INTERNATIONAL STANDARD

ISO 12209

First edition
2013-09-01

Gas cylinders — Outlet connections for gas cylinder valves for compressed breathable air

Bouteilles à gaz — Raccords de sortie pour robinets de bouteilles à gaz pour air comprimé respirable

Reference number
ISO 12209:2013(E)

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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.

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.

ISO 12209 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 2, *Cylinder fittings,* in collaboration with Technical Committee CEN/TC 23, *Transportable gas cylinders*.

This first edition of ISO 12209 cancels and replaces the first editions of the ISO 12209 series (ISO 12209-1:2000, ISO 12209-2:2000, ISO 12209-3:2000), which have been technically revised.

The main changes are:

— combination of former three parts of ISO 12209 into a single ISO 12209;

— modification of valve outlet, adaptor and o-ring dimensions; and

— addition of an outlet connection type test procedure in Annex A.

Gas cylinders — Outlet connections for gas cylinder valves for compressed breathable air

1 Scope

This International Standard specifies the characteristics of outlet connections for gas cylinder valves for compressed breathable air gas cylinders. It states the fundamental requirements for both; the connection and its components and includes basic dimensions. Included in this International Standard are the following connections:

— yoke type outlet connection for SCUBA use up to a maximum cylinder working pressure of 232 bar;

— threaded type outlet connections up to a maximum cylinder working pressure of 232 bar and 300 bar; and

— threaded type outlet connection for SCUBA use up to a maximum cylinder working pressure of 232 bar including adaptor for users to convert into a yoke type outlet.

Annex A gives the outlet connection type test procedures.

Requirements for cylinder valves (see ISO 10297) are not covered by this International Standard.

Requirements for material specifications and gas/material compatibility (see ISO 11114-1 and ISO 11114-2) are not covered by this International Standard.

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 2768-1, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
working pressure
settled pressure of a compressed gas at a uniform reference temperature of 15 °C in a full gas cylinder

[SOURCE: ISO 10286:2007, definition A.2.8]

3.2
SCUBA
self-contained underwater breathing apparatus

3.3
compressed breathable air
gas which has the nominal composition of atmospheric air and is subject to purity level controls

4 Yoke type outlet connection for SCUBA use up to a maximum cylinder working pressure of 232 bar

Figure 1 shows an example of the yoke type outlet connection in the assembled state.

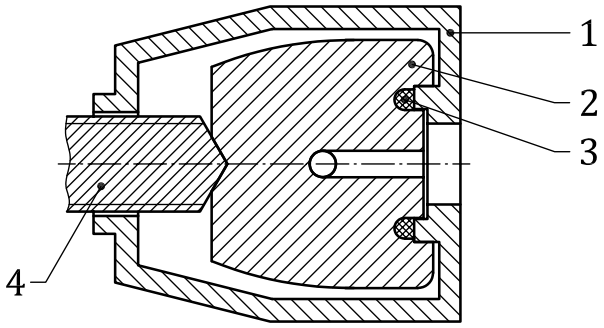
The valve outlet and o-ring dimensions including minimum shore hardness (HS) are shown in Figure 2 and given in Table 1 and Table 2.

The exact form of the o-ring groove is the responsibility of the manufacturer providing the connection passes the outlet connection type test according to Annex A using an o-ring specified in Table 2.

In order to ensure that the yoke does fit over the valve, minimum dimensions are given for the yoke (see Figure 3 and Table 3).

No outer dimensions are given for the yoke. However, the dimensions shall be chosen such that the yoke can resist a torque applied via the screw of 20 Nm without visible permanent deformation of the thread and/or the yoke. In addition, the tests described in Annex A shall be carried out.

Unless otherwise specified, the general tolerances for linear and angular dimensions shall be in accordance with class m of ISO 2768-1.



