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JAPANESE INDUSTRIAL STANDARD

JIS B 2290 : 1998
(ISO 1609 : 1986)

Vacuum technology—Flange dimensions

Introduction This Japanese Industrial Standard has been prepared based on **ISO 1609, Vacuum technology—Flange dimensions** issued in 1986 as the first edition without modifying the technical contents, but “Flanges for maintenance” not specified in the corresponding International Standard is added in the Annex (informative) to this Standard.

1 Scope This Standard specifies the dimensions for flanges and collars used in vacuum technology. The dimensions ensure interchangeability between bolted, clamped and rotatable flanges,

- a) whether the assembly be homogeneous (for example, bolted flanges or clamped flanges) or heterogeneous (for example, bolted flanges assembled with clamped flanges either by means of bolts or clamps or by means of bolts and rotatable flanges);
- b) whether the sealing rings used with the flanges be elastomer O-rings or metal sealing rings, provided that they are compatible with the linear sealing loads given in 4.

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- b) whether the sealing rings used with the flanges be elastomer O-rings or metal sealing rings, provided that they are compatible with the linear sealing loads given in 4.

2 Normative references The following standards contain provisions which through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards indicated below shall be applied.

JIS B 1256 *Plain washers*

JIS B 8365 *Dimensions of clamped-type vacuum couplings*

JIS Z 8601 *Preferred numbers*

ISO 273 *Fasteners—Clearance holes for bolts and screws*

ISO 1127 *Stainless steel tubes—Dimensions, tolerances and conventional masses per unit length*

ISO 4200 *Plain end steel tubes, welded and seamless—General tables of dimensions and masses per unit length*

3 Dimensions

3.1 General

3.1.1 The dimensions of the flanges or collars shall conform to those specified in tables 1 to 3. These dimensions are for finished products and do not include allowance for machining. Flanges or collars with nominal bores of 10 to 40 inclusive, given in tables 1 to 3, accept the corresponding quick-release couplings specified in JIS B 8365. Relevant dimensions and tolerances are specified in 5.

3.1.2 The selection of materials shall be compatible with the requirements for flanges and collars used in vacuum technology and with the dimensions given in tables 1 to 3.

3.1.3 In order to ensure the interchangeability of vacuum components, the flanges shall be aligned so that the bolt holes are spaced equidistantly about and off the symmetrical plane of the component.

3.2 Nominal bore

3.2.1 The tables 1 to 3 provide a series of values of nominal bores intended to identify the flanges or collars.

3.2.2 These values follow the progression of the R10 series of preferred numbers (see **JIS Z 8601**) from which only the term 12.5 has been eliminated.

3.2.3 The values of nominal bore belonging to the R5 series of preferred numbers are as follows:

10, 16, 25, 40, 63, 100, 160, 250, 400, 630, 1 000

3.2.4 The nominal bores 63 and 160 given in tables 1 to 3 correspond to practical diameters of 70 mm (or 65 mm) and 153 mm respectively.

3.3 Diameter of bolt holes, C The values for the diameter of bolt holes, C , are derived from the bolt diameters, D , in accordance with **ISO 273**—medium series.

3.4 Bolt diameter, D For a flange of given nominal bore, the bolt diameter, D , is the same for both bolted and rotatable flanges.

3.5 Mating face

3.5.1 Definition The mating face of the flange is the area in the form of a ring, the surface finish and the flatness of which make the sealing of the joint possible.

3.5.2 Limits The minimum mating face is defined by diameter E in table 1 and S in table 2, and by diameter F in tables 1 and 2.

