

# INTERNATIONAL STANDARD

# ISO 407

Third edition  
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## Small medical gas cylinders — Pin-index yoke-type valve connections

*Petites bouteilles à gaz médicaux — Raccords de robinets du type à  
étrier avec ergots de sécurité*



Reference number  
ISO 407:2004(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 407 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 2, *Cylinder fittings*.

This third edition cancels and replaces the second edition (ISO 407:1991), which has been technically revised.

# Small medical gas cylinders — Pin-index yoke-type valve connections

## 1 Scope

This International Standard concerns pin-index yoke-type valve connections for small medical gas cylinders, with a maximum working pressure (filling pressure at 15 °C) of 200 bar. This type of connection is typically used for small cylinders (5 l or below). In some cases, it may be used for larger cylinders. In this latter case, consideration shall be given to the need for valve protection.

It specifies:

- basic dimensions;
- requirements for alternative designs of the yoke-type valve connections;
- dimensions and positions for the holes and pins for the outlet connections.

It also specifies the dimensions and positions for the holes and pins for the outlet connections for the gases and gas mixtures given in Table 1.

This International Standard applies to small medical gas cylinders used for patient care, including therapeutic, diagnostic and prophylactic applications, in hospitals and for emergency treatment.

## 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 32:1977, *Gas cylinders for medical use — Marking for identification of content*

## 3 Valve

Each small medical gas cylinder can be fitted with a yoke valve (see Clause 5). The yoke valve shall have location holes of the dimensions and in the positions indicated in Clause 7 for the appropriate gas or gas mixture.

The name or chemical symbol of the gas or gas mixture shall be clearly and indelibly stamped on the valve.

Table 1 — Allocated gases and gas mixtures

Gas or gas mixture	Chemical symbol
Oxygen	O <sub>2</sub>
Oxygen/carbon dioxide (CO <sub>2</sub> ≤ 7 %)	O <sub>2</sub> + CO <sub>2</sub>
Oxygen/helium (He ≤ 80 %)	O <sub>2</sub> + He
Ethylene	C <sub>2</sub> H <sub>4</sub>
Nitrous oxide (with and without draw-off)	N <sub>2</sub> O
Cyclopropane	C <sub>3</sub> H <sub>6</sub>
Helium and helium/oxygen (O <sub>2</sub> < 20 %)	He
Carbon dioxide (with and without draw-off) and carbon dioxide/oxygen CO <sub>2</sub> > 7 %)	CO <sub>2</sub>
Medical air	Air
Nominal mixture 50 % oxygen/50 % nitrous oxide (47,5 % < N <sub>2</sub> O < 52,5 %)	O <sub>2</sub> + N <sub>2</sub> O
Nitrogen	N <sub>2</sub>
Mixture of air, helium and carbon monoxide (CO < 1 %)	Air + He + CO

## 4 Yoke

The connecting yoke shall conform to the requirements and dimensions given in Clauses 5 and 6. The yoke shall be fitted with pins, the dimensions and the positions of which correspond to the holes in the valve as indicated in Clause 7 for the appropriate gas or gas mixture.

The name or chemical symbol of the gas or gas mixture shall be clearly and indelibly stamped on the yoke. If an identification colour is used, it shall be in conformity with ISO 32.

Examples of the alternative designs for the connecting yoke are given in 6.2.

In Figures 3 and 4, the circled numbers and letters are the pin-hole positions.

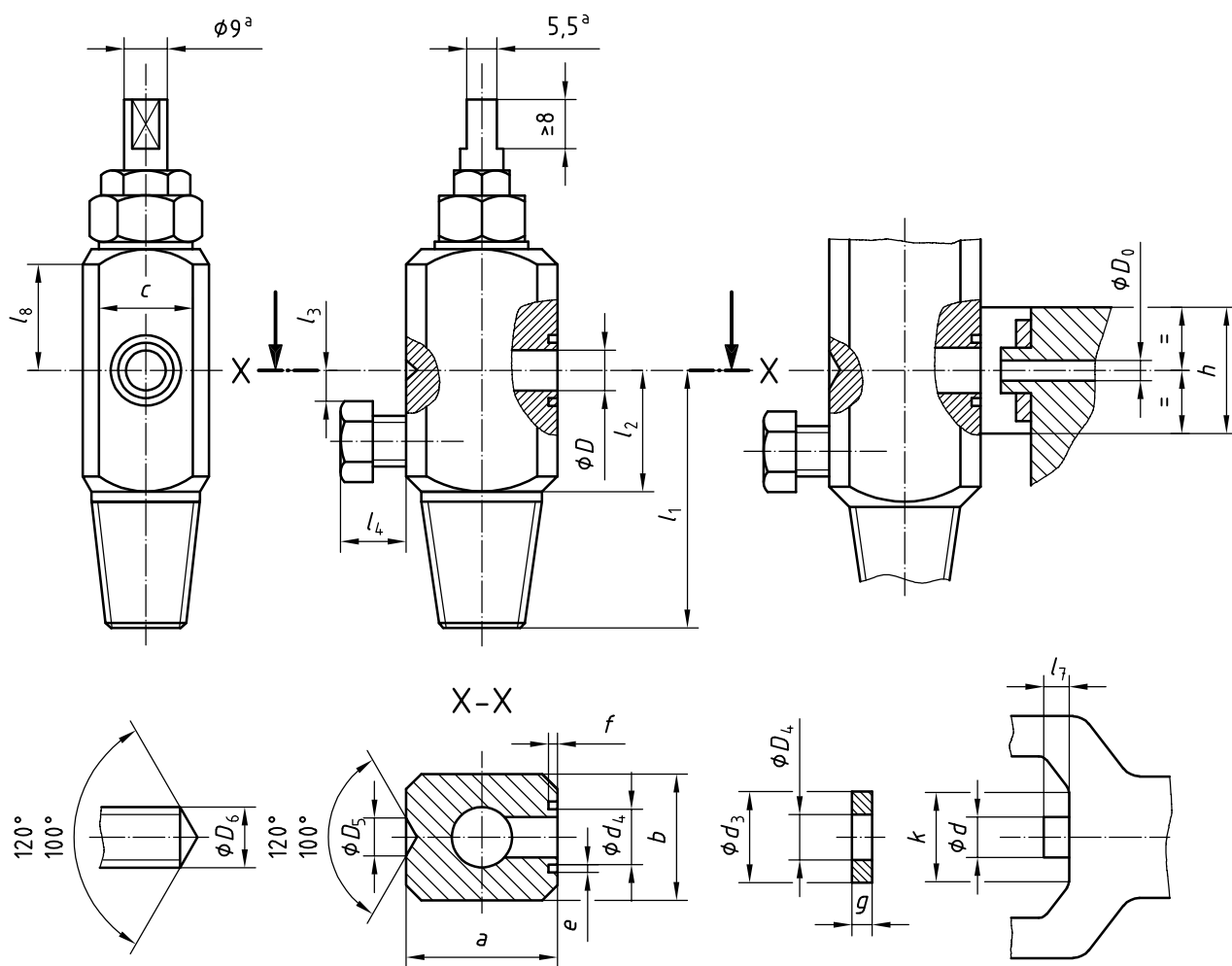
## 5 Basic dimensions

### 5.1 General

The basic dimensions for pin-index yoke-type valve connections are shown in Figures 1 to 4, and are listed in Table 2.

