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Gas cylinders — Gas cylinder valve connections for use in the micro-electronics industry —

Part 1:
Outline connections

Bouteilles à gaz — Raccords pour robinets de bouteilles à gaz pour l'industrie de la microélectronique —

Partie 1: Raccords de sortie

Reference number
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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 3.

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 part of ISO 10692 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10692-1 was prepared by Technical Committee ISO/TC 58, *Gas cylinders*, Subcommittee SC 2, *Cylinder fittings*.

ISO 10692 consists of the following parts, under the general title *Gas cylinders — Gas cylinder valve connections for use in the micro-electronics industry*:

— *Part 1: Outlet connections*

— *Part 2: Specification and type testing for valve to cylinder connections*

Annex A forms a normative part of this part of ISO 10692. Annex B is for information only.

Gas cylinders — Gas cylinder valve connections for use in the micro-electronics industry —

Part 1:
Outlet connections

1 Scope

This part of ISO 10692 applies to the outlet connections of gas cylinder valves for gases and gas mixtures and concerns special requirements where the highest levels of cleanliness and freedom from particles are demanded for the manufacture of microelectronic components or similar applications.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10692. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10692 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 68-2, *ISO general-purpose screw threads — Basic profile — Part 2: Inch screw threads.*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method.*

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

ISO 10297, *Gas cylinders — Refillable gas cylinder valves — Specification and type testing.*

ISO 10298, *Determination of toxicity of a gas or gas mixture*.

ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*.

3 General requirements

3.1 Materials

The following materials and specifications are recommended:

— For valve and nipple: AISI 316L, microfinished, hardness at least 130 HBW in accordance with ISO 6506-1;

— For the union nut: AISI 304, threading silver plated.

Other materials and values may be chosen if they give at least equivalent performance in terms of yield stress and resistance to corrosion (see ISO 11114-1).

3.2 Operation

For these connections the outboard leak rate shall not exceed a value of 1×10^{-7} mbar·l·s^{-1} at 137 bar helium when the connection is tightened to 50 N·m.

When this outboard leak rate is obtained, an inboard helium leak rate shall be no greater than 1×10^{-9} mbar·l·s^{-1}.

The gasket shall be an unused recessed flat, uncoated gasket of Ni 200, fully annealed with the requirements of 8.1. Its hardness shall be HBW 2,5/62,5: 80 to 100 HBW (in accordance with ISO 6506-1) with a surface finish < 0,8 µm turned in the sealing area. Gaskets of other materials, e.g. polymers, may be used if they do not compromise the leak integrity of the connection and are compatible with the duty. These gaskets shall be used at a torque appropriate for the material.

NOTE Conditions of use may cause significant differences in both the inboard and outboard leak rates, e.g. nickel gaskets should be used only once.

3.3 Marking

The valves shall be marked with the requirements listed in ISO 10297, as far as appropriate. In addition to all the required valve marking the letters "*nnn*", where *nnn* is the outlet number, shall be marked.

4 General design

Figure 1 shows the connection in the assembled state (view from the top). The nipple tip has two notches to facilitate the removal of the gasket.

A pair of keys on the nipple and of the corresponding key ways on the valve prevent rotation of the parts during assembly. The keys shall be opposite to each other and vertically oriented. The antirotational device shall always be in place. The nut shall not engage on the outlet thread until the antirotational pins fitted to the plug are engaged in the slots on the valve outlet. An alternative way to design the antirotational device of the nipple is described in 8.3.

The union nut shall have two venting holes opposite to each other.

5 Dimensions

Dimensions for the outlet connections are given in Figures 2 to 9. Only dimensions explicitly given there are mandatory. Others shall be chosen as appropriate. All dimensions are in millimetres. The thread definition is given in clause 9.

