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Vacuum technology — Dimensions of knife-edge flanges

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Vacuum technology — Dimensions of knife-edge flanges

Technique du vide — Dimensions des brides à guillotine

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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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This document was prepared by Technical Committee ISO/TC 112, *Vacuum technology*.

This third edition cancels and replaces the second edition (ISO 3669:2017), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

— the title has been updated;

— Clause 4 and Table 1: "l_7" has changed to "l_7 – Depth for pipe connection";

— Reference [4] has been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a minor revision of the second edition (ISO 3669:2017) and contains significant technical changes from the first edition (ISO 3669:1986), which defined two series of "bakeable" flanges:

— as a preferred series, the main dimensions of which ensure compatibility with already standardized non-bakeable flanges (see ISO 1609);

— a secondary series corresponding to flanges in common use.

This document specifies only one series and is no longer dependent on the preferred number. Effectively, the preferred series has been made obsolete, thereby promoting the secondary series to be the one and only set of specified dimensions. Furthermore, several dimensions in what was formerly the secondary series, have been modified to correspond to flanges in common use. Finally, detailed dimensions for the knife-edge sealing profile have been incorporated.

It is noted, however, that the original ConFlat®[1)] flange dimensions and tolerances, as developed by Varian, were not available during the development stage of this specification. The intent of this document is to ensure interchangeability of flanges. It is reasonable to accept that flanges manufactured to the original Varian specifications are compatible with flanges manufactured according to this document, even though they might not fall within all tolerances.

1) ConFlat® is the trademark of a product supplied by Varian, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

INTERNATIONAL STANDARD ISO 3669:2020(E)

Vacuum technology — Dimensions of knife-edge flanges

1 Scope

This document specifies the dimensions of fixed or rotatable bolted knife-edge flanges used in vacuum systems for pressures ranging from atmospheric to as low as 10^{-11} Pa.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
knife-edge flange
metal sealed flange used for high and ultra-high vacuum service

Note 1 to entry: Sandwiching one metal gasket between two knife-edge flanges and securely bolting these together makes a vacuum tight joint. The seal is made when the identical circular (triangular profile) knife-edges are bolted together. A deformable metal gasket captured between the knife-edge flanges establishes the sealing surface.

Note 2 to entry: Originally developed as ConFlat® flanges. The widespread and continued use of knife-edge flanges has made these a de facto international standard, codified by this document.

3.2
nominal bore
value intended to both identify the flange and specify the largest practical size of tubing that can be accommodated by the flange

Note 1 to entry: See Table 1, in which the convention of identifying original flanges by the outside diameter of the flange (historically in inches) has been maintained.

3.3
leak check groove
groove machined into the seal side of the flange to facilitate the free passage of trace gas from the outer perimeter of the flange to the seal zone near the metal gasket

4 Symbols and abbreviated terms

Symbol	Designation	Unit
l_1	nominal outside diameter of flange	mm (in)
l_2	max. tube	mm
l_3	bolt hole	mm
l_4	bolt circle	mm

Symbol	Designation	Unit
φ	position tolerance of bolt hole centre	mm
l_5	seal recess	mm
l_6	knife-edge	mm
l_7	depth for pipe connection	mm
l_8	setback for inner rotatable ring	mm
l_9	flange thickness	mm
l_{10}	outside diameter of metal gasket	mm

5 Requirements

5.1 Materials

5.1.1 Flange

The selection of the material shall be compatible with the requirements for the flanges. Considerations may include service temperature, sealing capacity, corrosion resistance, magnetic permeability, type of seal gasket used and dimensions.

NOTE Austenitic stainless steel is commonly used, but it is not the intent of this document to specify or limit the choice of flange material to austenitic stainless steel.

5.1.2 Bolt holes

The flange may have either clearance or tapped bolt holes.

NOTE As a number of flanges in use currently originated in the United States, the tapped flanges often have English tapped holes. Of increasing use are flanges with metric threads. Both are presented in this document (see Table 1).

5.1.3 Grooves

Leak check grooves should be used. The grooves shall be arranged equidistantly between the bolt holes.