5.2 Pin-index yoke-type valve body

Dimensions in millimetres



a Applicable only to single-key valves.

Figure 1 — Pin-index yoke-type valve body

5.3 Single-pin yoke-type valve connection system

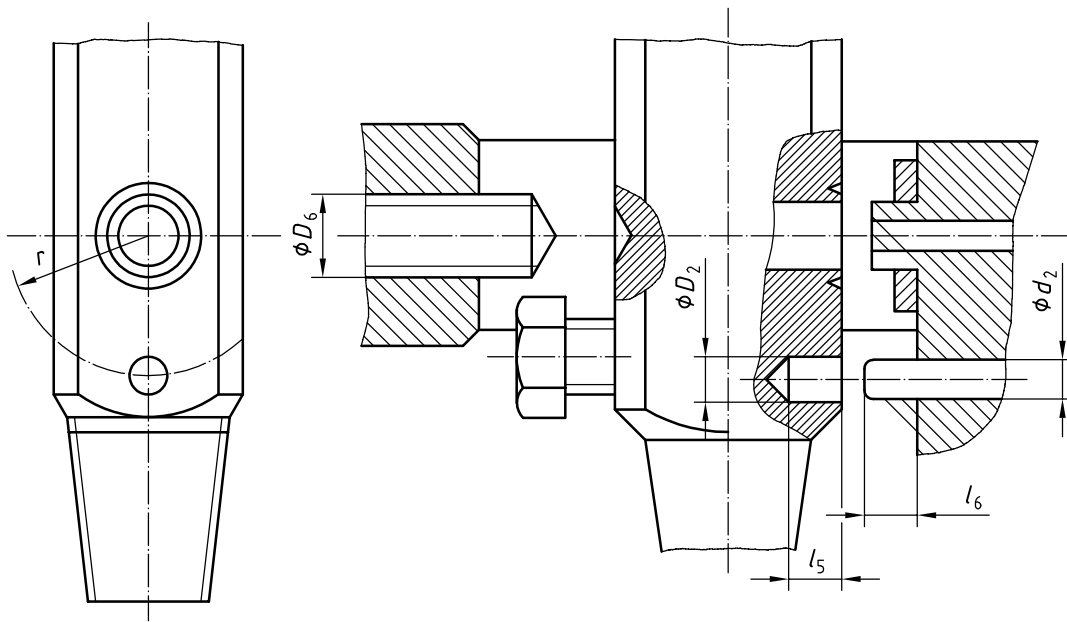


Figure 2 — Single-pin yoke-type valve connection system

5.4 Two-pin yoke-type valve connection system with the pins in a single row

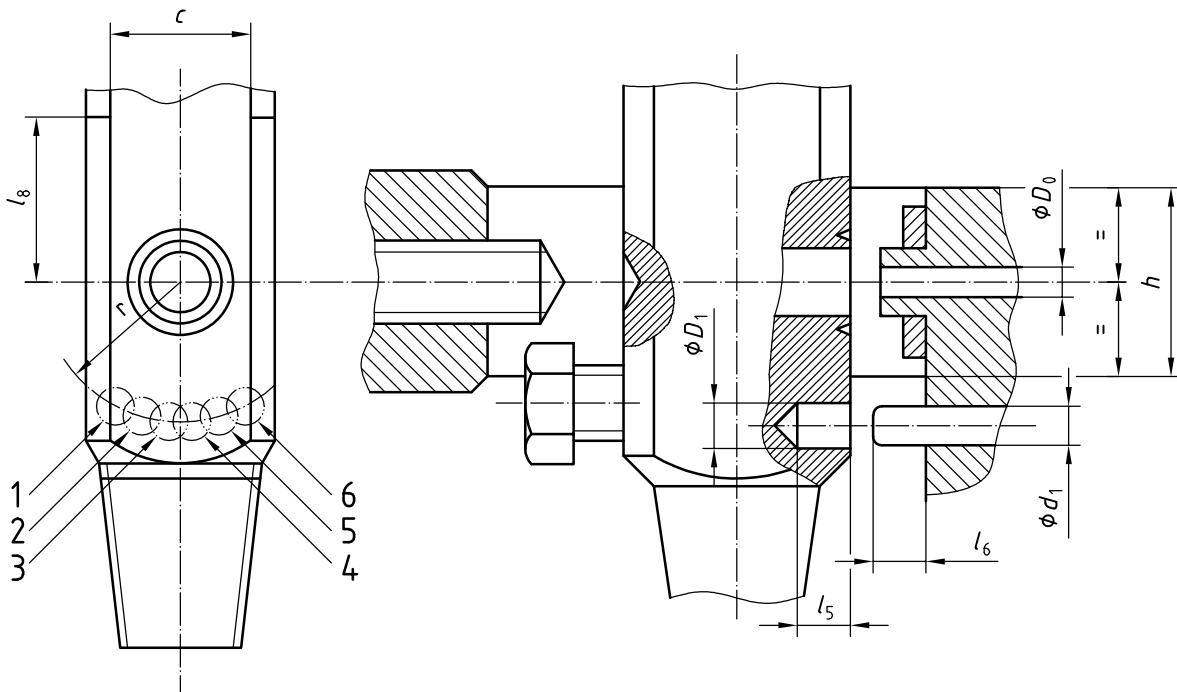


Figure 3 — Two-pin yoke-type valve connection system with the pins in a single row



5.5 Two-pin yoke-type valve connection system with the pins in a double row

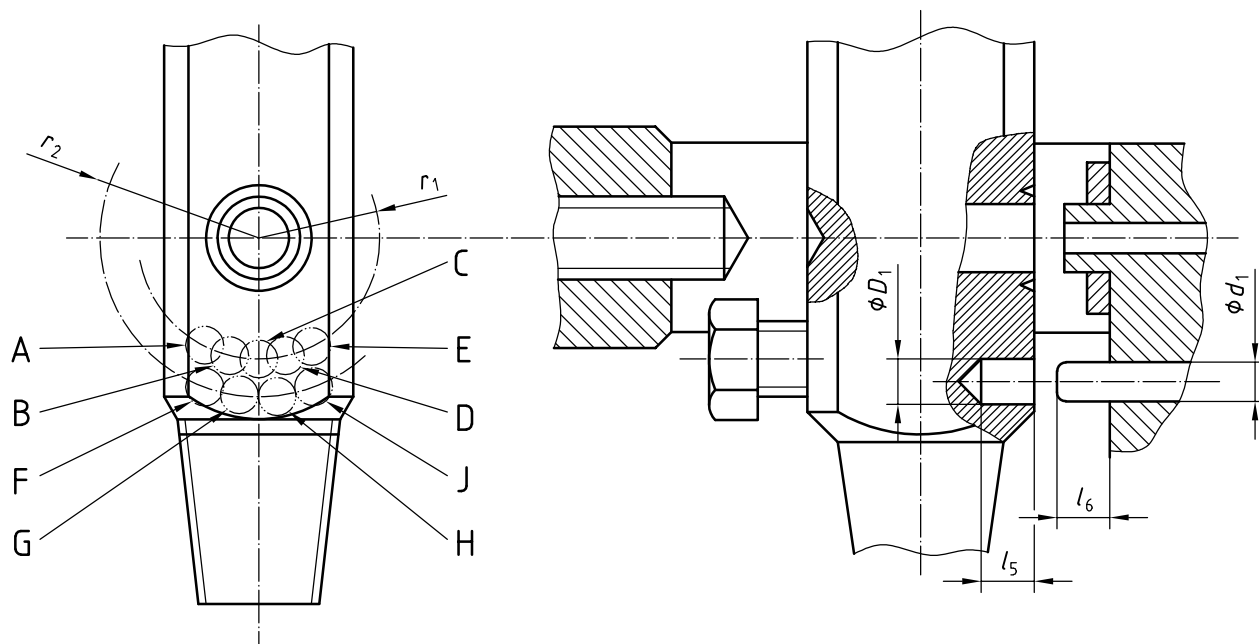


Figure 4 — Two-pin yoke-type valve connection system with the pins in a double row

5.6 Basic dimensions

See Table 2.