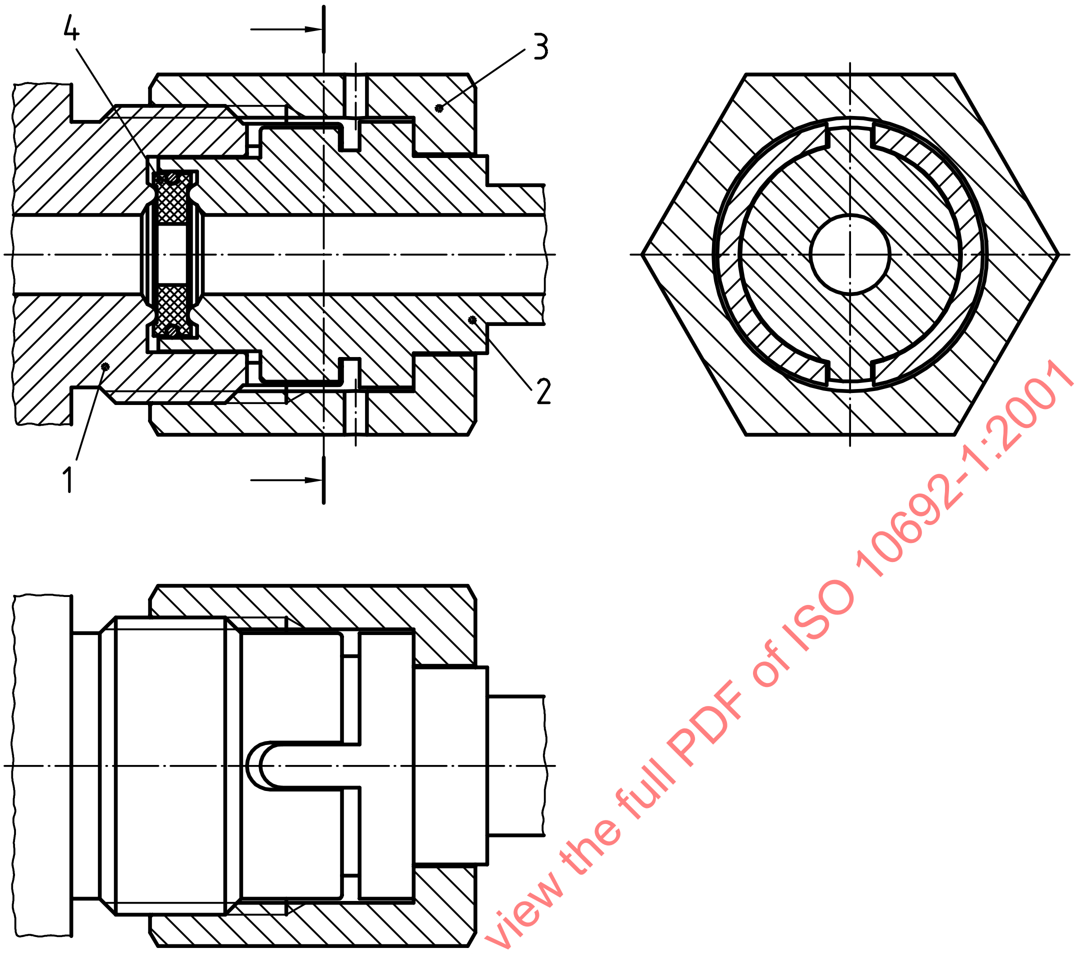
The diameters d_A, d_B, d_M and d_N are not dimensioned in the figures because they assume different values for each connection. They are chosen in such a way that combinations other than the intended ones are impossible. The diameters d_A and d_B on the valve outlet as well as d_M and d_N on the nipple shall be concentric within 0,05 mm full indicator movement because these are critical dimensions for safety.

6 630 and 640 series connections

Details of the valve outlet are given in Figure 2. Figure 3 gives details of the nipple.

The values of the diameters d_A, d_B, d_M and d_N for the 630 and 640 series connections are given in Table 1.

Figure 4 shows the union nut.