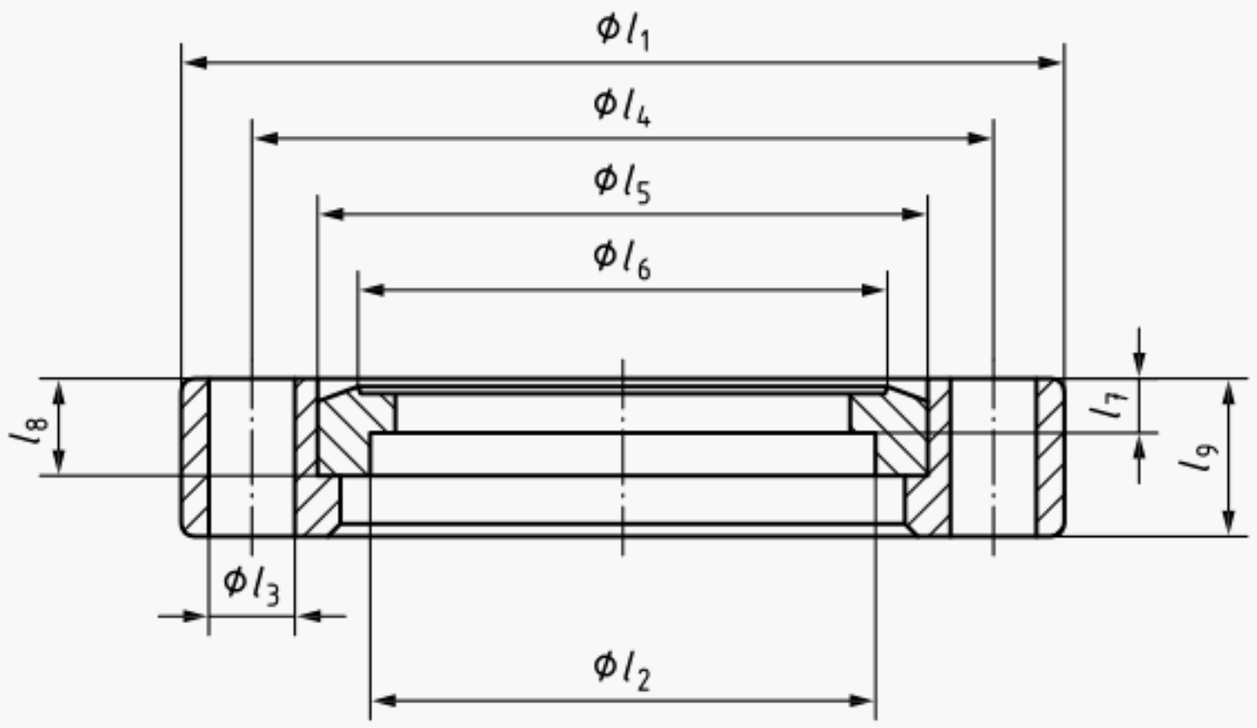
5.1.4 Gasket

In general, the gasket should be softer than the flange to avoid dulling of flange knife-edge.

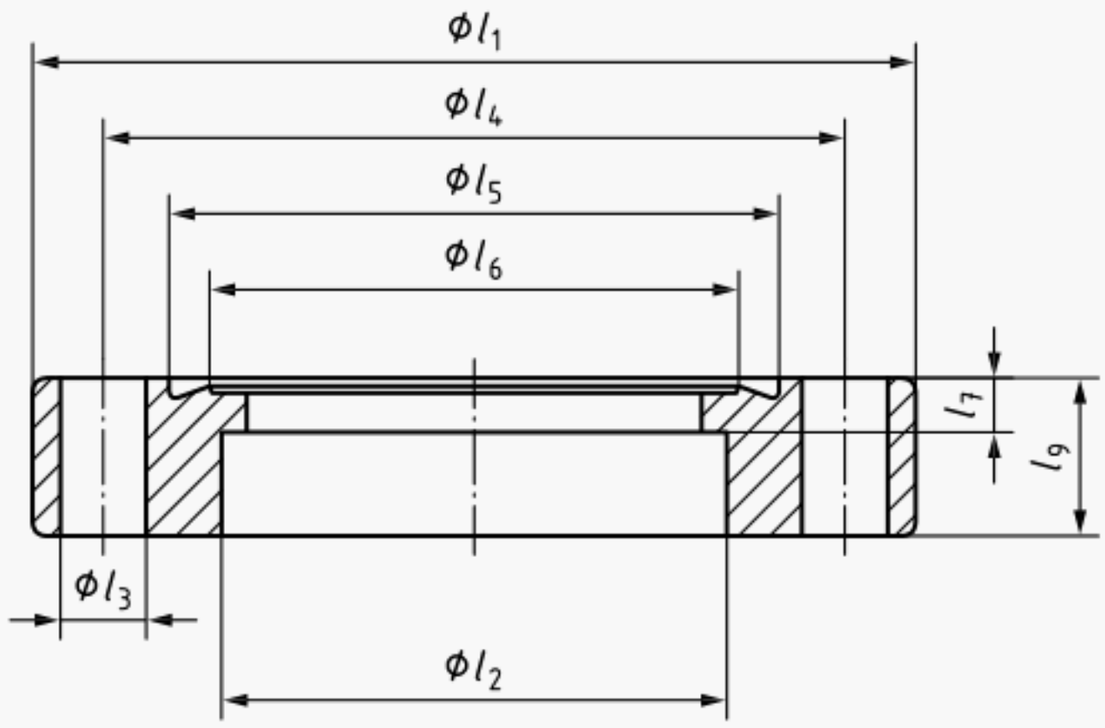
NOTE Oxygen-free high conductivity (OFHC) copper is commonly used, but it is not the intent of this document to specify or limit the choice of gasket material to OFHC copper.