**Table 2 — Basic dimensions for pin-index yoke-type valve connections**

Dimension	mm	Dimension	mm
<i>a</i>	25 <sup>+0,8</sup> <sub>-0,2</sub>	<i>e</i>	0,8 max
<i>b</i>	22,2 <sup>+0,4</sup> <sub>-0</sub>	<i>f</i>	0,8 max
<i>c</i>	16 min	<i>g</i>	1,6 ± 0,4
<i>D</i>	7 <sup>+0,2</sup> <sub>-0</sub>	<i>h</i> <sup>a</sup>	20 ± 0,5
<i>D</i> <sub>0</sub>	2,4 ± 0,8	<i>k</i>	16,5 min
<i>D</i> <sub>1</sub>	4,75 <sup>+0,1</sup> <sub>-0</sub>	<i>l</i> <sub>1</sub>	44,5 min
<i>D</i> <sub>2</sub>	5,8 to 5,9	<i>l</i> <sub>2</sub>	22 min
<i>D</i> <sub>4</sub>	6,3 <sup>0</sup> <sub>-0,2</sub>	<i>l</i> <sub>3</sub> <sup>b</sup>	8 min
<i>D</i> <sub>5</sub>	6 <sup>0</sup> <sub>-0,5</sub>	<i>l</i> <sub>4</sub> <sup>b</sup>	9,6 max
<i>D</i> <sub>6</sub> <sup>c</sup>	7 min	<i>l</i> <sub>5</sub>	5,5 <sup>+0,5</sup> <sub>0</sub>
<i>d</i>	6,5 <sup>0</sup> <sub>-0,2</sub>	<i>l</i> <sub>6</sub>	5,5 <sup>0</sup> <sub>-0,5</sub>
<i>d</i> <sub>1</sub>	4 ± 0,1	<i>l</i> <sub>7</sub>	3 to 3,6
<i>d</i> <sub>2</sub>	5,4 <sup>0</sup> <sub>-0,1</sub>	<i>l</i> <sub>8</sub> <sup>d</sup>	15 min
<i>d</i> <sub>3</sub>	16 ± 0,5	<i>r</i>	14,3 nom.
<i>d</i> <sub>4</sub>	9 ± 0,2	<i>r</i> <sub>1</sub>	12 nom.
		<i>r</i> <sub>2</sub>	17,5 nom.

<sup>a</sup> Dimensions *h* and *q*, *q*<sub>1</sub> (see Clause 6). As an alternative, these dimensions may be given in order to satisfy the requirements of 6.1 g).

<sup>b</sup> Applicable only if a projecting-type safety plug is used.

<sup>c</sup> Dimension *D*<sub>6</sub> is the dimension at the top of the cone.

<sup>d</sup> This dimension is very important.

## 6 Requirements for alternative designs of yoke-type valve connections

### 6.1 Requirements for the design of the connecting yoke

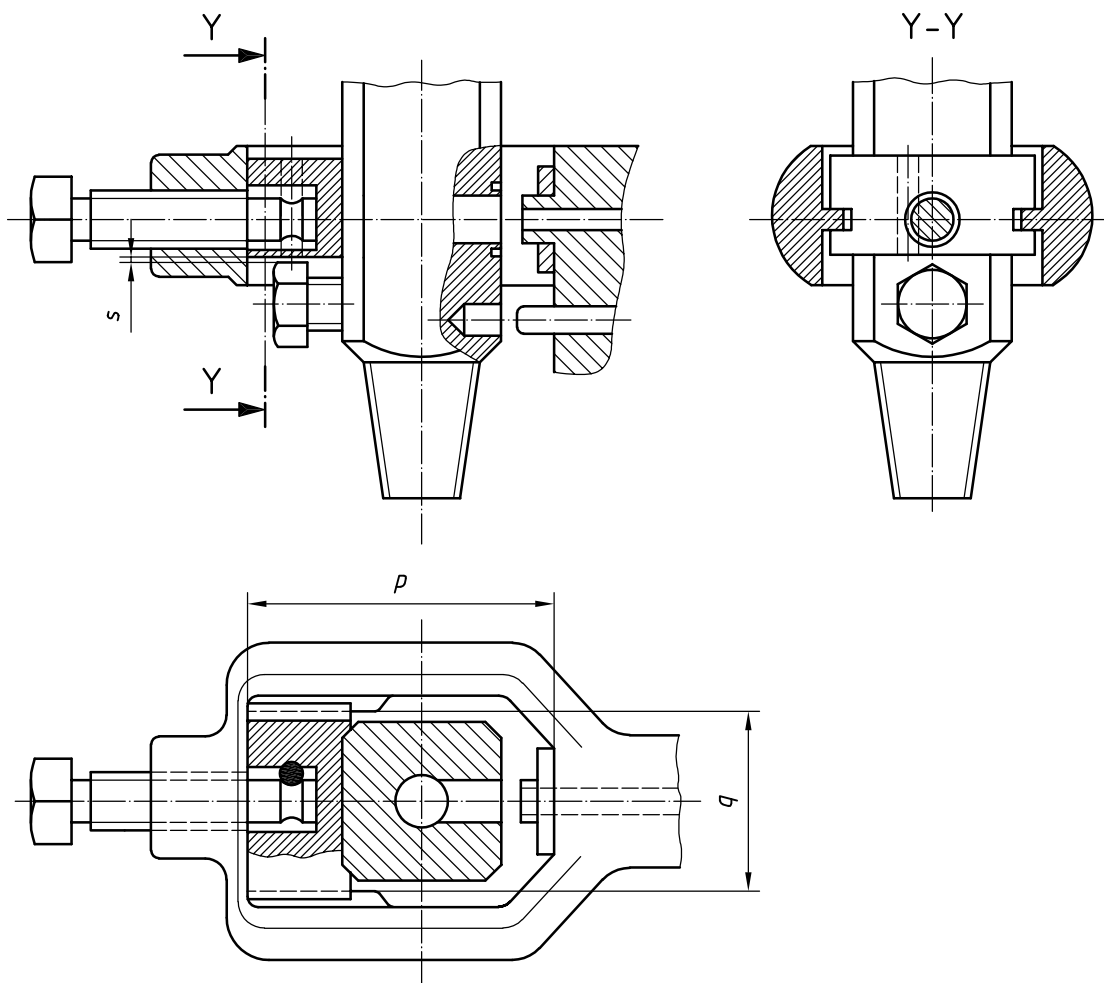
The design of the connecting yoke shall meet the following requirements.