3.5.3 Profile The flange sealing face shall be flat and no part of the flange shall project in relation to this plane.

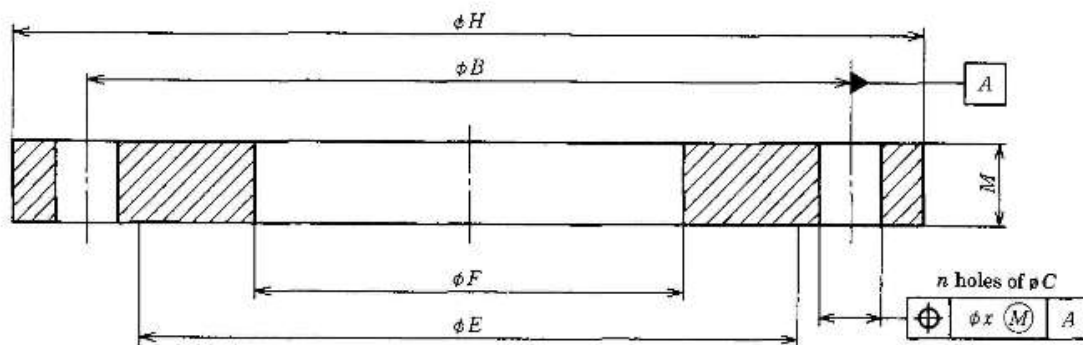
3.6 Width of the collar onto which the clamp hooks, G The value for the width depends on the system of clamps used and should not be greater than 2.5 mm.

3.7 Outside diameter of bolted and rotatable flanges, H The dimensions given for the outside diameter are compatible with the requirement that the bolt washers (**JIS B 1256**) shall not project beyond the outer circumference of the flange.

3.8 Number of bolt holes, n The linear sealing loads tabulated in table 4 of 4 for a given bolt stress are derived from the values of the number of bolt holes, n .

3.9 Inner diameter for the contact area of clamps, U So as to take into account the diversity of the clamping systems which may be used, for example on collars with welding necks, the maximum inner diameter of the annulus reserved for contact with the clamps is defined by diameter U .

Table 1 Dimensions of bolted flanges

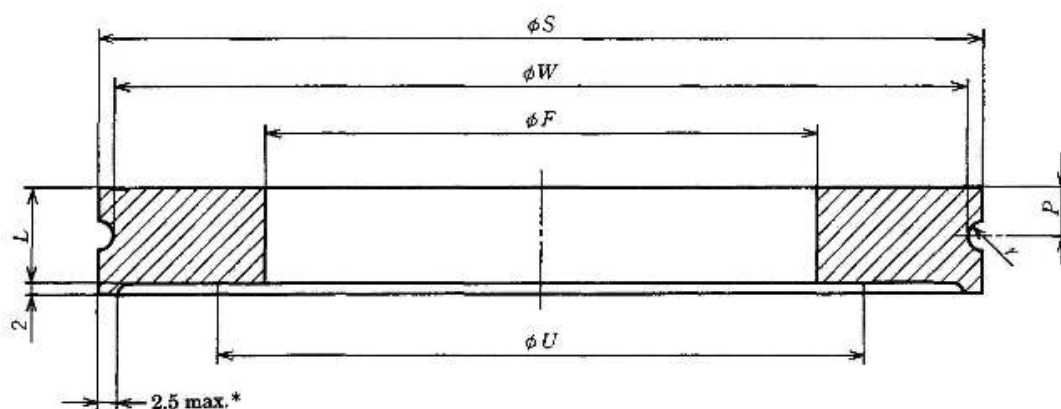


Unit : mm

Nominal bore *	B	C H13	x	Bolts		E**	F**	H	M s16
				D	n				
10	40	6.6	0.6	6	4	30	12.2	55	8
16	45	6.6	0.6	6	4	35	17.2	60	8
20	50	6.6	0.6	6	4	40	22.2	65	8
25	55	6.6	0.6	6	4	45	26.2	70	8
32	70	9	1	8	4	55	34.2	90	8
40	80	9	1	8	4	65	41.2	100	12
50	90	9	1	8	4	75	52.2	110	12
63	110	9	1	8	4	95	70	130	12
80	125	9	1	8	8	110	83	145	12
100	145	9	1	8	8	130	102	165	12
125	175	11	1	10	8	155	127	200	16
160	200	11	1	10	8	180	153	225	16
200	260	11	1	10	12	240	213	285	16
250	310	11	1	10	12	290	261	335	16
320	395	14	2	12	12	370	318	425	20
400	480	14	2	12	16	450	400	510	20
500	580	14	2	12	16	550	501	610	20
630	720	14	2	12	20	690	651	750	24
800	890	14	2	12	24	860	800	920	24
1 000	1 090	14	2	12	32	1 060	1 000	1 120	24

