13,1–22,9			17,4
	13,8–22,2			17
	14,5–21,5			16,7
	15,2–20,8			16,3
	15,9–20,1			16
	16,6–19,4			15,7
	17,3–18,7			15,3
	18–18			15

A.2 Connectors

See Figure A.2, Table A.2, and Figure A.4.

Dimensions in millimetres



NOTE 1 If spherical end connectors (hard seat connectors) are used, similar dimensions will be used and Annex B is followed.

NOTE 2 The tolerance on lengths is ±0,1 mm.

Figure A.2 — Connectors

Table A.2 — Dimensions of connectors

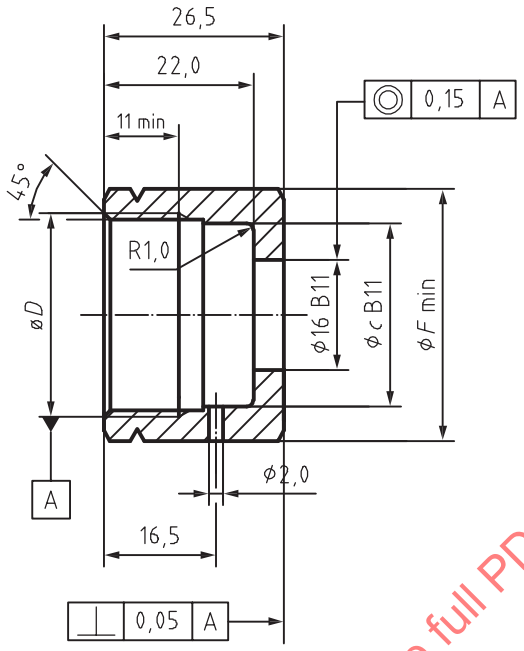
Thread, left and right (*d*)	(*A*/*a*) – (*B*/*b*)	**Constant** *A+B*	(*C*/*c*)	*L7*
	mm		mm	mm
	11,2–16,8			21,5
	11,9–16,1			21,5
*W*24x2	12,6–15,4	28	21	21,2
	13,3–14,7			21,2
	14–14			21,2
	11,8–20,2			21,5
	12,5–19,5			21,2
	13,2–18,8			21,2
*W*27x2	13,9–18,1	32	24	21,2
	14,6–17,4			21,2
	15,3–16,7			21,2
	16–16			21,2
	12,4–23,6			21,2
	13,1–22,9			21,2
	13,8–22,2			21,2
	14,5–21,5			21,2
*W*30x2	15,2–20,8	36	27	21,2
	15,9–20,1			21,2
	16,6–19,4			21,2
	17,3–18,7			21,2
	18–18			21,2

NOTE The tolerance on lengths is ±0,1 mm.

A.3 Union nut

See Figure A.3 and Table A.3.

Dimensions in millimetres



NOTE 1 The tolerance on lengths is ±0,1 mm.

NOTE 2 Left hand threaded nuts are “nicked”.