Key

1 yoke
2 valve outlet
3 o-ring
4 screw

Figure 1 — Yoke type connection — Assembly drawing

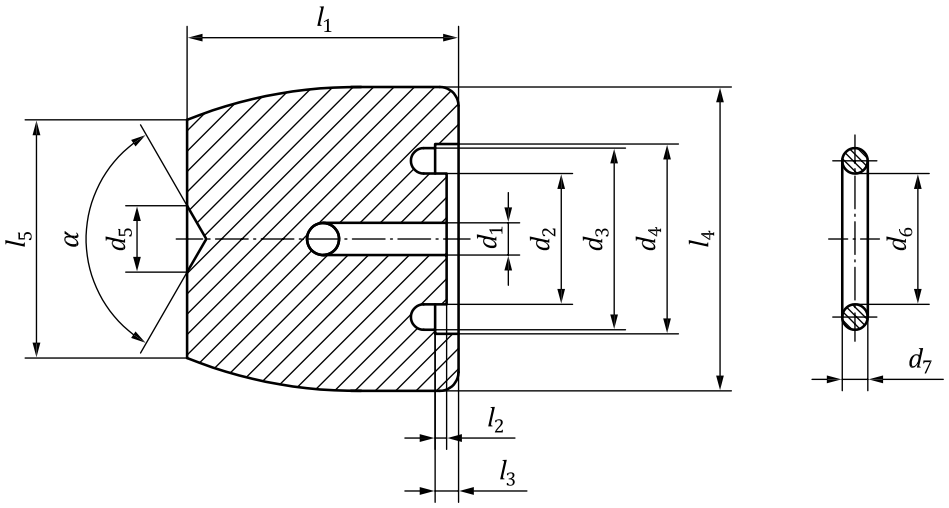


Figure 2 — Valve outlet dimensions

Table 1 — Valve outlet dimensions

Symbol	Dimension mm	Tolerance mm	Concentricity mm
d_1	to be specified by the manufacturer		
d_2	12,67 max.	—	0,1
d_3	17,45 max.	—	0,1
d_4	18,16	± 0,08	0,1
d_5	6,3	± 0,08	0,3
l_1	25,5 max.	—	not applicable
l_2	1,0 max.	—	not applicable
l_3	1,98	± 0,35	not applicable
l_4	28,58 max.	—	not applicable
l_5	22,5 max.	—	not applicable
α	120 °	—	not applicable

Table 2 — O-ring dimensions and properties

Symbol/Property	"Small type"		"Large type"	
	Dimension mm	Tolerance mm	Dimension mm	Tolerance mm
d_6	12,42	± 0,13	12,37	± 0,13
d_7	1,78	± 0,08	2,62	± 0,08
HS	(90 ± 5) Shore A			

NOTE 1 The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240) and the hardness is defined in ASTM D2240.

NOTE 2 The "small type" o-ring is commonly referred to as "-014" by most o-ring manufacturers. The "large type" o-ring is commonly referred to as "-112" by most o-ring manufacturers.

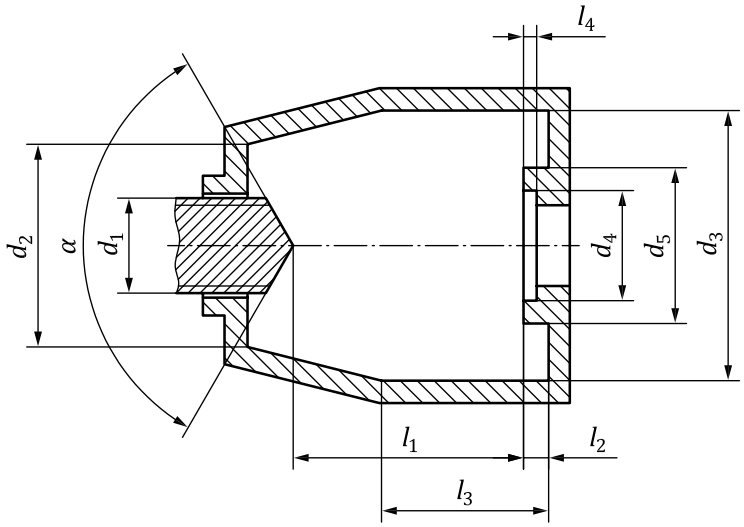


Figure 3 — Yoke dimensions

Table 3 — Yoke dimensions

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	26 min.	—	d_1	10 min	—
l_2	2,8 min.	—	d_2	23 min	—
l_3	18,8 min.	—	d_3	31 min	—
l_4	1,52 min.	—	d_4	12,8	+0,20 –0,05
α	110°	± 5°	d_5	17,9	± 0,05

5 Threaded type outlet connections up to a maximum cylinder working pressure of 232 bar and 300 bar

5.1 General requirements

The two outlet connections specified in this clause consist each of a valve outlet, a filling connector and a gas withdrawal connector. Use of the specified filling connectors is essential to ensure the safe use of each connection at its intended working pressure.

Basic dimensions for the valve outlet, connectors and its components are shown on Figures 4, 6, 8, 9, 11 and 13 and are specified in Tables 4, 5, 6, 7, 8 and 9 respectively.

Unless otherwise specified, the general tolerances for linear and angular dimensions shall be in accordance with class m of ISO 2768-1.

5.2 232 bar threaded outlet connection

5.2.1 General

The outlet connection specified here is intended for use at cylinder working pressures not exceeding 232 bar.

5.2.2 232 bar valve outlet

Figure 4 shows the valve outlet to be used for cylinders with a maximum working pressure of 232 bar and Table 4 specifies its dimensions.