- a) A gas-tight seal shall only be possible when the pins in the yoke correspond to the holes in the valve;
- b) when the pins in the yoke do not correspond to the holes in the valve, a gas-tight seal shall not be possible and damage to the yoke or the valve shall be prevented;
- c) pins shall be fixed or assembled in such a manner that they cannot be removed by the user or become loose in service;
- d) the sealing washer shall be a retained fit on the yoke spigot;

- e) the use of more than one sealing washer is not permitted;
- f) the yoke shall be able to resist, without permanent deformation, the load resulting from a torque of 50 N·m applied to the valve clamping screw or locking device;
- g) the dimensions of the yoke shall limit the movement of the valve in the yoke to a maximum of 6° about the long axis prior to pin engagement.

**6.2 Examples of alternative construction for the connecting yoke**

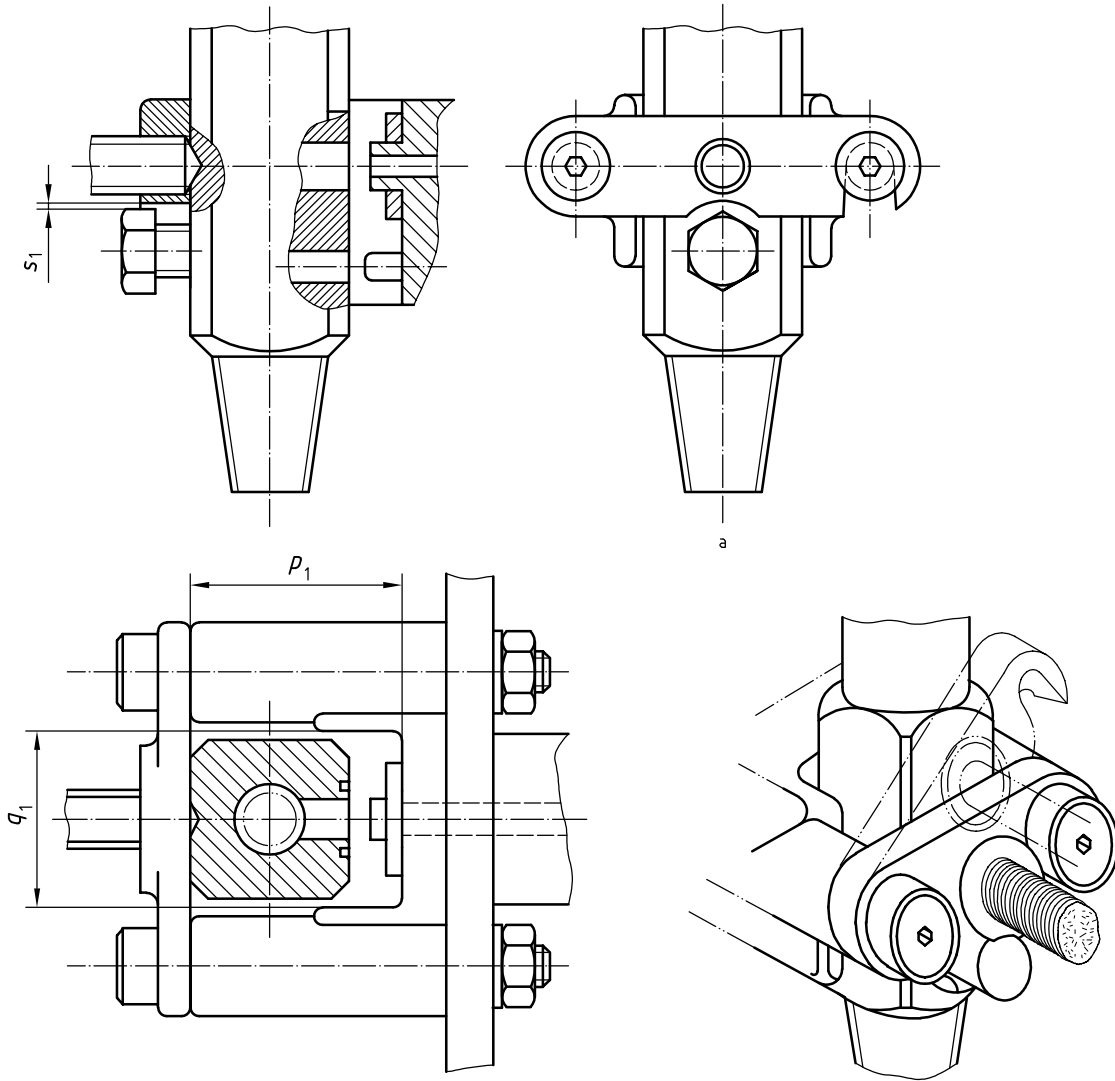
Three alternative designs of pin-index yoke-type connections are shown in Figures 5 to 7.



Dimension	mm
$p^a$	44,5 max
$q^b$	$24^{+0,50}_0$
$s^c$	0,8 min

<sup>a</sup> May be reduced to 35 mm if clearance is provided for projecting-type safety plug.  
<sup>b</sup> See the note for dimension  $h$  in Table 2.  
<sup>c</sup> Applicable only if a projecting-type safety plug is used.

**Figure 5 — First alternative**



Dimension	mm
$p_1$	30,2 max
$q_1^a$	$24^{+0,50}_0$
$s_1^b$	0,8 min
<sup>a</sup> See the note for dimension $h$ in Table 2. <sup>b</sup> Applicable only if a projecting-type safety plug is used.	

a View with clamping screw removed.