5.2 Dimensions

Flange dimensions are shown and specified in Figures 1 to 3 and in Table 1 and Table 2. See Figure 4 for the recommended dimensions of leak check grooves.



a) Rotatable flange



b) Non-rotatable flange

Figure 1 — Basic flange dimensions

Dimensions in millimetres

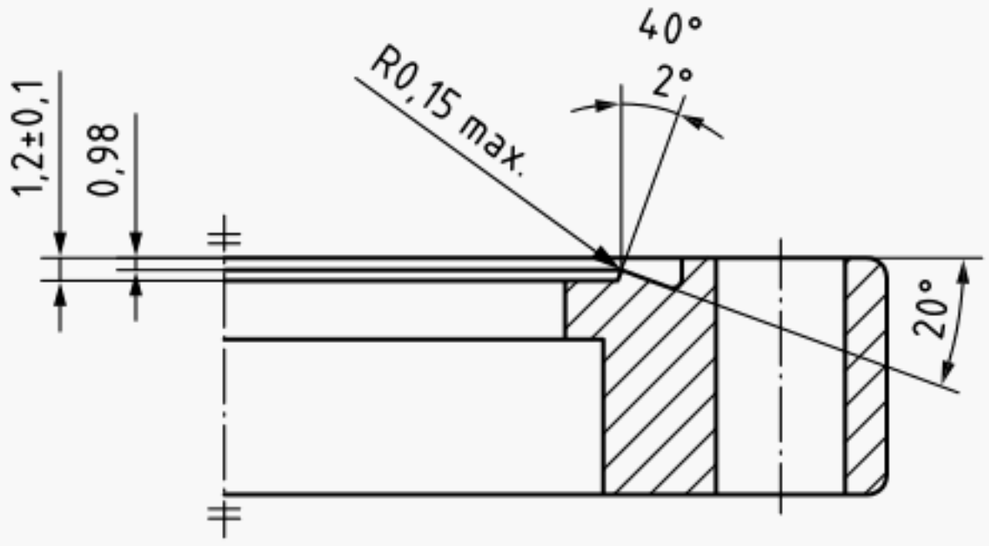


Figure 2 — Knife-edge detail

Dimensions in millimetres

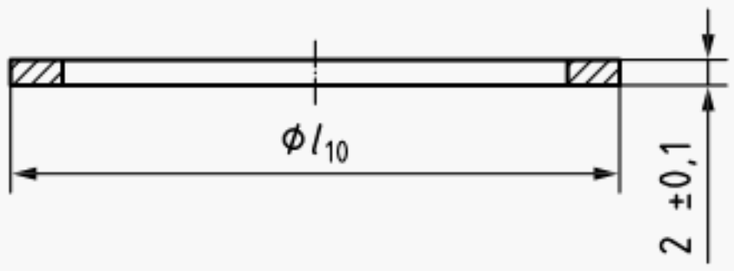
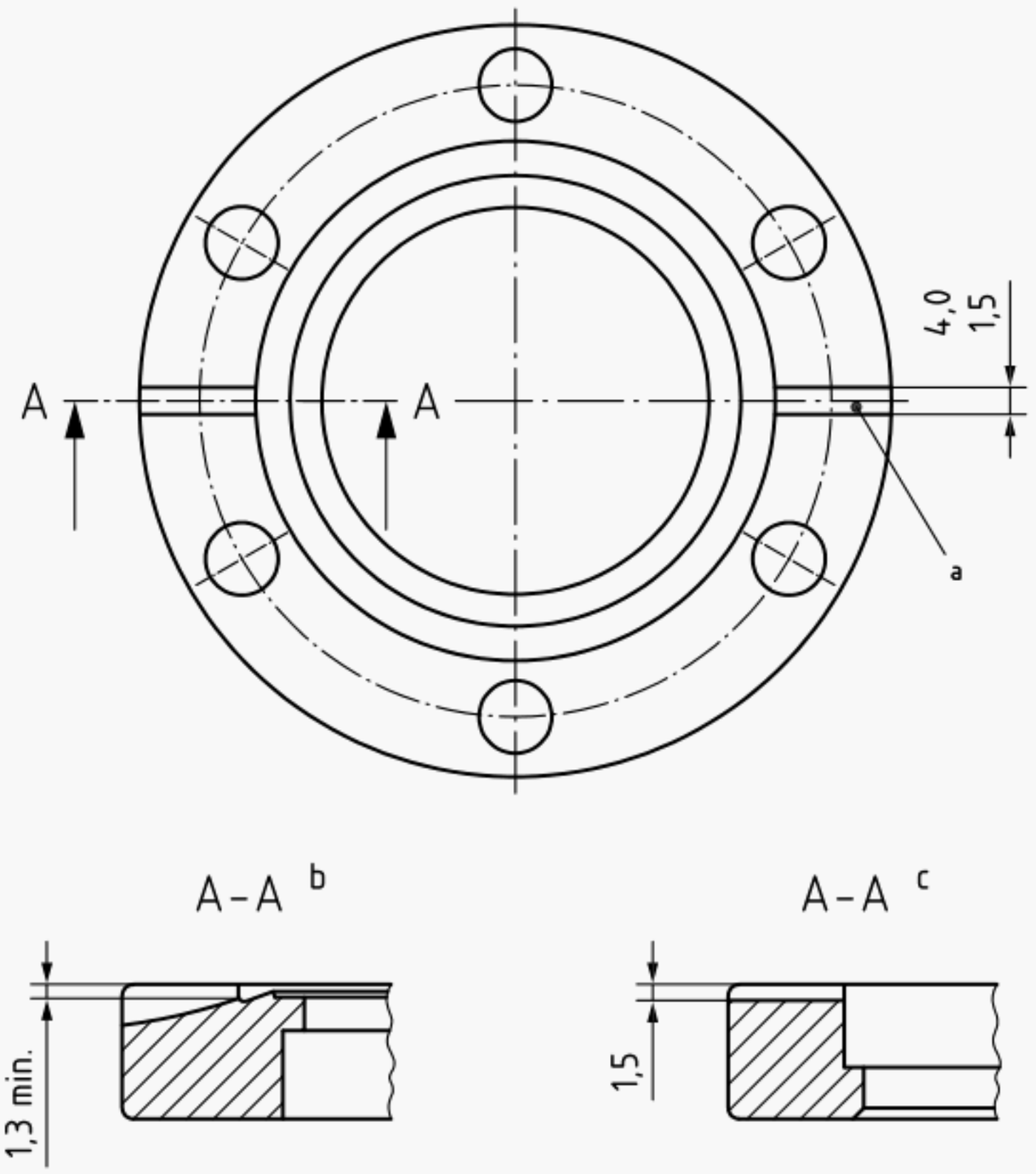


Figure 3 — Metal gasket

Dimensions in millimetres



Key

a Recommendation: leak check groove equidistant (± 0,15 mm) between bolt holes.

b Non-rotatable flange.

c Rotatable flange.

Figure 4 — Recommended dimensions for leak check grooves

Table 1 — Flange dimensions