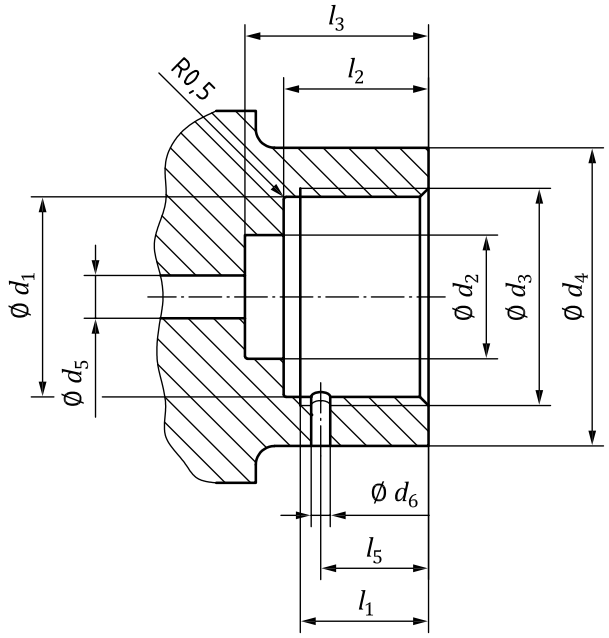


Figure 4 — 232 bar valve outlet

Table 4 — Dimensions of 232 bar valve outlet

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	10 min.	—	d_2	13	+0,3 0
l_2	15	0 –0,5	d_3	G 5/8[a]	—
l_3	19	+0,5 –0,2	d_4	30 min.	—
l_5	12	—	d_5	5 max.	—
d_1	20,5 min.	—	d_6	2	+1 0

[a] For dimensions of pipe threads, see ISO 228-1.

5.2.3 232 bar filling connection

Figure 5 is an assembly drawing of the filling connection to be used for filling cylinders up to a maximum working pressure of 232 bar.

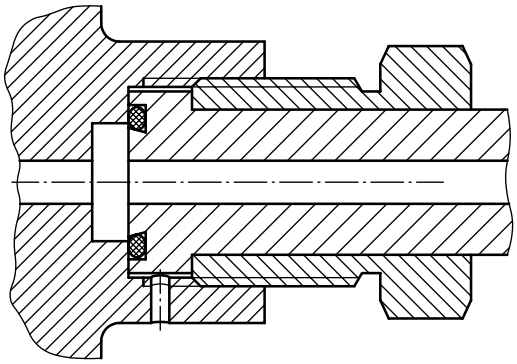


Figure 5 — 232 bar filling connection — Assembly drawing

Figure 6 shows the individual parts of the filling connector and Table 5 specifies their basic dimensions. The valve outlet is shown in Figure 4.

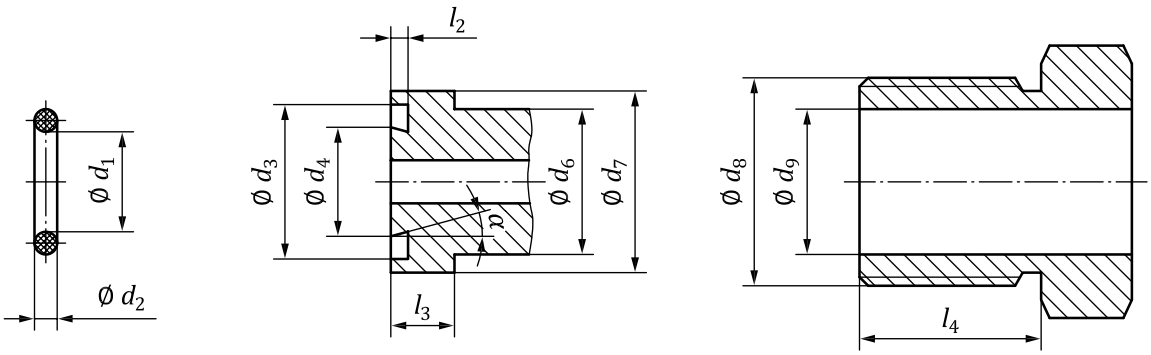


Figure 6 — 232 bar filling connector — Components

Table 5 — Dimensions of 232 bar filling connector

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_2	1,9	$^{0}_{-0,1}$	d_3	17	—
l_3	7	$^{0}_{-2}$	d_4	12	—
l_4	20	—	d_6	16	$^{-0,05}_{-0,16}$ [b]
α	15°	—	d_7	20 max.	—
d_1	11,2	—	d_8	G 5/8[a]	—
d_2	2,65	—	d_9	16	$^{+0,25}_{+0,15}$ [c]
NOTE The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240).					

[a] For dimensions of pipe threads, see ISO 228-1.

[b] The tolerance is taken from ISO 286 where it is defined as “d11”.

[c] The tolerance is taken from ISO 286 where it is defined as “B11”.

5.2.4 232 bar gas withdrawal connection

Figure 7 is an assembly drawing of the gas withdrawal connection for valves for use with cylinders with a maximum working pressure of 232 bar.

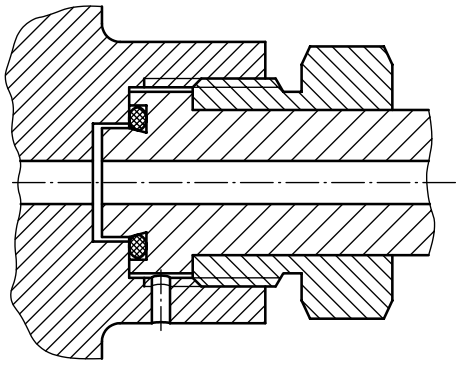


Figure 7 — 232 bar gas withdrawal connection — Assembly drawing

Figure 8 shows the individual components of the gas withdrawal connector and Table 6 specifies their basic dimensions. Figure 4 shows the valve outlet.