Figure 6 — Second alternative

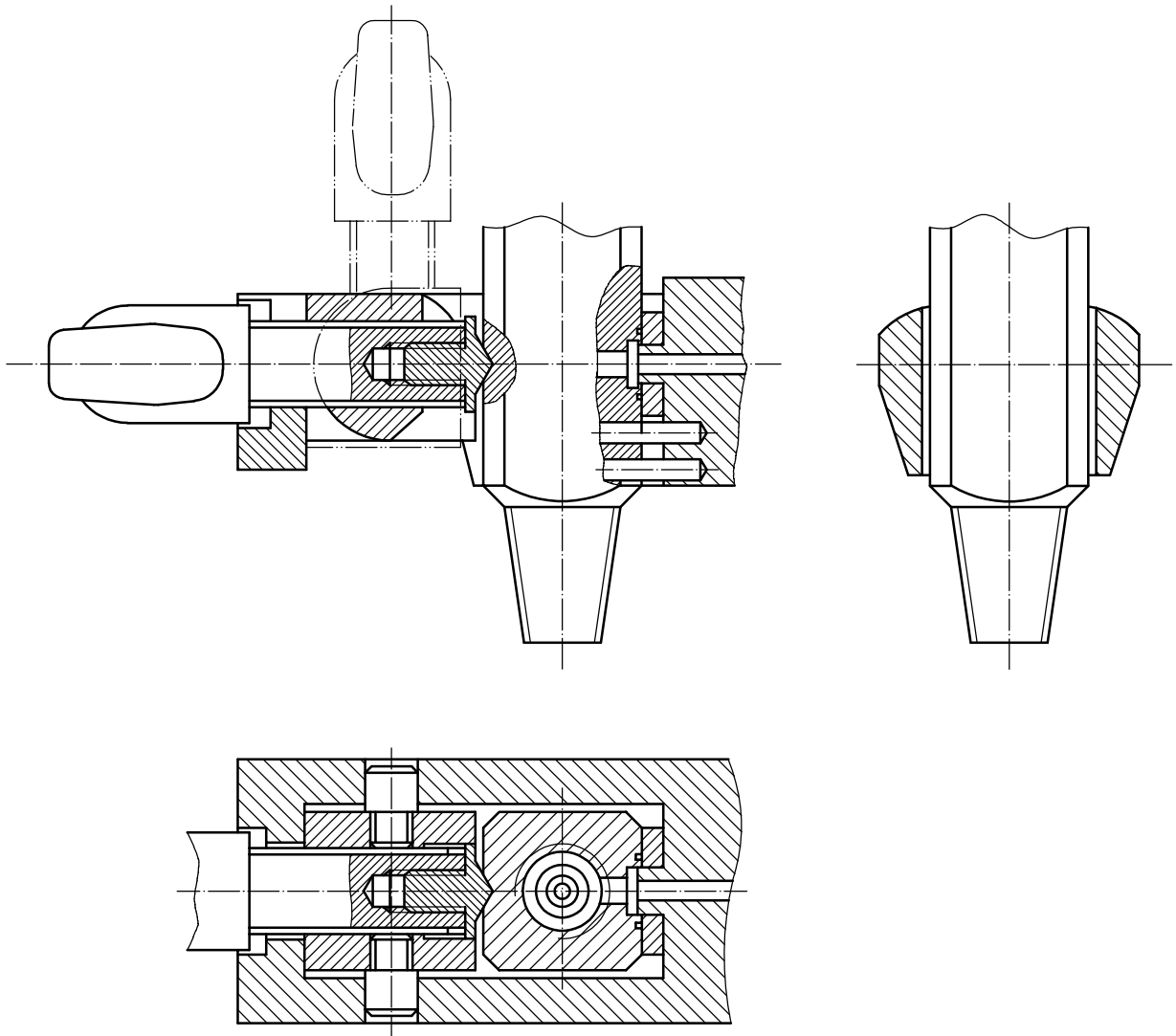


Figure 7 — Third alternative

## 7 Dimensions and positions of the holes and pins for yoke-type valve connections

### 7.1 General

The dimensions and positions of the holes and pins for yoke-type valve connections are shown in Figures 8 to 18. In Figures 9 to 18, the circled numbers are the pin-hole positions.

### 7.2 Outlet connection with single-pin system

Outlet connection for a nominal mixture of 50 % oxygen/50 % nitrous oxide ( $47,5 \% < N_2O < 52,5 \%$ ).

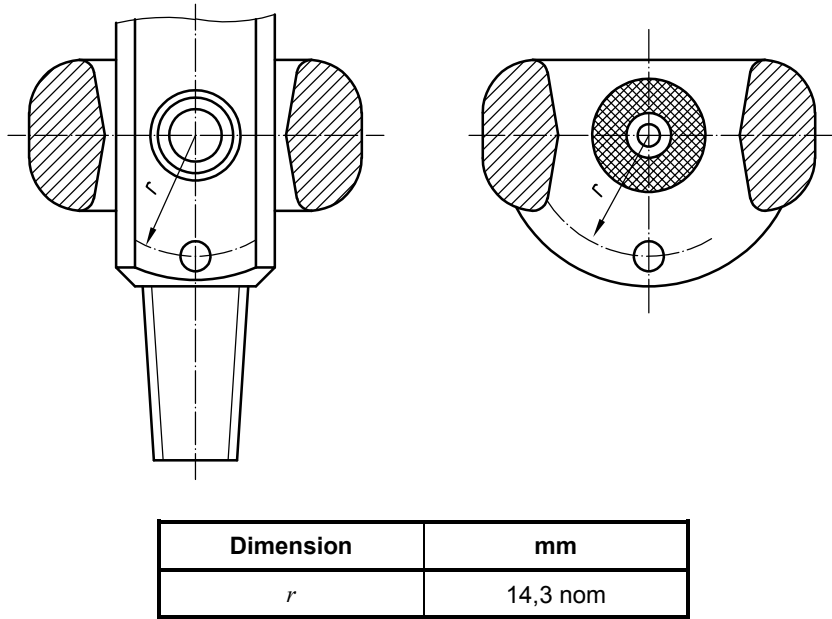


Figure 8 — Outlet connection for a nominal mixture of 50 % oxygen/50 % nitrous oxide

### 7.3 Outlet connections with two-pin/single-row system

#### 7.3.1 Outlet connection for oxygen

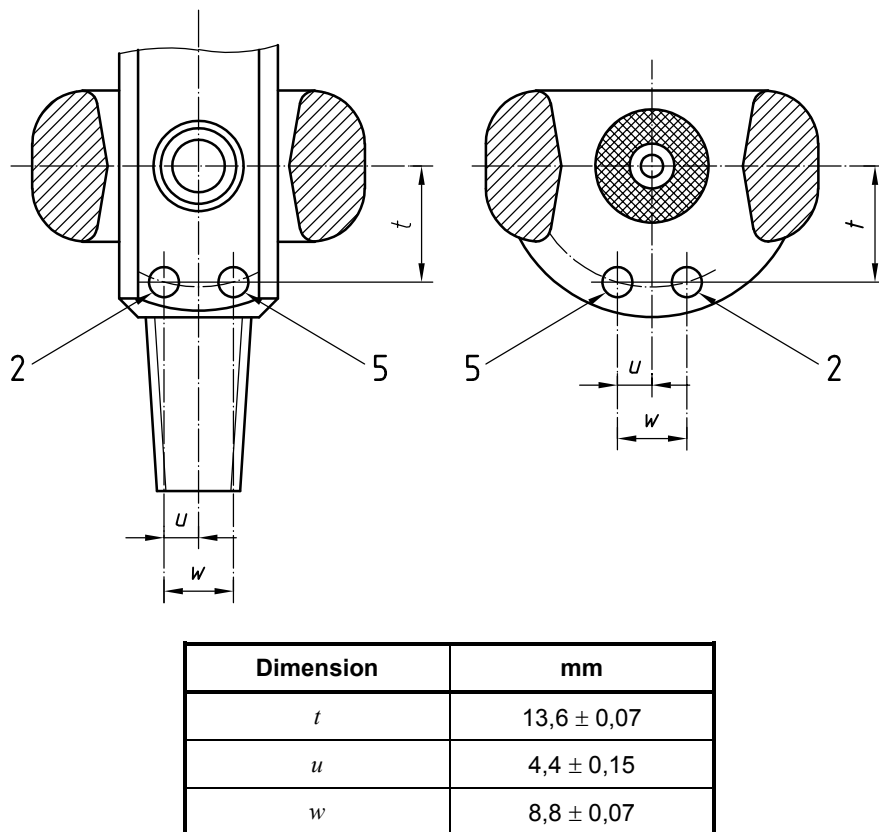
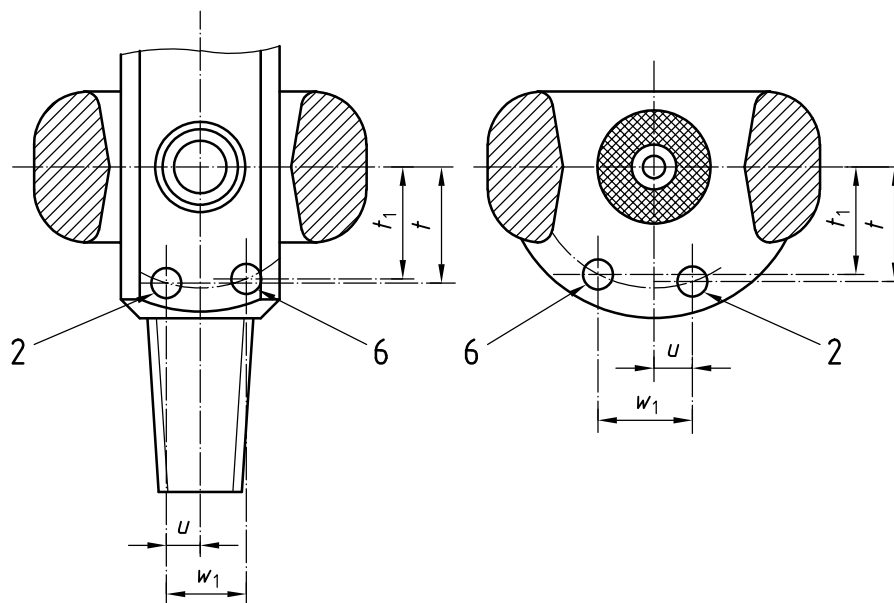