Nominal bore	l_1 **Nominal outside diameter** mm (in)	l_2 **Max. tube**[a] mm	**No. bolts**[b]	l_3 **Bolt hole** Tol. +0,2 0 mm	**Bolt thread**[c]	l_4 **Bolt circle** mm	φ **Position tolerance of bolt hole centre** mm	l_5 **Seal recess** Tol. +0,2 0 mm	l_6 **Knife-edge** Tol. ±0,1 mm	l_7 **Depth for pipe connection** min mm	l_8 **Setback for inner rotatable ring** mm	l_9 **Flange thickness** min mm
10CF	25,0 (1,0)	12,0	6	3,3	M3x0,5	17,5	φ0,1	13,5	10,5	3,0	–	6,0
16CF[d]	33,8 (1,33)	19,4	6	4,4	M4x0,7 (#8–32)	27,0	φ0,1	21,4	18,3	3,3	5,9	7,0
25CF	54,0 (2,12)	25,8	4	6,8	M6x1,0 (1/4"-28)	41,3	φ0,2	33,0	27,7	4,3	6,0	11,5
40CF[d]	69,9 (2,75)	44,5	6	6,8	M6x1,0 (1/4"-28)	58,7	φ0,2	48,3	41,9	4,3	7,7	12,5

a Given for guidance only and corresponds to commonly used austenitic stainless-steel flanges.