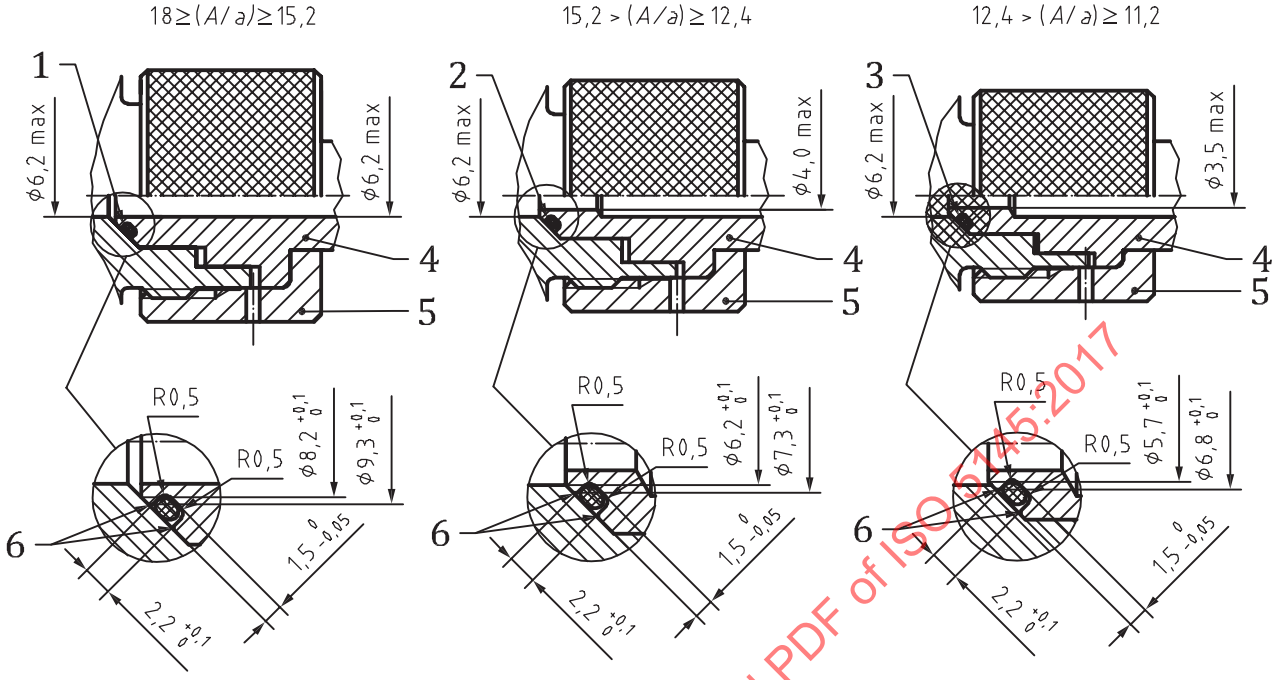
Figure A.3 — Union nut

Table A.3 — Dimensions of the union nut (in millimetre)

Nominal thread diameter *D* = nominal diameter of the connection	*C*	*F*
24	21	31
27	24	34
30	27	37

NOTE The tolerance on lengths is ±0,1 mm.

A.4 Metal on elastomer seal - O-ring/groove details



Key

1, 2, and 3	O-rings
4	nipple
5	nut
6	chamfer 0,2 mm
A	See Table 1

The dimensions of the O-rings for the nipple are generally the following:

— for 1: 7,66 × Ø 1,78;
— for 2: 6,07 × Ø 1,78;
— for 3: 5,28 × Ø 1,78.

The minimum hardness is 80 Shore A.

Figure A.4 — Examples of mounting the O-ring groove

Annex B
(normative)

Use of union nuts requiring tools

For connectors using a nut which can be tightened with a tool, there is a possibility that the threading system can be overstressed accidentally when using such a tool to tighten the connection.

If a nut which can be tightened with a tool is to be used, it shall be marked “30 N.m max”.

Use of the alternative soft sealing connector (elastomeric) which seals handtight with a nut that requires no tool is recommended where safety and operational concerns permit.

NOTE The hard seat connection design normally requires no more than 15 N.m. of torque to be applied for a seal to be made.

Annex C
(informative)

Examples of allocation of cylinder valve outlets for the use of medical gases

C.1 General

This annex gives examples of how to allocate cylinder valve outlets in the case of gases for medical use to ensure patient safety. Such gases are treated differently depending on whether they are gases for inhalation or for other purposes. Allocation is based on the pharmacological and therapeutic properties of the gases and not physical aspects such as pressure definitions.

C.2 Definitions

C.2.1 Gas for medical use

Any gas or mixture of gases intended to be administered to patients for therapeutic, diagnostic, or prophylactic purposes, with or without pharmacological action, or to be used for surgical tools. It covers so respectively both medicinal and medical gases.

C.2.2 Medicinal gas

Any gas or mixture of gases intended to be administered to patients for therapeutic, diagnostic, or prophylactic purposes using pharmacological action and classified as a medicinal product, e.g. according to Reference [11].

C.2.3 Gas for inhalation

Medicinal gas intended for introduction into the body through respiration. The gas is administrated alone directly or after mixing at the point of use with oxygen or air.

C.2.4 Medicinal gas mixture containing oxygen

Gas mixture which oxygen content is to be taken in account in order to limit the duration of the inhalation under standard atmospheric conditions, for example, binary mixtures (from nitrogen, helium, nitrous oxide, carbon dioxide) or ternary mixtures or more used e.g. for lung function testing (LFT). Medicinal gas mixtures containing oxygen can be classified as follows:

— hypoxic mixtures: mixtures with lower than normal O_2 content: gas with $O_2 < 20\ \%$[1)] for short term inhalation;

— hyperoxic mixtures: mixtures with greater than normal O_2 content: gas with $O_2 > 23{,}5\ \%$ for continuous inhalation;

— normoxic mixtures: mixtures with normal O_2: $20\ \%$[1)] $\leq O_2 \leq 23{,}5\ \%$ for continuous inhalation.

1) 19,5 % for some national pharmacopoeia.