Figure 9 — Outlet connection for oxygen

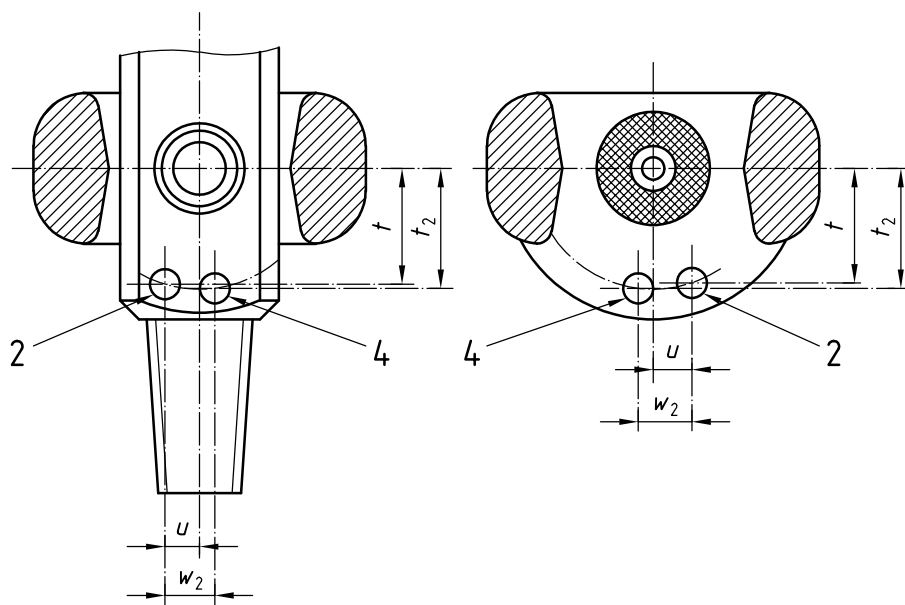
7.3.2 Outlet connection for oxygen/carbon dioxide mixture ( $\text{CO}_2 \leq 7\%$ )



Dimension	mm
$t$	$13,6 \pm 0,07$
$t_1$	$12,4 \pm 0,07$
$u$	$4,4 \pm 0,15$
$w_1$	$11,55 \pm 0,07$

Figure 10 — Outlet connection for oxygen/carbon dioxide mixture ( $\text{CO}_2 \leq 7\%$ )

7.3.3 Outlet connection for oxygen/helium mixture ( $\text{He} \leq 80\%$ )

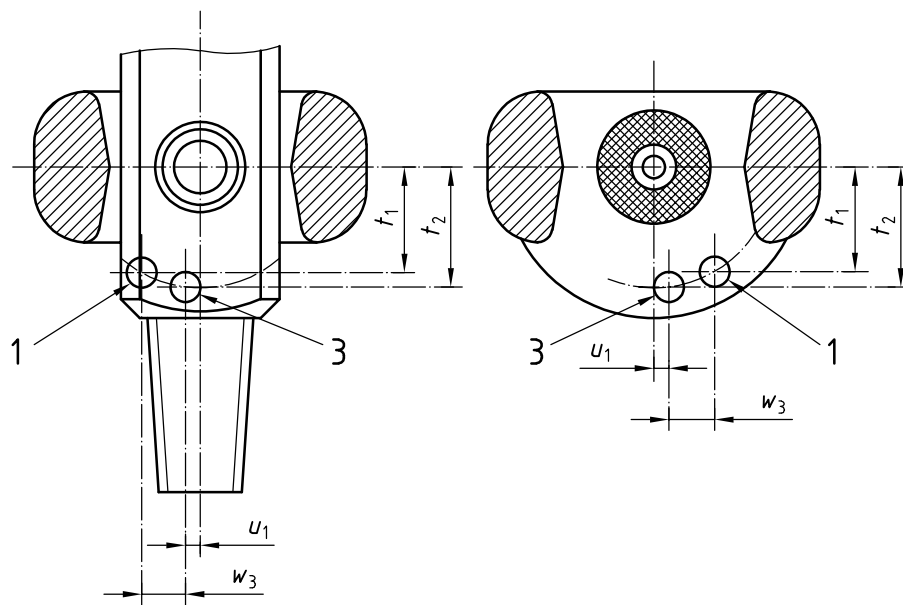


Dimension	mm
$t$	$13,6 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u$	$4,4 \pm 0,15$
$w_2$	$5,9 \pm 0,07$

Figure 11 — Outlet connection for oxygen/helium mixture ( $\text{He} \leq 80\%$ )



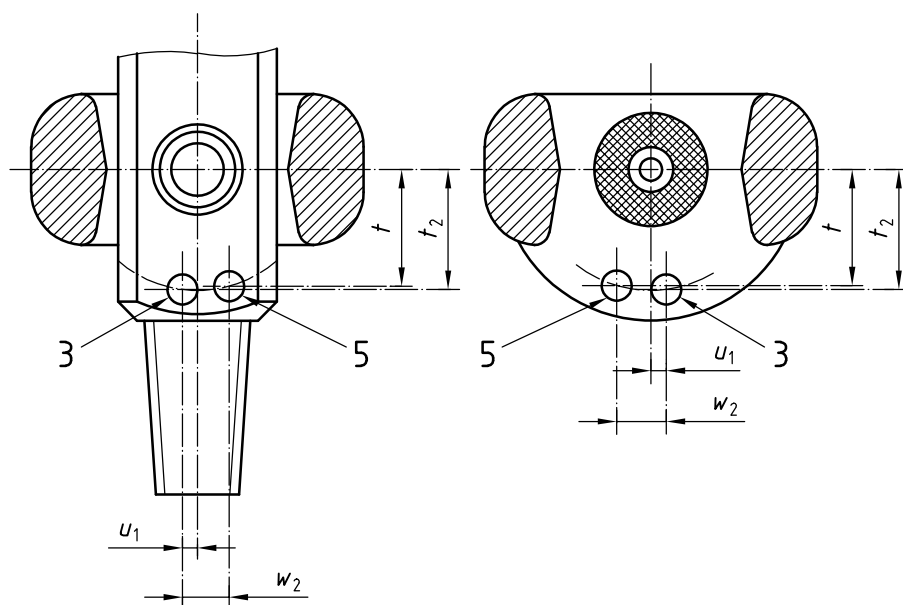
7.3.4 Outlet connection for ethylene



Dimension	mm
$t_1$	$12,4 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u_1$	$1,5 \pm 0,15$
$w_3$	$5,65 \pm 0,07$