Notes * See 3.2. It should be noted that the nominal bores recommended above 1 000 are: 1 250, 1 600, 2 000 and 2 500.

** See 3.5.2.

Table 2 Dimensions of collars for clamped or rotatable flanges

Unit: mm

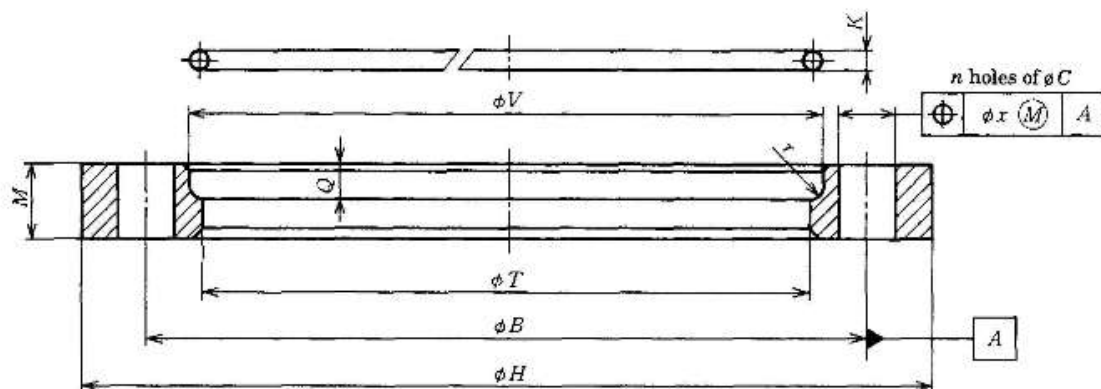
Nominal bore*	F**	L js16	P H14	r B10	S** h11	U***	W h11
10	12.2	6	3	1	30	15	28
16	17.2	6	3	1	35	20	33
20	22.2	6	3	1	40	25	38
25	26.2	6	3	1	45	30	43
32	34.2	6	3	1	55	40	53
40	41.2	10	5	1.5	65	50	62
50	52.2	10	5	1.5	75	60	72
63	70	10	5	1.5	95	80	92
80	83	10	5	1.5	110	95	107
100	102	10	5	1.5	130	115	127
125	127	10	5	2.5	155	140	150
160	153	10	5	2.5	180	165	175
200	213	10	5	2.5	240	225	235
250	261	10	5	2.5	290	275	285
320	318	15	7.5	2.5	370	355	365
400	400	15	7.5	4	450	435	442
500	501	15	7.5	4	550	535	542
630	651	20	10	5	690	660	680

Notes * See 3.2. It should be noted that the nominal bores recommended above 630 are: 800, 1 000, 1 250, 1 600, 2 000 and 2 500.