Table 6 — Basic dimensions of 232 bar gas withdrawal connector

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	3	—	d_3	17	—
l_2	1,9	$^{0}_{-0,1}$	d_4	12	$^{+0,1}_{0}$
l_3	7	$^{0}_{-2}$	d_6	16	$^{-0,05}_{-0,16}$ [b]
l_4	12	± 0,3	d_7	20 max.	—
a	15°	—	d_8	G 5/8[a]	—
d_1	11,2	—	d_9	16	$^{+0,25}_{+0,15}$ [c]
d_2	2,65	—	—	—	—

NOTE The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240).

[a] For dimensions of pipe threads, see ISO 228-1.

[b] The tolerance is taken from ISO 286 where it is defined as “d11”.

[c] The tolerance is taken from ISO 286 where it is defined as “B11”.

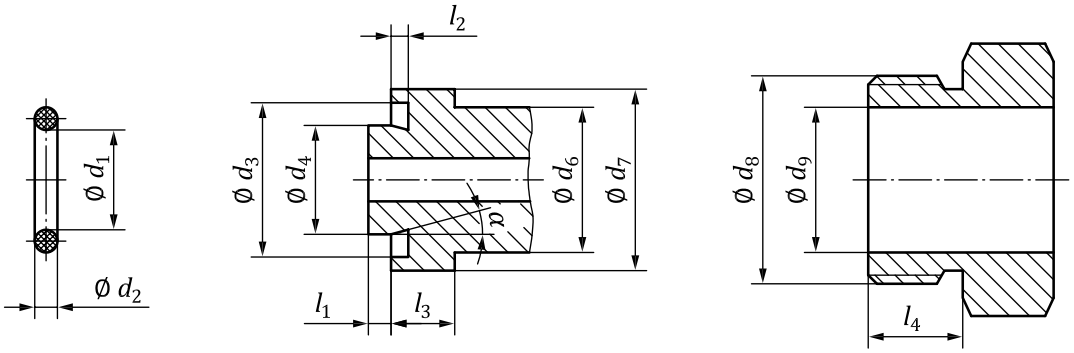


Figure 8 — 232 bar gas withdrawal connector — Components

5.3 300 bar threaded outlet connection

5.3.1 General

The outlet connection specified here is intended for use at cylinder working pressures not exceeding 300 bar.

5.3.2 300 bar valve outlet

Figure 9 shows the valve outlet to be used for cylinders with a maximum working pressure of 300 bar and Table 7 specifies its dimensions.

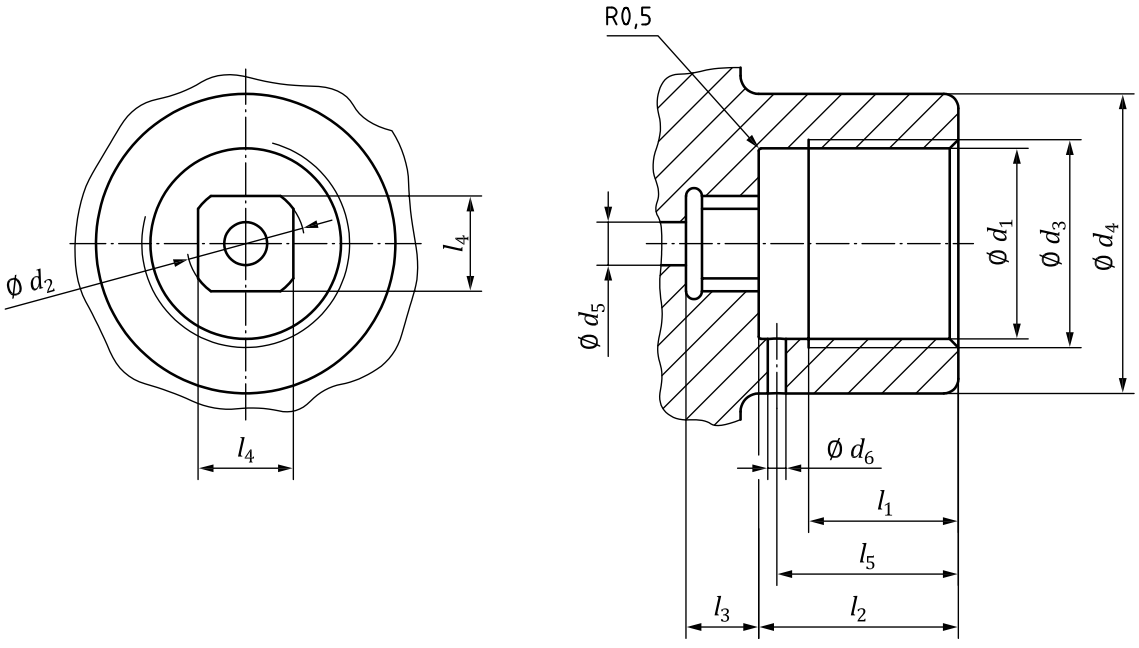


Figure 9 — 300 bar valve outlet

Table 7 — Dimensions of 300 bar valve outlet

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	16 min.	—	d_2	13	$^{0}_{-0,2}$
l_2	22	$^{+0,3}_{-0,1}$	d_3	G 5/8[a]	—
l_3	8	$^{0}_{-0,3}$	d_4	30 min.	—
l_4	10,5	± 0,1	d_5	5 max.	—
l_5	18	—	d_6	2	$^{+1}_{0}$
d_1	20,5 min.	—	—	—	—

[a] For dimensions of pipe threads, see ISO 228-1.