Figure 12 — Outlet connection for ethylene

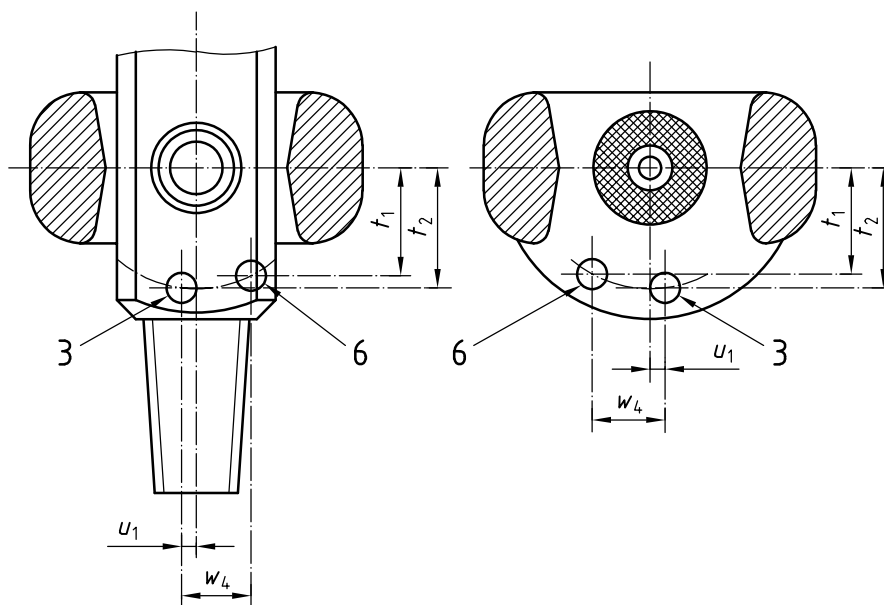
7.3.5 Outlet connection for nitrous oxide



Dimension	mm
$t$	$13,6 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u_1$	$1,5 \pm 0,15$
$w_2$	$5,9 \pm 0,07$

Figure 13 — Outlet connection for nitrous oxide (with gas draw-off)

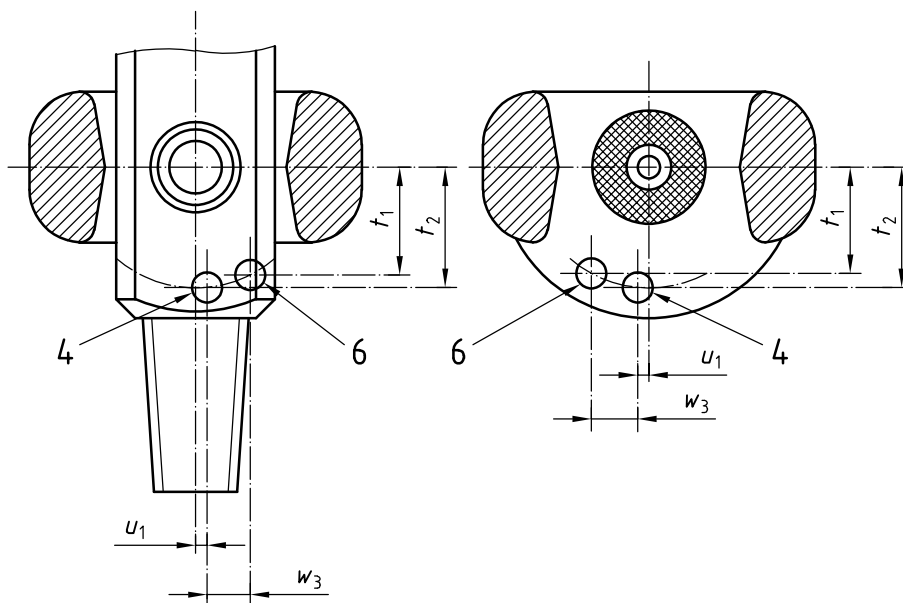
7.3.6 Outlet connection for cyclopropane



Dimension	mm
$t_1$	$12,4 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u_1$	$1,5 \pm 0,15$
$w_4$	$8,65 \pm 0,07$

Figure 14 — Outlet connection for cyclopropane

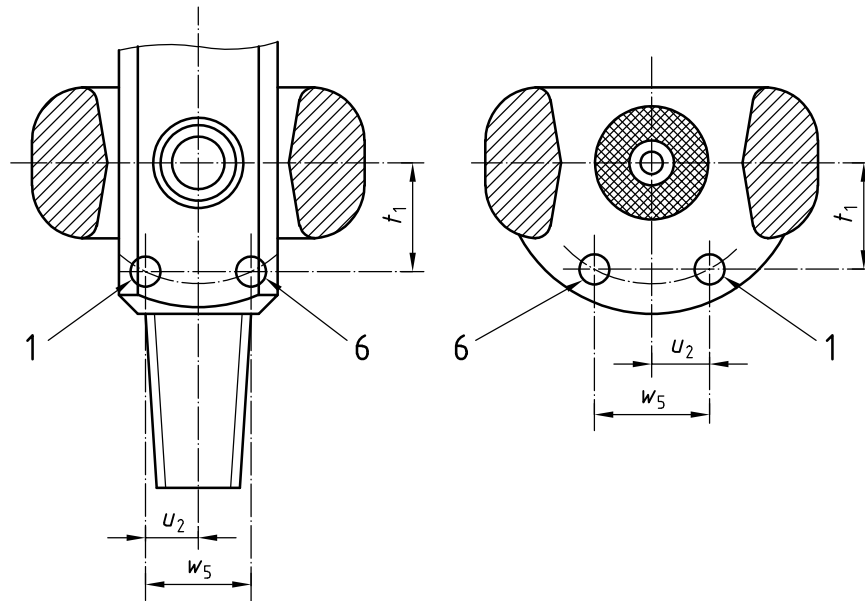
7.3.7 Outlet connection for helium/oxygen mixture ( $O_2 < 20\%$ )



Dimension	mm
$t_1$	$12,4 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u_1$	$1,5 \pm 0,15$
$w_3$	$5,65 \pm 0,07$

Figure 15 — Outlet connection for helium/oxygen mixture ( $O_2 < 20\%$ )