** See 3.5.2.

*** See 3.9.

Table 3 Dimensions of rotatable flanges with retaining rings



Unit : mm

Nominal bore *	B	C H13	z	Bolts		H	K**	M js16	Q***	T H11	V H14	r B10
				D	n							
10	40	6.6	0.6	6	4	55	2	8	3	30.1	32.1	1
16	45	6.6	0.6	6	4	60	2	8	3	35.1	37.1	1
20	50	6.6	0.6	6	4	65	2	8	3	40.1	42.1	1
25	55	6.6	0.6	6	4	70	2	8	3	45.1	47.1	1
32	70	9	1	8	4	90	2	8	3	55.5	57.5	1
40	80	9	1	8	4	100	3	12	5.5	65.5	68.5	1.5
50	90	9	1	8	4	110	3	12	5.5	75.5	78.5	1.5
63	110	9	1	8	4	130	3	12	5.5	95.5	98.5	1.5
80	125	9	1	8	8	145	3	12	5.5	110.5	113.5	1.5
100	145	9	1	8	8	165	3	12	5.5	130.5	133.5	1.5
125	175	11	1	10	8	200	5	16	6.5	155.7	160.7	2.5
160	200	11	1	10	8	225	5	16	6.5	180.7	185.7	2.5
200	260	11	1	10	12	285	5	16	6.5	240.7	245.7	2.5
250	310	11	1	10	12	335	5	16	6.5	290.7	295.7	2.5
320	395	14	2	12	12	425	5	20	8.5	370.8	375.8	2.5
400	480	14	2	12	16	510	8	20	10	450.8	458.8	4
500	580	14	2	12	16	610	8	20	10	550.8	558.8	4
630	720	14	2	12	20	750	10	24	12	691	701	5

Notes * See 3.2. It should be noted that the nominal bores recommended above 630 are: 800, 1 000, 1 250, 1 600, 2 000 and 2 500.

** In the absence of a standard for the drawn wire used for the rings, the following tolerances are suggested:

± 0.02 mm for $K = 2$ mm

± 0.025 mm for $K = 3.5$ mm and 5 mm

± 0.03 mm for $K = 8$ mm

*** In no case should the surface of the rotatable flange protrude past the collar face when assembled.

Remarks : The diameter of the retaining ring shall be compatible with dimension V.

4 Linear sealing loads Fig. 1 shows the detail of a bolt assembly with O-ring, the values given in table 4 have been calculated for each bolted flange under the following conditions of use.

σ is the resulting linear load, in newtons per millimetre, exerted on a unit length of an elastomer O-ring by the uniform tightening of n bolts to a stress of 200 N/mm², the mean diameter of the sealing ring, before compression, being equal to $(d_1 + d_2)$ mm.

Linear sealing load shall be calculated according to the following formula.

$$\sigma = \frac{200 ns}{\pi (d_1 + d_2)}$$

where, s : cross-sectional area of the core of the bolt (mm²)

d_1 : inside diameter of the sealing ring (mm)

d_2 : cross-sectional diameter of the sealing ring before compression (mm)

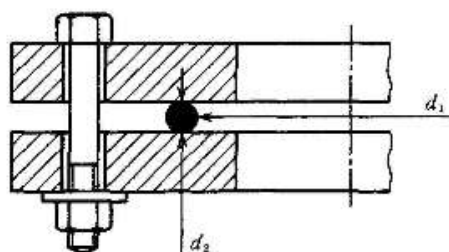
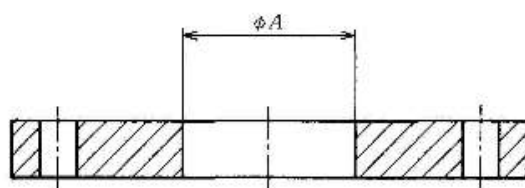
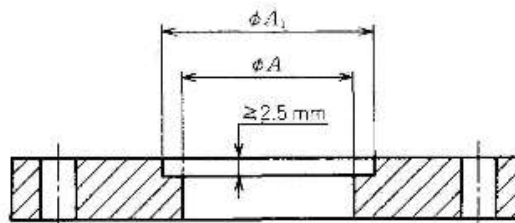


Fig. 1 Detail of a bolt assembly with O-ring

Table 4 Linear sealing loads

Nominal bore mm	Typical values of σ N/mm
10	185
16	154
20	132
25	116
32	177
40	146
50	124
63	96
80	164
100	138
125	184
160	157
200	174
250	143
320	162
400	179
500	146
630	150
800	144
1 000	156

5 Bores for vacuum flanges and required outside tube diameters Bores for vacuum flanges and required nominal diameter of tube shall be as given in table 5 and table 6. Bores for vacuum flanges shall be as given in table 5, and bore for vacuum flange with recess shall be as given in table 6.