5.3.3 300 bar filling connection

Figure 10 is an assembly drawing of the filling connection to be used for filling cylinders up to a maximum working pressure of 300 bar.

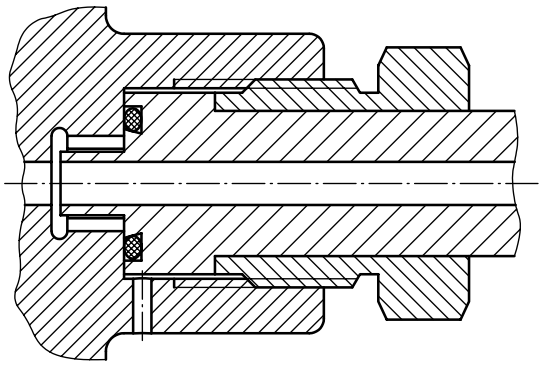


Figure 10 — 300 bar filling connection — Assembly drawing

Figure 11 shows the individual components of the filling connector and Table 8 specifies their basic dimensions. Figure 9 shows the valve outlet.

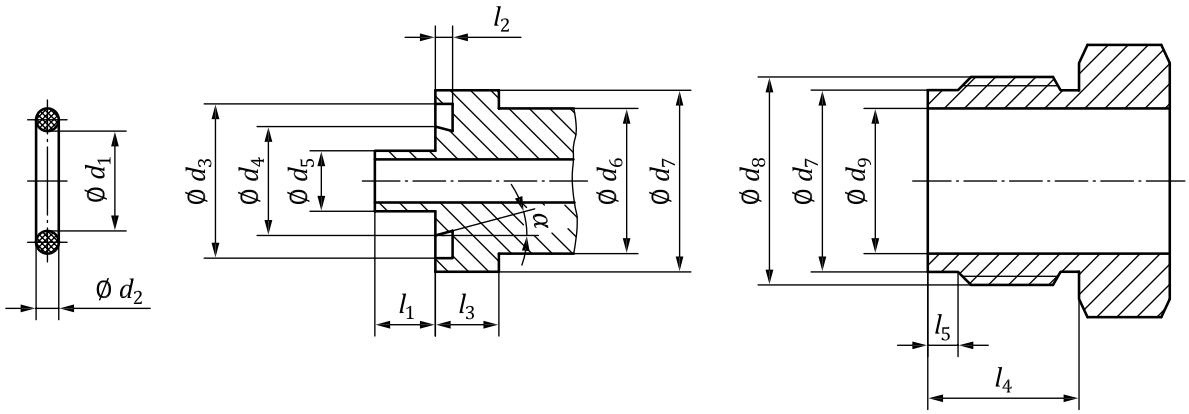


Figure 11 — 300 bar filling connector — Components

Table 8 — Dimensions of 300 bar filling connector

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	7	+0,3 0	d_3	17	—
l_2	1,9	0 –0,1	d_4	12	+0,1 0
l_3	10	+0,3 0	d_5	7	0 –0,1
l_4	17 min.	—	d_6	16	–0,05 –0,16 [b]
l_5	3	+0,5 0	d_7	20 max.	—
a	15°	—	d_8	G 5/8[a]	—
d_1	11,2	—	d_9	16	+0,25 +0,15 [c]
d_2	2,65	—	—	—	—

NOTE The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240).

[a] For dimensions of pipe threads, see ISO 228-1.

[b] The tolerance is taken from ISO 286 where it is defined as “d11”.

[c] The tolerance is taken from ISO 286 where it is defined as “B11”.

5.3.4 300 bar gas withdrawal connection

Figure 12 is an assembly drawing of the gas withdrawal connection for valves for use with cylinders with a maximum working pressure of 300 bar.

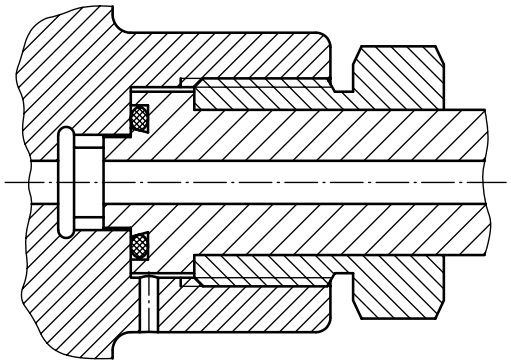


Figure 12 — 300 bar gas withdrawal connection — Assembly drawing

Figure 13 shows the individual components of the gas withdrawal connector and Table 9 specifies their basic dimensions. Figure 9 shows the valve outlet.