Key

1 Valve outlet

2 Nipple

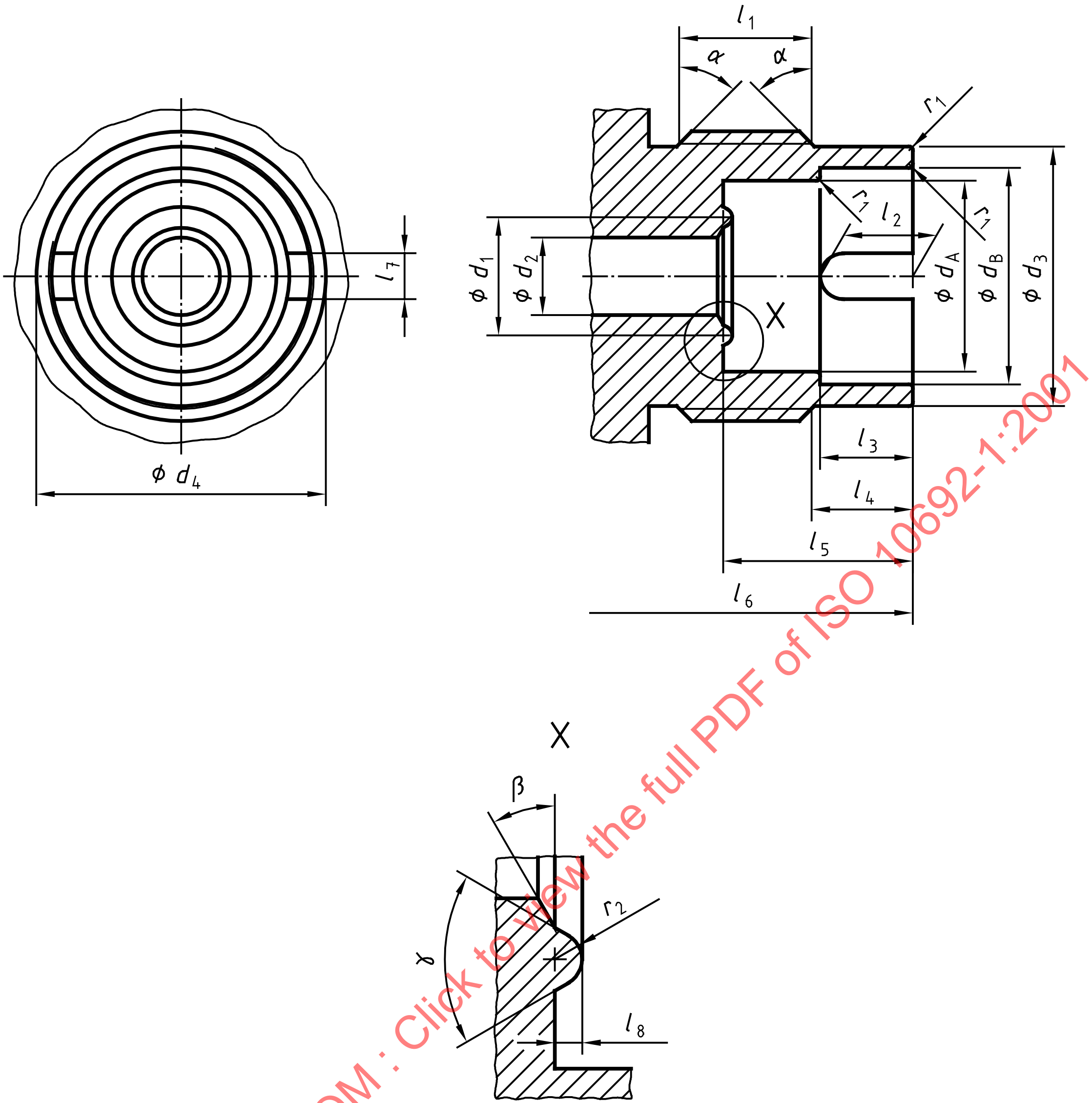
3 Union nut

4 Gasket and circlips

Figure 1 — Assembly drawing of the connections (view from the top)

Table 1 — Index diameters of the 630 and 640 series connections

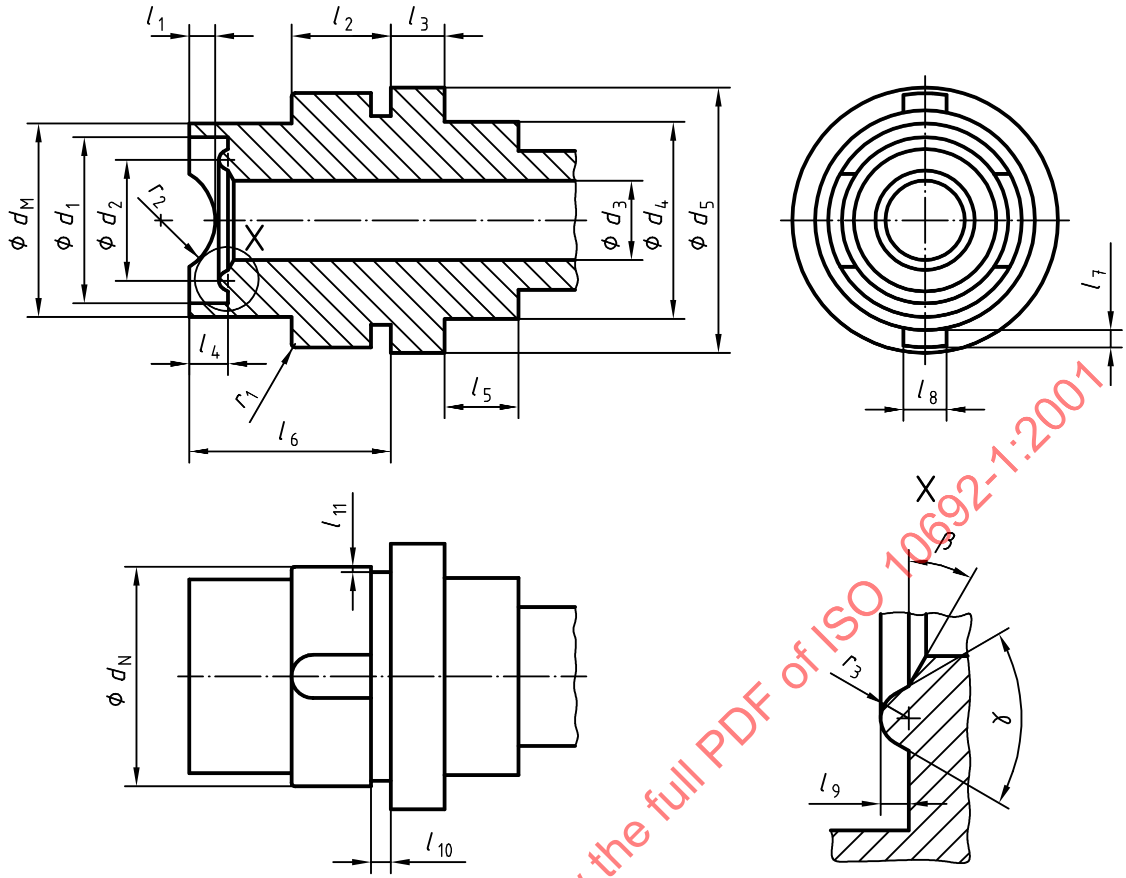
No.	d_A		d_B		d_M		d_N	
	min.	max.	min.	max.	min.	max.	min.	max.
632	16,49	16,58	20,22	20,32	16,31	16,40	20,04	20,14
634	16,84	16,94	19,86	19,96	16,66	16,76	19,69	19,79
636	17,2	17,3	19,51	19,61	17,02	17,12	19,33	19,43
638	17,55	17,65	19,15	19,25	17,37	17,48	18,97	19,08
640	17,91	18,00	18,80	18,89	17,73	17,83	18,62	18,71
642	18,26	18,36	18,26	18,36	18,08	18,18	18,08	18,18



l_1	11,1 min.	d_1	$10{,}62 \leqslant d_1 \leqslant 10{,}71$
l_2	$8{,}38^{+0{,}25}_{-0{,}13}$	d_2	8,13 max.
l_3	$8{,}38^{+0}_{-0{,}25}$	d_3	$23{,}37 \leqslant d_3 \leqslant 23{,}49$
l_4	$9{,}14^{+0{,}25}_{-0}$	d_4	1,030 external [a]
l_5	$17{,}15^{\ 0}_{-0{,}25}$	r_1	$0{,}25 \leqslant r_1 \leqslant 0{,}38$
l_6	42,54 max.	r_2	$0{,}76 \leqslant r_2 \leqslant 0{,}89$
l_7	$4{,}09 \leqslant l_7 \leqslant 4{,}19$	α	45° ± 5°
l_8	$0{,}76 \leqslant l_8 \leqslant 0{,}89$	β	30° ± 5°
—	—	γ	60° ± 1°