Table 5 Bores for vacuum flanges**Table 6 Bores for vacuum flanges with recess**

Unit : mm

Nominal bore	A*
10	10
16	16
20	21
25	24
32	34
40	41
50	51
63	70
80	83
100	102
125	127
160	153
200	213
250	261
320	318
400	400
500	501
630	651
800	800
1 000	1 000

Note * Dimension A is given for guidance only and depends on the tube and the method of welding.

Unit : mm

Nominal bore	A1*
10	12.2
16	17.2
20	22.2
25	26.2
32	34.2
40	41.2
50	52.2

Note * Tolerance for A₁:
+0.2 mm
0

This recess permits the use of centrally located sealing ring carriers.

6 Method for tubes of vacuum flanges The values given in table 7 are taken from ISO 1127 or, for diameters greater than 600 mm, from ISO 4200.

Table 7 Tubes for vacuum flanges

Unit : mm

Nominal bore	Tube outside diameter*	Tube thickness*
10	14	2
16	20	2
20	25	2
25	28	2
32	38	2
40	44.5	2
50	57	3.2
63	76.1	3.2
80	88.9	3.2
100	108	3.2
125	133	3.2
160	159	3.2
200	219.1	3.2
250	267**	3.2
320	323.9	3.2
400	406.4	3.2
500	508	3.6
630	660.4	5
800	812.8	6.3
1 000	1 016	8

Notes * The values of the outside diameters and thickness of the tube are included for guidance only.

** Although this value is not mentioned in ISO 1127, it was adopted instead of 273 with a view to allowing the seal positioning.

Annex (informative)
Flanges for maintenance

Introduction This Annex describes dimensions of vacuum flanges used for the purpose of maintenance specified in **JIS B 2290 : 1968** *Vacuum flanges* because the said flanges have been used and infiltrated into many users in the industries, and does not constitute a part of this Standard.

1 Dimensions

1.1 Standard dimensions Standard dimensions of the flange shall be as given in Annex table 1.

1.2 Tolerance for dimensions Tolerance for dimensions of the flange shall be as given in Annex table 2.

1.3 Types, shapes and dimensions of gaskets The types, shapes and dimensions of gaskets are given in Annex table 3.

- 4 The material of the bolts shall, as a rule, be SS400 of **JIS G 3101**.
- 5 In the case that O-ring is used for the gasket, the chamfered edge of the groove can be made smaller than shown above.

Annex Table 2 Tolerance for flange dimensions

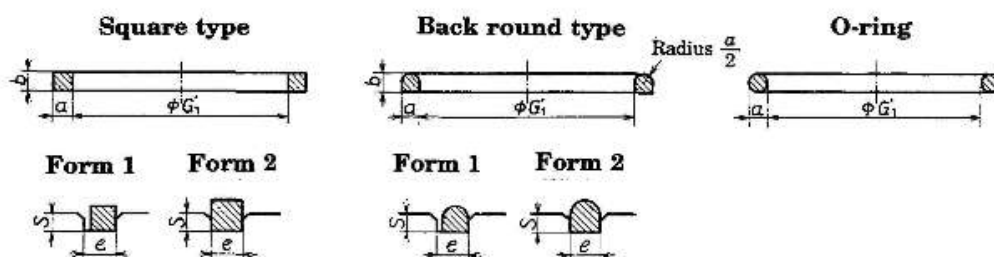
Unit : mm

Parts of flange		State of surface	Range of standard dimensions	Tolerance
Outside dia. D	Unmachined		70 to 235	+3 0
			300 to 575	+4 0
			625 to 1 170	+6 0
	Finished		70 to 235	+1 0
			300 to 575	+1.5 0
			625 to 1 170	+2 0
Thickness T	One-side finished		8 to 18	+1.5 0
			20 to 28	+2 0
	Both-side finished		8 to 18	+1 0
			20 to 28	+1.5 0
Bolt hole	Dia. of centre circle C	—	50 to 210	±0.5
			270 to 585	±0.6
			640 to 1 120	±0.8
	Pitch of hole	—	(39.25 to 146.53)*	±0.5
Groove for gasket	Inside dia. G_1	—	24 to 325	+1.0 0
			380 to 640	+1.5 0
			690 to 1 055	+2 0
	Width	—	(5 to 12)*	+0.1 0
	Depth S	—	3 to 7	0 -0.2

Note * Figures are obtained from the standard dimensions in Annex Table 1.