Table 9 — Basic dimensions of 300 bar gas withdrawal connector

Symbol	Dimension mm	Tolerance mm	Symbol	Dimension mm	Tolerance mm
l_1	3	—	d_3	17	—
l_2	1,9	0 −0,1	d_4	12	+0,1 0
l_3	7	—	d_5	10	0 −0,1
l_4	18 max.	—	d_6	16	−0,05 [b] −0,16
a	15°	—	d_7	20 max.	—
d_1	11,2	—	d_8	G 5/8[a]	—
d_2	2,65	—	d_9	16	+0,25 [c] +0,15
NOTE The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240).					
[a] For dimensions of pipe threads, see ISO 228-1.					
[b] The tolerance is taken from ISO 286 where it is defined as “d11”.					
[c] The tolerance is taken from ISO 286 where it is defined as “B11”.					

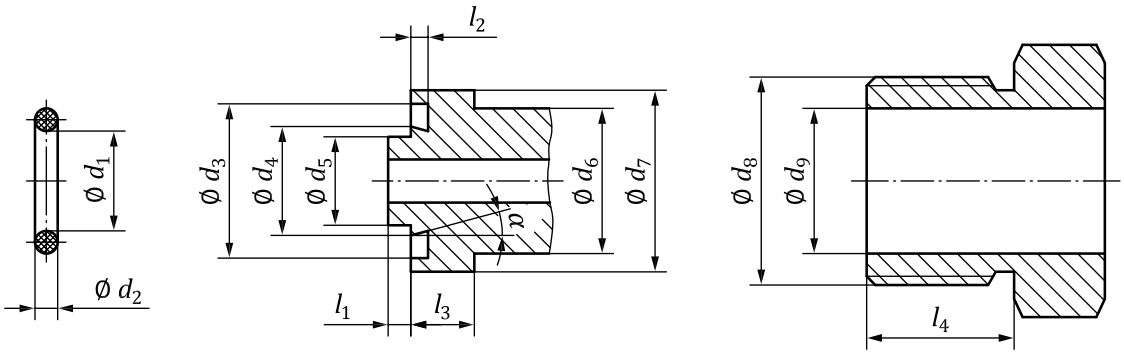
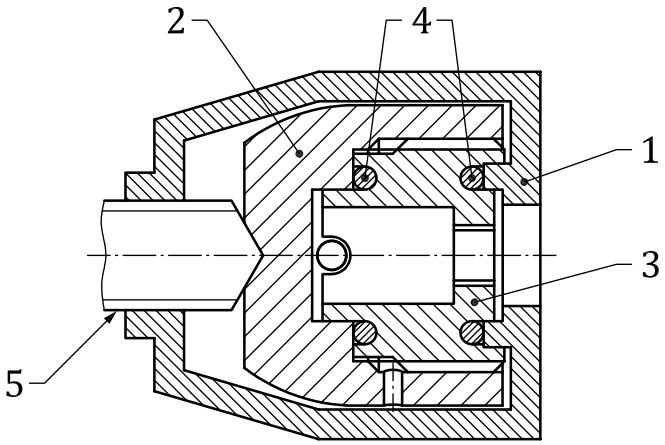


Figure 13 — 300 bar gas withdrawal connector — Components

6 Threaded type valve outlet connection for SCUBA use up to a maximum cylinder working pressure of 232 bar including adaptor for users to convert into a yoke type outlet

The purpose of this outlet connection is to allow use with both 232 bar threaded and 232 bar yoke type downstream equipment by including a user fitted adaptor. This outlet connection shall only be used for SCUBA and up to a maximum cylinder working pressure of 232 bar. Figure 14 is an assembly drawing of the connection with the adaptor in position.



Key

1 yoke
2 valve outlet
3 adaptor
4 o-ring
5 screw

Figure 14 — Adaptor 232 bar connection — Assembly drawing

In order to ensure that the yoke does fit over the valve, maximum dimensions are given for the valve (see Figure 15 and Table 10), and minimum dimensions are given for the yoke (see Figure 3 and Table 3).

The dimensions of the valve outlet adaptor and o-rings and minimum shore hardness (HS) are given in Figure 16 and Table 11 and 12.

The exact form of the o-ring grooves is the responsibility of the manufacturer providing the connection passes the outlet connection type test according to Annex A using an o-ring specified in Table 12.

Unless otherwise specified, the general tolerances for linear and angular dimensions shall be in accordance with class m of ISO 2768-1.

Table 10 — Dimensions of threaded valve outlet for the 232 bar adaptor connection

Symbol	Dimension mm	Tolerance mm	Concentricity mm
a	120°	± 5°	not applicable
l_1	12	± 0,5	not applicable
l_2	15	0 –0,5	not applicable
l_3	19	+0,5 –0,2	not applicable
l_4	25	± 0,5	not applicable
l_5	12	—	not applicable
l_6	22,5 max.	—	not applicable
l_7	30 max	—	not applicable
d_1	20,5 min.	—	0,1
d_2	13	+0,3 0	0,1
d_3	G 5/8[a]	—	0,1
d_5	see Note	—	—
d_6	2	+1 0	not applicable
d_7	6,3	± 0,8	0,3
NOTE Dimensions and location of gas passage to be specified by the manufacturer.			
[a] For dimensions of pipe threads, see ISO 228-1.			