b Number of bolts equispaced on bolt circle.

c Metric tap (English tap), according to ISO 965-1.

d These flanges are most commonly used.

Table 1 *(continued)*

Nominal bore	l_1 **Nominal outside diameter** mm (in)	l_2 **Max. tube**[a] mm	**No. bolts**[b]	l_3 **Bolt hole** Tol. +0,2 0 mm	**Bolt thread**[c]	l_4 **Bolt circle** mm	φ **Position tolerance of bolt hole centre** mm	l_5 **Seal recess** Tol. +0,2 0 mm	l_6 **Knife-edge** Tol. ±0,1 mm	l_7 **Depth for pipe connection** min mm	l_8 **Setback for inner rotatable ring** mm	l_9 **Flange thickness** min mm
50CF	85,7 (3,38)	51,0	8	8,4	M8x1,25 (5/16"-24)	72,4	φ0,2	61,8	55,9	4,9	9,7	16,0
63CF[d]	114,3 (4,50)	70,0	8	8,4	M8x1,25 (5/16"-24)	92,2	φ0,2	82,5	77,2	6,4	12,7	17,0
75CF	117,4 (4,62)	76,2	10	8,4	M8x1,25 (5/16"-24)	102,3	φ0,2	91,6	85,2	6,5	13,0	17,5
100CF[d]	152,4 (6,00)	108,0	16	8,4	M8x1,25 (5/16"-24)	130,3	φ0,2	120,6	115,3	7,2	14,3	19,5
125CF	171,5 (6,75)	127,0	18	8,4	M8x1,25 (5/16"-24)	151,6	φ0,2	141,8	136,3	7,2	14,3	21,0
160CF[d]	203,2 (8,00)	159,0	20	8,4	M8x1,25 (5/16"-24)	181,0	φ0,2	171,4	166,1	8,0	15,9	21,0
200CF[d]	254,0 (10,00)	206,0	24	8,4	M8x1,25 (5/16"-24)	231,8	φ0,2	222,2	216,9	8,6	17,2	24,0
250CF[d]	304,8 (12,00)	256,0	32	8,4	M8x1,25 (5/16"-24)	284,0	φ0,2	273,1	267,5	9,0	18,0	24,0
275CF	336,6 (13,25)	273,4	30	10,8	M10x1,5 (3/8"-24)	306,3	φ0,2	294,4	288,2	9,9	19,8	28,0
300CF	368,3 (14,5)	306,0	32	10,8	M10x1,5 (3/8"-24)	338,1	φ0,2	326,4	320,0	9,9	19,8	28,0
350CF	419,1 (16,5)	356,0	36	10,8	M10x1,5 (3/8"-24)	388,9	φ0,4	376,7	373,0	10,4	20,7	28,0
400CF	469,9 (18,5)	406,0	40	10,8	M10x1,5 (3/8"-24)	437,9	φ0,4	424,4	419,0	10,4	20,7	28,0

[a] Given for guidance only and corresponds to commonly used austenitic stainless-steel flanges.

[b] Number of bolts equispaced on bolt circle.

[c] Metric tap (English tap), according to ISO 965-1.

[d] These flanges are most commonly used.

Table 2 — Dimensions for metal gasket

Nominal bore	**Outside diameter** l_{10} mm	**Tolerance** mm
10CF	13,3	0 −0,2
16CF	21,3	
25CF	32,9	
40CF	48,2	
50CF	61,7	
63CF	82,4	
75CF	91,5	
100CF	120,5	0 −0,3
125CF	141,7	
160CF	171,3	
200CF	222,1	

Table 2 *(continued)*

Nominal bore	Outside diameter l_{10} mm	Tolerance mm
250CF	272,9	0 −0,5
275CF	294,3	
300CF	326,2	
350CF	376,5	
400CF	423,9	

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

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