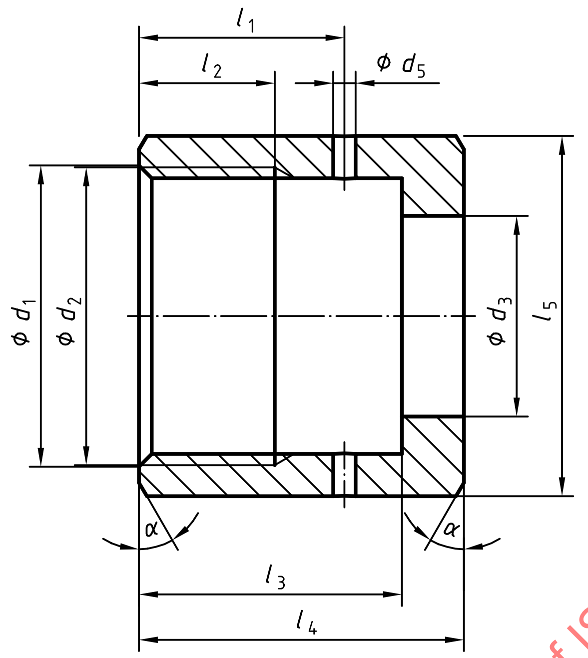
[a] Nominal diameter in inches.

Figure 2 — Valve outlet of the 630 and 640 series connections (view from the top)



l_1	2,29 ± 0,13	d_1	$14,61 \leqslant d_1 \leqslant 14,73$
l_2	$8,76^{+0,25}_{0}$	d_2	$10,62 \leqslant d_2 \leqslant 10,71$
l_3	$4,75^{+0,25}_{0}$	d_3	8,13 maximum
l_4	$3,38 \leqslant l_4 \leqslant 3,47$	d_4	$17,32 \leqslant d_4 \leqslant 17,45$
l_5	5,85 minimum	d_5	23,42 ± 0,13
l_6	$17,78^{+0,25}_{0}$	r_1	$0,25 \leqslant r_1 \leqslant 0,38$
l_7	1,52 ± 0,05	r_2	4,8 ± 0,25
l_8	$3,78 \leqslant l_8 \leqslant 3,84$	r_3	$0,76 \leqslant r_3 \leqslant 0,89$
l_9	$0,76 \leqslant l_9 \leqslant 0,89$	β	30° ± 5°
l_{10}	$8,51 \leqslant l_{10} \leqslant 8,76$	γ	60° ± 1°
l_{11}	2,11 maximum	—	—

Figure 3 — Nipple of the 630 and 640 series connections



l_1	18,14 ± 0,13	d_1	26,59 ± 0,25
l_2	11,4 min.	d_2	1,035 internal [a]
l_3	$23{,}24\,^{0}_{-0{,}25}$	d_3	17,70 ± 0,13
l_4	28,7 ± 0,25	d_5	1,98
l_5	31,8 hexagonal	α	30° ± 5°

[a] Nominal diameter in inches.

Figure 4 — Union nut of the 630 and 640 series connections

7 710 and 720 series connections

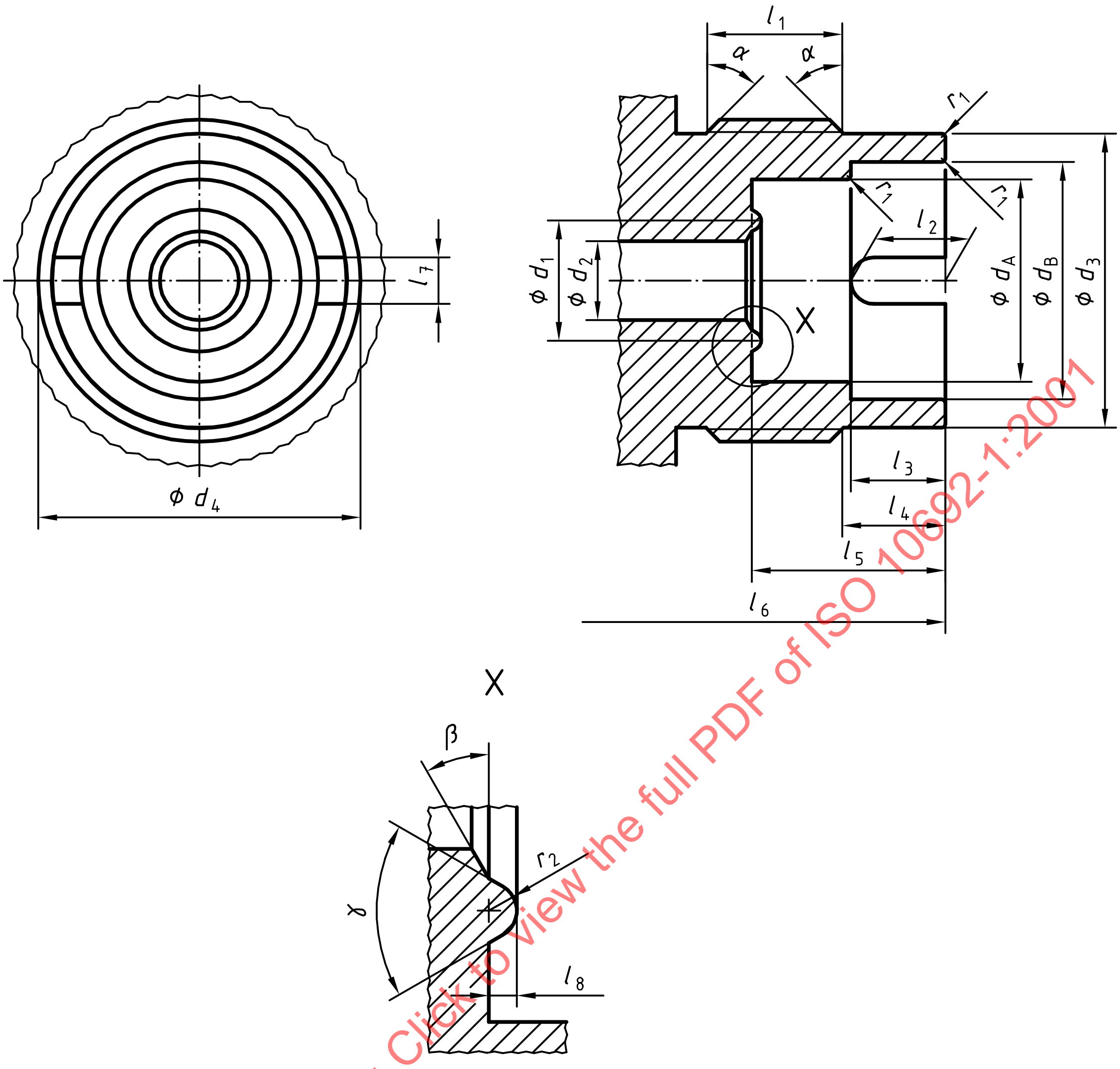
The connections of the 710 and 720 series are similar to those of the 630 and the 640 series, except for the thread and the corresponding dimensions and for the diameters d_A, d_B, d_M and d_N.