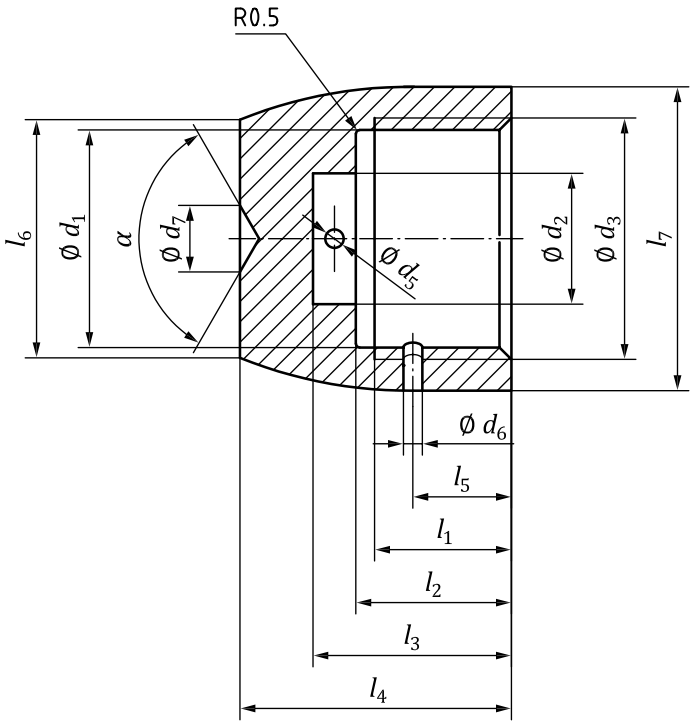


Figure 15 — Threaded valve outlet for the 232 bar adaptor connection

Table 11 — 232 bar adaptor dimensions

Symbol	Dimension mm	Tolerance mm	Concentricity mm
l_1	15	± 0,1	not applicable
l_2	1 max.	—	not applicable
l_3	1,98	± 0,35	not applicable
l_4	10	± 1	not applicable
l_5	5 min.	—	not applicable
l_6	18 max.	—	not applicable
l_7	5 min. width across flats	—	not applicable
d_1	20 max.	—	0,1
d_2	12,67 max.	—	0,1
d_3	17,45 max.	—	0,1
d_4	18,16	± 0,08	0,1
d_5	5 to 9,5	—	0,1
d_8	G 5/8[a]	—	—

[a] For dimensions of pipe threads, see ISO 228-1.

Table 12 — O-ring dimensions and properties

Symbol / Property	Dimension mm	Tolerance mm
d_6	12,37	± 0,13
d_7	2,62	± 0,08
HS	90 shore A	± 5 shore A

NOTE 1 The o-ring dimensions are taken from ISO 3601-1 (same as ASTM D2240) and the hardness is defined in ASTM D2240.

NOTE 2 This o-ring is commonly referred to as "-112" by most o-ring manufacturers.