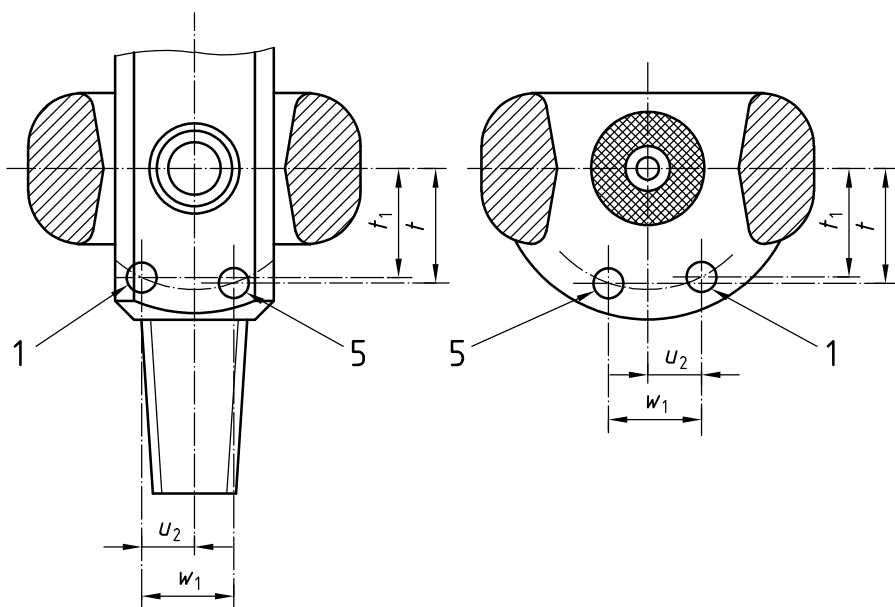
7.3.8 Outlet connection for carbon dioxide and carbon dioxide/oxygen mixture ( $\text{CO}_2 > 7\%$ )



Dimension	mm
$t_1$	$12,4 \pm 0,07$
$u_2$	$7,15 \pm 0,15$
$w_5$	$14,3 \pm 0,07$

Figure 16 — Outlet connection for carbon dioxide and for carbon dioxide/oxygen mixture ( $\text{CO}_2 > 7\%$ ) (gas draw-off)

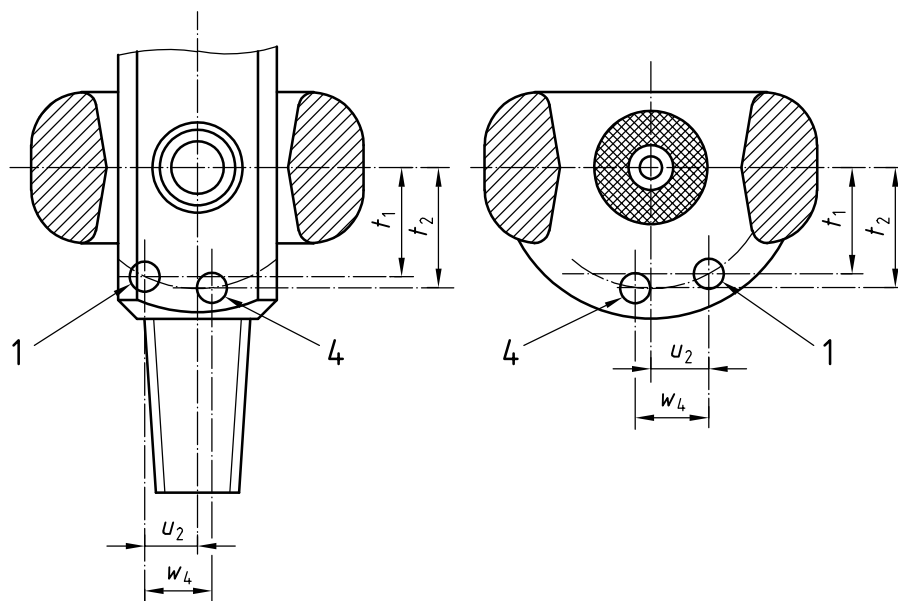
7.3.9 Outlet connection for medical air



Dimension	mm
$t$	$13,6 \pm 0,07$
$t_1$	$12,4 \pm 0,07$
$u_2$	$7,15 \pm 0,15$
$w_1$	$11,55 \pm 0,07$

Figure 17 — Outlet connection for medical air

7.3.10 Outlet connection for nitrogen



Dimension	mm
$t_1$	$12,4 \pm 0,07$
$t_2$	$14,2 \pm 0,07$
$u_2$	$7,15 \pm 0,15$
$w_4$	$8,65 \pm 0,07$

Figure 18 — Outlet connection for nitrogen

7.4 Outlet connection with two-pin/double-row system

See Table 3 in which the left-hand column includes, where appropriate, the allocated gas or gas mixture.

Table 3 — Outlet connection with two-pin/double-row system

Dimensions in millimetres

Gas	Holes in valve	Holes in yoke
<p>A – F Mixture of air, He, CO: CO &lt; 1 %</p>		
<p>B – F CO<sub>2</sub> with liquid draw-off</p>		
<p>C – F N<sub>2</sub>O with liquid draw-off</p>		
<p>D – F Nitrogen/nitrogen monoxide (NO &lt; 0,01 %) (NO &lt; 100 ppm by volume)</p>		



Table 3 (continued)

Gas	Holes in valve	Holes in yoke
<p>E – F Nitrogen/nitrogen monoxide (0,01 % ≤ NO &lt; 0,1 %) (100 ppm by volume ≤ NO &lt; 1 000 ppm by volume)</p>		
<p>A – G Xenon</p>		
<p>B – G Helium</p>		
<p>C – G non-allocated</p>		

Table 3 (continued)

Gas	Holes in valve	Holes in yoke
<p>D – G non-allocated</p>	<p>DG</p>	<p>DG</p>
<p>E – G Carbon dioxide (gas draw-off)</p>	<p>EG</p>	<p>EG</p>
<p>A – H non-allocated</p>	<p>AH</p>	<p>AH</p>
<p>B – H non-allocated</p>	<p>BH</p>	<p>BH</p>

Table 3 (continued)

Gas	Holes in valve	Holes in yoke
<p>C – H non-allocated</p>		
<p>D – H non-allocated</p>		
<p>E – H non-allocated</p>		
<p>A – J Non-flammable, non-corrosive gas mixtures labelled as drugs or medical devices and not having another connection assignment (CGA 973)</p>		

Table 3 (continued)

Gas	Holes in valve	Holes in yoke
<p>B – J</p> <p>Oxidizing mixtures not having another medical yoke connection assignment (CGA 977)</p>		
<p>C – J</p> <p>Those gases and gas mixtures assigned to CGA connection 350 and not having another medical yoke CGA connection assignment (CGA 981)</p>		
<p>D – J</p> <p>Gases and gas mixtures assigned to CGA connection 580 and not having another medical yoke CGA connection assignment</p>		
<p>E – J</p> <p>Gas mixture of Carbon Dioxide (4,9 % to 5,2 % CO<sub>2</sub>) and oxygen assigned to CGA connection 989</p>		

NOTE 1 Medical research is responsible for new gas mixtures being developed which require new connection assignments to preclude hazardous cross-connects.

NOTE 2 CGA connection 350 is assigned to flammable or toxic gases. Some gases under CGA connection 350 have medical applications and require their own connection.

NOTE 3 CGA connection 580 is assigned to inerts. Some inert gas mixture are not covered by currently assigned or proposed medical gas assignments and require their own connection for medical applications.