Figure 5 gives details of the valve outlet. Figure 6 shows details of the nipple. The values of the diameters d_A, d_B, d_M and d_N for the 710 and 720 series connections are given in Table 2.

Figure 7 shows the union nut.

Table 2 — Diameters for the 710 and 720 connections

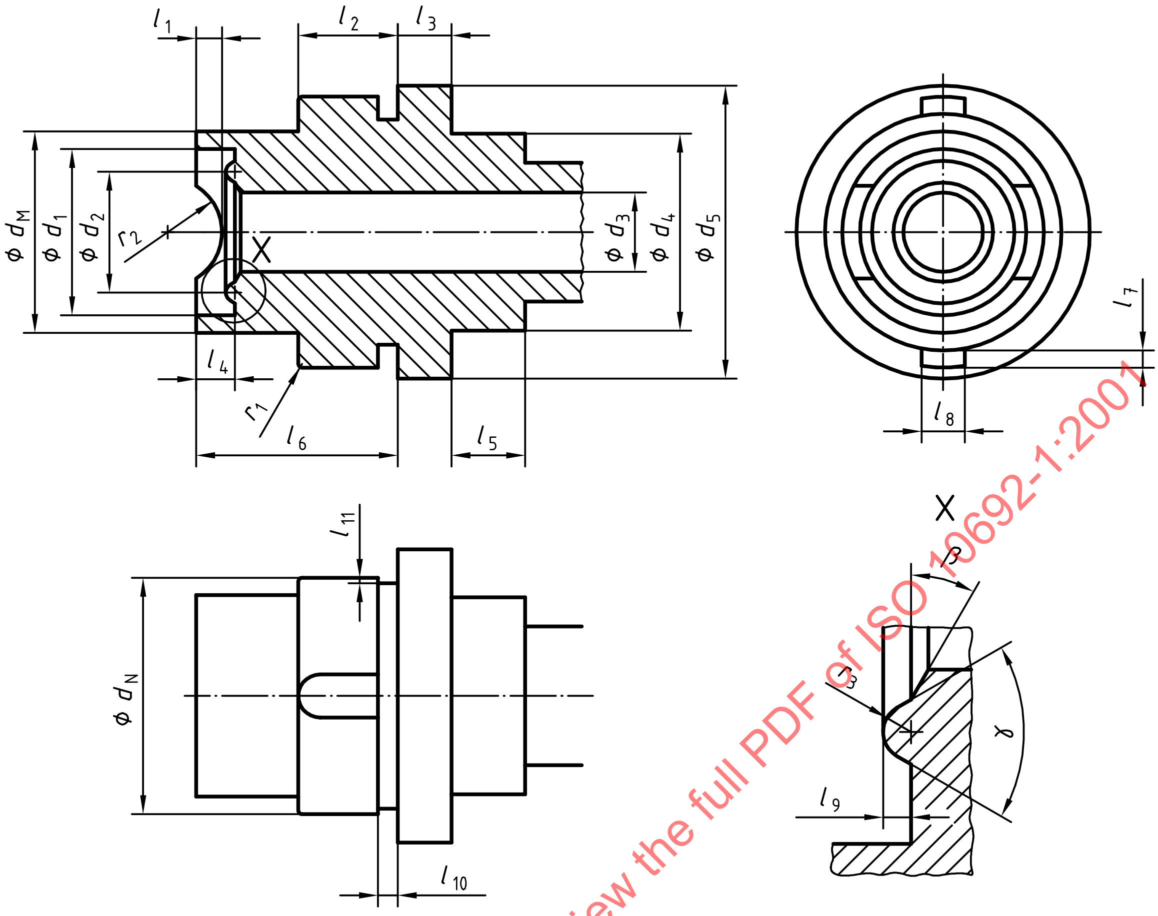
No.	d_A		d_B		d_M		d_N	
	min.	max.	min.	max.	min.	max.	min.	max.
712	16,48	16,58	22,43	22,52	16,30	16,41	22,25	22,35
714	16,84	16,94	22,08	22,17	16,67	16,76	21,90	21,99
716	17,20	17,29	21,72	21,81	17,02	17,11	21,54	21,64
718	17,56	17,65	21,37	21,46	17,38	17,47	21,19	21,28
720	17,91	18,00	21,01	21,10	17,73	17,83	20,83	20,92
722	18,27	18,36	20,65	20,75	18,09	18,18	20,48	20,57
724	18,62	18,71	20,30	20,39	18,44	18,54	20,12	20,21
726	18,98	19,07	19,94	20,04	18,80	18,89	19,77	19,86
728	19,33	19,43	19,33	19,43	19,16	19,25	19,16	19,25