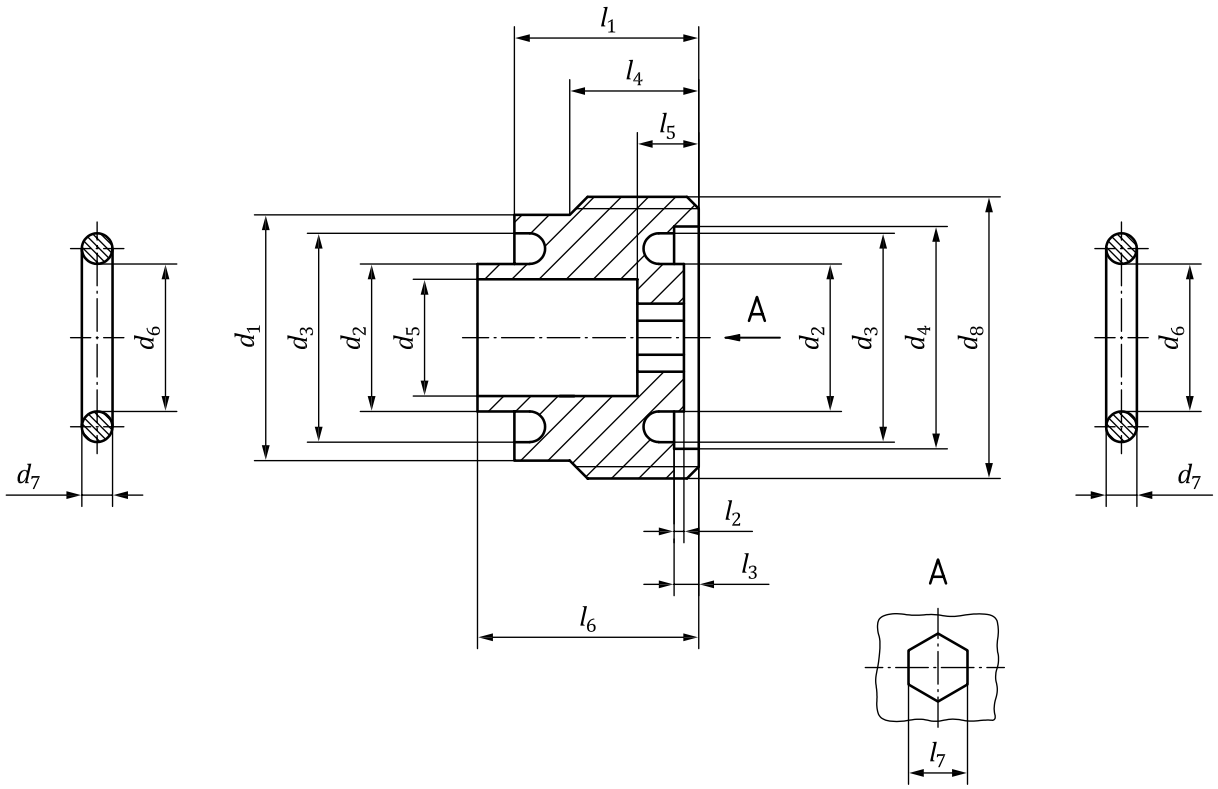


Figure 16 — Adaptor and o-rings to convert from 232 bar threaded to 232 bar yoke type outlet connection

7 Marking

Valves, gas withdrawal connectors and filling connectors in accordance with this International Standard shall be durably and legibly marked with the number of this International Standard and the working pressure, e.g. ISO 12209 232bar. Additionally the yoke shall be marked with the year and month (or week) of manufacture, e.g. YY/MM or YY-WW.

The adaptor in Figure 16 shall be marked with the manufacturer's identification.

Annex A
(normative)

Outlet connection type test procedures

A.1 Type test procedures for yoke type connections

A.1.1 Test of integrity of o-ring sealing connection

Test A.1.1 shall be run on three samples.

For the purposes of this test the torque to be applied to the yoke handle shall be determined from:

$$T = d \times 7/65$$

where

T is the resulting torque value to be applied, given in Nm;

d is the diameter of the handwheel in mm (twice the largest radius from the centre of the handwheel).

NOTE The relationship above was taken from ISO 10297.

Each connection shall be cycled 10 times with tightening the yoke handle to the torque determined according to A.1.1. One cycle consists of tightening to the predetermined torque, pressurizing the connection to 1,2 times the working pressure for a minimum of at least 6 s, releasing the pressure to atmospheric pressure and then loosening the yoke handle.

After the connection has been cycled 10 times, tighten the connection to the predetermined torque and pressurize the connection to 1,2 times the working pressure. Measure the leak rate of the connection with a recognized procedure.

Failure is leakage of 50 cm^3/h or greater at ambient temperature.

A.1.2 Test of endurance and wear resistance of the metallic components

Test A.1.2 shall be run on three samples.

Each connection shall be cycled 500 times with tightening the yoke handle to the torque determined according to A.1.1. One cycle consists of tightening to the predetermined torque, pressurizing the connection to 1,2 times the working pressure for a minimum of at least 6 s, releasing the pressure to atmospheric pressure and then loosening the yoke handle. O-rings may be replaced as needed.

After the above, one additional cycle shall be conducted with a new o-ring installed and the pressure being held for five minutes.

After the connection has been cycled 500 times, tighten the connection to the predetermined torque and pressurize the connection to 1,2 times the working pressure. Measure the leak rate of the connection with a recognized procedure.

Failure is abnormal damage and/or leakage of 50 cm^3/h or greater at ambient temperature.

A.1.3 Test of the overpressure resistance of the complete connection

Test A.1.3 shall be run on one sample.

Each connection shall be subjected to a hydraulic pressure test and shall withstand a pressure of at least 1,5 times the working pressure of the connection and held for 2 minutes without visual permanent deformation or rupture.

A.2 Type test procedures for threaded type connections

A.2.1 Determine the torque just necessary for a gas-tight connection (up to 50 cm^3/h at ambient temperature) at the maximum cylinder working pressure applicable to the connection. For cycling purposes, twice this torque shall be used to simulate normally applied field torque.

A.2.2 Cycling shall be conducted at atmospheric pressure, since that is the pressure at which connections are normally made. O-rings may be replaced as needed.

A.2.3 Each connection shall be cycled 500 times with tightening to the torque determined in accordance with A.2.1. One cycle consists of tightening to the predetermined torque and then loosening to at least finger-tight.

A.2.4 Each connection shall be subjected to a hydraulic pressure test of at least four times the maximum rated pressure of the connection for a minimum of two minutes without structural failure.

Bibliography

[1] ASTM D2240, *Standard Test Method for Rubber Property-Durometer Hardness*

[2] ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

[3] ISO 286 (all parts), *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes*

[4] ISO 3601-1, *Fluid power systems — O-rings — Part 1: Inside diameters, cross-sections, tolerances and designation codes*

[5] ISO 10286, *Gas cylinders — Terminology*

[6] ISO 10297, *Gas cylinders — Cylinder valves — Specification and type testing*

[7] ISO 11114-1, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*

[8] ISO 11114-2, *Gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*

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