- Remarks 1 This table shows the tolerances for the standard dimensions of Annex Table 1.
- 2 The tolerances for f , g and h of Annex Table 1 shall be appropriately determined for individual cases in such a way as to be no cause of inconveniences in practice.

Annex Table 3 Types, shapes and dimensions of gaskets



Unit : mm

Gasket											Flange			
Inside dia. G_1		Square				Back round				O-ring	Nominal bore	Outside dia. of steel pipe to be jointed	Groove	
		Form 1		Form 2		Form 1		Form 2					Width e	Depth S
Nominal	Real measure	a	b	a	b	a	b	a	b	a				
24	23.5±0.24	4 ±0.1	4 ±0.1	5 ±0.1	5 ±0.1	4 ±0.1	4 ±0.1	5 ±0.1	5 ±0.1	4 ±0.1	10	17.3	5	3
34	33.5±0.33										20	27.2		
40	39.5±0.37										25	34.0		
55	54.5±0.49										40	48.6		
70	69.0±0.61										50	60.5		
85	84.0±0.72										65	76.3		
100	99.0±0.83										80	89.1		
120	119.0±0.97										100	114.3		
150	148.5±1.18										125	139.8		
175	173.0±1.36										150	165.2		
225	222.5±1.70	6 ±0.1	6 ±0.1	8 ±0.2	8 ±0.2	6 ±0.1	6 ±0.1	8 ±0.2	8 ±0.2	6 ±0.15	200	216.3	8	4.5
275	272.0±2.02										250	267.4		
325	321.5±2.34										300	318.5		
380	376.0±2.68										350	355.6		
430	425.5±2.99										400	406.4		
480	475.0±3.30	8 ±0.2	10 ±0.3	12 ±0.3	12 ±0.3	8 ±0.2	10 ±0.3	12 ±0.3	12 ±0.3	10 ±0.3	450	457.2	12	7
530	524.5±3.60										500	508.0		
585	579.0±3.92										550	558.8		
640	633.5±4.24										600	609.6		
690	683.0±4.54										650	660.4		
740	732.5±4.83										700	711.2		
790	782.0±5.12										750	762.0		
845	836.5±5.44										800	812.8		
950	940.5±6.06										900	914.4		
1 055	1 044.0±6.67										1 000	1 016.0		

Remarks : The tolerances for gasket dimensions given here are those of classes 1 to 3 in JIS B 2401—O-rings. For the class 4 C, 1.5 times the above tolerance and for class 4 D, 1.2 times.

Related standards :

- JIS B 0022 *Datums and datum-systems for geometrical tolerances*
- JIS B 0601 *Surface roughness—Definitions and designation*
- JIS B 0621 *Definitions and designations of geometrical deviations*
- JIS B 2401 *O-rings*
- JIS G 3101 *Rolled steels for general structure*
- JIS G 3459 *Stainless steel pipes*
- JIS G 4314 *Stainless steel wires for springs*
- ISO 3 *Preferred numbers—Series of preferred numbers*
- ISO 286 *ISO system of limits and fits*
- ISO 887 *Plain washers for metric bolts, screws and nuts—General plan*
- ISO 2861-1 *Vacuum technology—Quick-release couplings—Dimensions—Part 1 : Clamped type*
- ISO 3601-1 *Fluid systems—Sealing devices—O-rings—Part 1 : Inside diameters, cross-sections, tolerances and size identification code*

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