l_1	11,1 min.	d_1	$10{,}62 \leqslant d_1 \leqslant 10{,}71$
l_2	$8{,}38\,^{+\,0{,}25}_{-\,0{,}13}$	d_2	8,13 max.
l_3	$8{,}38\,^{\;\;0}_{-\,0{,}25}$	d_3	$26{,}04 \leqslant d_3 \leqslant 26{,}16$
l_4	$9{,}14\,^{+\,0{,}25}_{\;\;0}$	d_4	1,125 external [a]
l_5	$17{,}15\,^{\;\;0}_{-\,0{,}25}$	r_1	$0{,}25 \leqslant r_1 \leqslant 0{,}38$
l_6	42,54 max.	r_2	$0{,}76 \leqslant r_2 \leqslant 0{,}89$
l_7	$4{,}09 \leqslant l_7 \leqslant 4{,}19$	α	45° ± 5°
l_8	$0{,}76 \leqslant l_8 \leqslant 0{,}89$	β	30° ± 5°
—	—	γ	60° ± 1°

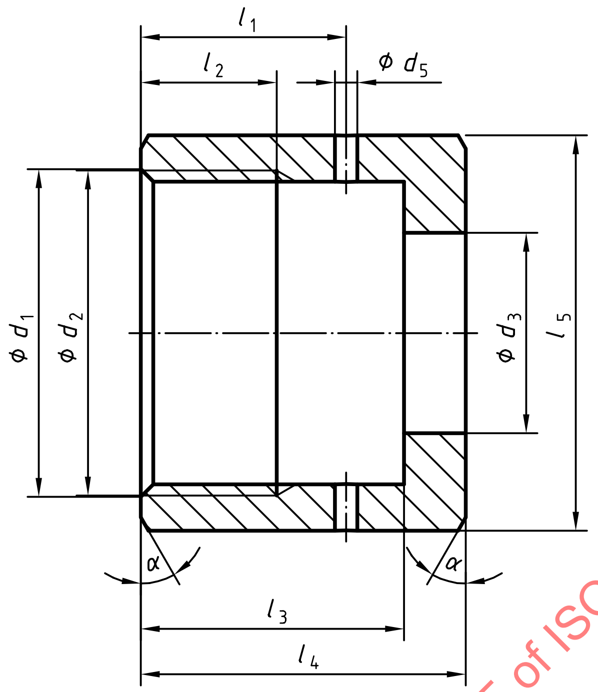
[a] Nominal diameter in inches.

Figure 5 — Valve outlet of the 710 and 720 series connections (view from the top)



l_1	$2,29 \pm 0,13$	d_1	$14,61 \leqslant d_1 \leqslant 14,73$
l_2	$8,76^{+0,25}_{0}$	d_2	$10,62 \leqslant d_2 \leqslant 10,71$
l_3	$4,75^{+0,25}_{0}$	d_3	8,13 max.
l_4	$3,38 \leqslant l_4 \leqslant 3,47$	d_4	$17,32 \leqslant d_4 \leqslant 17,45$
l_5	5,85 min.	d_5	$25,86 \pm 0,13$
l_6	$17,78^{+0,25}_{0}$	r_1	$0,25 \leqslant r_1 \leqslant 0,38$
l_7	$1,52 \pm 0,05$	r_2	$4,8 \pm 0,25$
l_8	$3,78 \leqslant l_8 \leqslant 3,84$	r_3	$0,76 \leqslant r_3 \leqslant 0,89$
l_9	$0,76 \leqslant l_9 \leqslant 0,89$	β	$30° \pm 5°$
l_{10}	$8,51 \leqslant l_{10} \leqslant 8,76$	γ	$60° \pm 1°$
l_{11}	2,11 max.	—	—

Figure 6 — Nipple of the 710 and 720 series connections



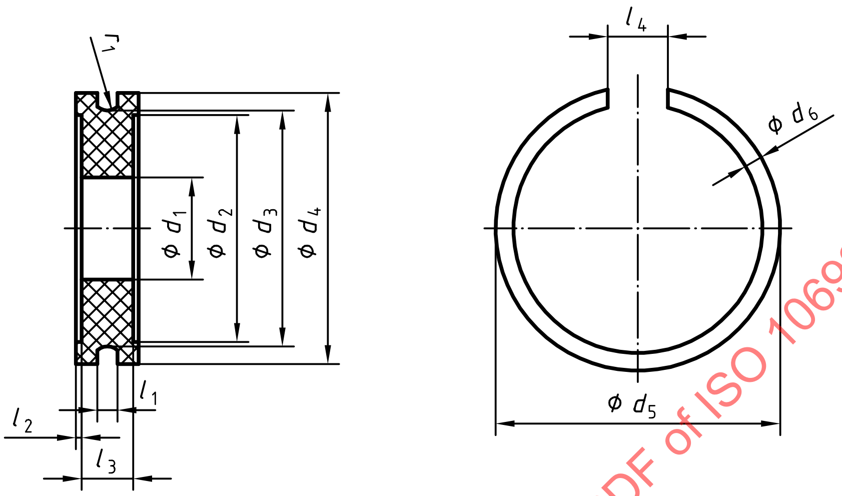
l_1	18,14 ± 0,13	d_1	28,96 ± 0,13
l_2	11,4 minimum	d_2	1,130 internal [a]
l_3	$23{,}24\ ^{0}_{-0{,}25}$	d_3	17,70 ± 0,13
l_4	28,7 ± 0,25	d_5	1,98 ± 0,13
l_5	34,93 hexagonal	α	30° ± 5°
[a] Nominal diameter in inches.			

Figure 7 — Union nut of the 710 and 720 series connections

8 Components common to both series

8.1 Gasket and clip

Dimensional details of a gasket (typically Ni 200) and the corresponding stainless steel wire clip are given in Figure 8. The clip holds the gasket in the nipple bore to prevent it from falling out.



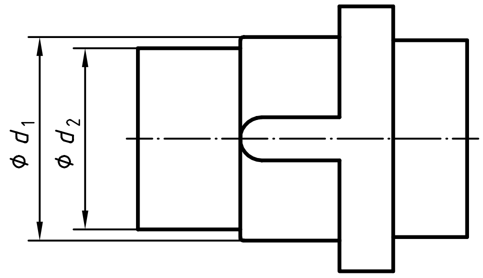
l_1	$1,02 \leqslant l_1 \leqslant 1,09$	d_1	$5,34 \leqslant d_1 \leqslant 5,46$
l_2	$0,30\ _{-0,05}^{\ 0}$	d_2	$12,19 \pm 0,13$
l_3	$2,72\ _{-0,10}^{\ 0}$	d_3	$12,45 \leqslant d_3 \leqslant 12,52$
l_4	$3,18 \pm 0,13$	d_4	$14,28 \leqslant d_4 \leqslant 14,40$
r_1	0,81 maximum	d_5	$14,99 \leqslant d_5 \leqslant 15,11$
—	—	d_6	$0,94 \pm 0,13$

Figure 8 — Gasket and clip

8.2 Blind plug

Figure 9 shows the blind plug used, e.g., for blocking the valve outlet during transport. Except for the dimensions explicitly mentioned in the figure and for the absence of a bore, the plug shall have the same dimensions as the 630 and 640 series nipple (see Figure 3). The appropriate nut for the valve outlet shall be used (either as in Figure 4 for 630 and 640 series outlets or Figure 7 for series 710 and 720 outlets). The blind plug shall have a device to prevent separation from the union nut, e.g. a metallic retaining clip.

The blind plug may be tightened by means of a gasket made of an organic material (such as polychlorotetrafluoroethylene) instead of a metal gasket. Such a gasket shall not have a hole; apart from this, the dimensions shall be the same as for the metal gasket (see Figure 8). A lower seating torque shall be used than for the metallic gasket.

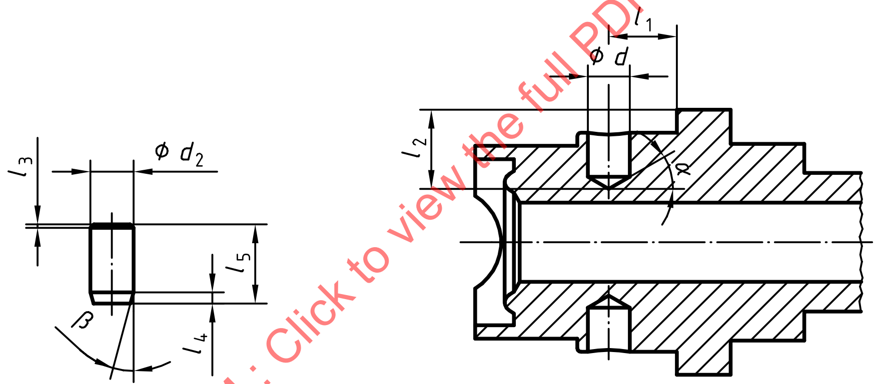


d_1	18,08 max.
d_2	16,31 max.

Figure 9 — Blind plug

8.3 Alternative nipple design

The anti-rotational device on the side of the nipple may be realized by means of a pair of pins, as shown in Figure 10, instead of by means of keys as shown in Figure 1. Apart from the bore and pin dimensions as given in Figure 10 and the absence of the keys, the nipple shall have the same dimensions as given in Figure 3 for the 630 and 640 series or in Figure 6 for the 710 and 720 series.



l_1	5,0 ± 0,25	d_1	$3{,}70\,^{+0{,}02}_{\ \ 0}$
l_2	$7{,}00\,^{+0{,}15}_{\ \ 0}$	d_2	$3{,}80\,^{+0{,}15}_{\ \ 0}$
l_3	$0{,}3\,^{\ \ 0}_{-0{,}01} \times 45°$	α	30° ± 5°
l_4	$1{,}0\,^{+0{,}2}_{\ \ 0}$	β	15° ± 5°
l_5	$7{,}00\,^{+0{,}10}_{-0{,}05}$	—	—

Figure 10 — Alternative design of the anti-rotational device of the nipple

9 Thread profile

The thread as shown in Figure 11 is an $\alpha = 60°$ thread ($P = H$) similar to those described in ISO 68-2, but with modified truncations. The nominal diameter of the internal thread is larger than that of the corresponding external thread. The general shape of the thread is shown in Figure 11.

Only right-hand threads with a pitch of P = 1,814 mm and only two combinations of external/internal thread are used in this part of ISO 10692. The complete set of their diameters with tolerances is given in Table 3.

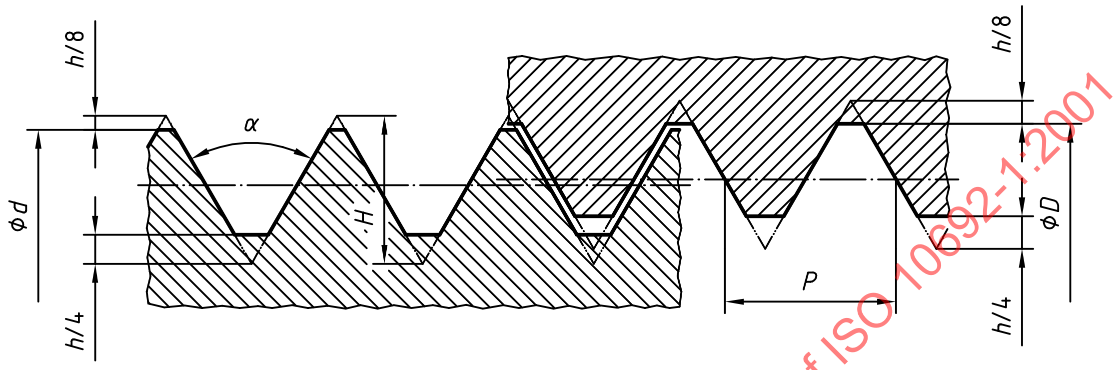


Figure 11 — Thread profile

Table 3 — Relevant thread dimensions with tolerances in millimetres

Diameter		**Nominal diameter**			
		1,030 external (Valve)	**1,035 internal** (Nut)	**1,125 external** (Valve)	**1,130 internal** (Nut)
Major	maximum	26,162	–	28,575	–
	nominal	**26,162**	**26,289**	**28,575**	**28,702**
	minimum	26,035	26,289	28,448	28,702
Pitch	maximum	24,983	25,212	27,396	27,625
	nominal	**24,983**	**25,111**	**27,396**	**27,523**
	minimum	24,882	25,111	27,295	27,523
Minor	maximum	23,936	24,521	26,350	26,934
	nominal	**23,936**	**24,326**	**26,350**	**26,738**
	minimum	–	24,326	–	26,738

10 Allocation of outlet to single gases listed in annex A

The term "single gas" in this context means that the gas is not comprised of a gas mixture. All gases belong to exactly one of seven groups characterized by inflammability/oxidizing ability (see ISO 10156) and toxicity (see ISO 10298) according to the pattern given in Table 4. Most groups have more than one valve outlet; the gases allocated to them are clearly indicated. Such extra separation into 15 connections is to assure compatibility in the specialist microelectronics industry.

A number of gases are already in use in the fields of application dealt with here, and they have been allocated to valve outlets. A list of them is given in Annex A. These allocations are mandatory.

Table 4 — Valve outlet allocations

		Fire hazard					
		Non-inflammable Non-oxidizing		Inflammable		Oxidizing	
		Group	Outlet	Group	Outlet	Group	Outlet
Toxicity	Non-toxic	①	Atmospheric gases : (Ar, He, Kr, N_2, Ne, Xe) 718 Other gases: 716	②	Silanes: 632 NH_3 and Amines: 720 Other gases: 724	③	NF_3: 640 Oxygen: 714 Other gases: 712
	Toxic	④	HF and WF6: 638 Other fluorides: 642 $SiCl_4$: 636 Other gases: 634	⑤	Metal organics: 726 Toxic Hydrides: 632 CO: 724 Halogenated silanes: 636 (H_2, $SiCl_2$, $HSiCl_3$, SiH_2F_2) Other gases: 722	⑥	Toxic oxidizing gases: 728

11 Allocation of other gases and of gas mixtures to outlets

The fire potential and the toxicity of the other gases and gas mixtures shall be determined in accordance with ISO 10156 and ISO 10298 respectively. It shall then be identified to which group (from ① to ⑥) of Table 4 the relevant mixture corresponds. The outlet to be selected in each group shall be the one allocated to the single gas which generates the main hazard in the mixture (e.g. a toxic mixture containing 30 % N_2, 3 % AsH_3 and 67 % CO will have outlet No. 632). If the mixture does not contain any gases to which a specific outlet is allocated for the relevant gas group, then the outlet corresponding to "other gases" shall be used.

In recognition of the valve outlets which are currently in use in many parts of the world, non-oxidizing mixtures containing silanes, arsine, phosphine, diborane and germane may, as an alternative, be allocated with a 632 outlet.

Warning — The components of a gas mixtures shall be compatible, so that at normal temperatures during transport and storage no dangerous reactions are likely to occur in the blended mixture which would endanger the safety of the cylinder.