

JIS

JAPANESE INDUSTRIAL STANDARD

**O-rings housings —
Design criteria**

JIS B 2406—1991

Translated and Published

by

Japanese Standards Association

In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

JAPANESE INDUSTRIAL STANDARD

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O-rings housings - Design criteria

B 2406-1991

1. Scope

This Japanese Industrial Standard specifies the shapes and dimensions of groove parts to be installed on those of 25.0 MPa (255 kgf/cm²) or under in working pressure, among the O-rings specified in JIS B 2401. This Standard does not apply to the groove parts for vacuum flanges and low friction uses.

Remarks 1. The cited standards to this Standard are as given in the following:

JIS B 0401 System of Limits and Fits

JIS B 2401 O-rings

JIS K 6301 Physical Testing Methods for Vulcanized Rubber

2. In this standard, units and numerical values given in { } are in accordance with the traditional units, and are appended for informative reference.
3. Informative Reference 1 (Matters to be considered concerning installation of O-rings) and Informative Reference 2 (O-ring oil and air pressure - design criteria for O-rings housings - basic calculations) are appended to the text of this Standard.

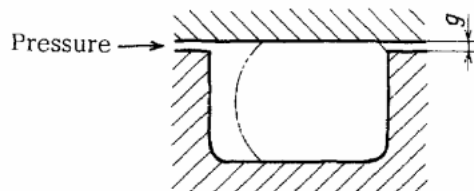
2. Shapes and dimensions of groove parts

2.1 Groove parts for dynamic use and static use (cylindrical surface)

2.1.1 Shapes and dimensions The shapes and dimensions of groove parts for dynamic use and static use (cylindrical surface) shall be in accordance with Attached Table 1.

2.1.2 Clearances In the working conditions, where the clearances (2g) are not more than the values of Table 1, back-up rings may not be used, but where these exceed the values of Table 1, back-up rings shall be used jointly.

Table 1. Maximum values of clearance (2 g)
where no back-up ring is used



Unit: mm

Hardness of O-ring (durometer hardness Hs) ⁽¹⁾	Clearance (2g)				
	Working pressure (MPa) (kgf/cm ²)				
	4.0 {41} or under	Over 4.0 {41} up to and incl. 6.3 {64}	Over 6.3 {64} up to and incl. 10.0 {102}	Over 10.0 {102} up to and incl. 16.0 {163}	Over 16.0 {163} up to and incl. 25.0 {255}
70	0.35	0.30	0.15	0.07	0.03
90	0.65	0.60	0.50	0.30	0.17

Note ⁽¹⁾ The durometer hardness shall be in accordance with the Type A (JIS A) of 5.2.2 in JIS K 6301.

2.2 Groove parts for static use (plane)

2.2.1 Shapes and dimensions The shapes and dimensions for groove parts of static use (plane) shall be in accordance with Attached Table 2.

3. Surface roughness of groove parts

The surface roughness of the portions with which an O-ring comes in contact shall conform to Table 2.

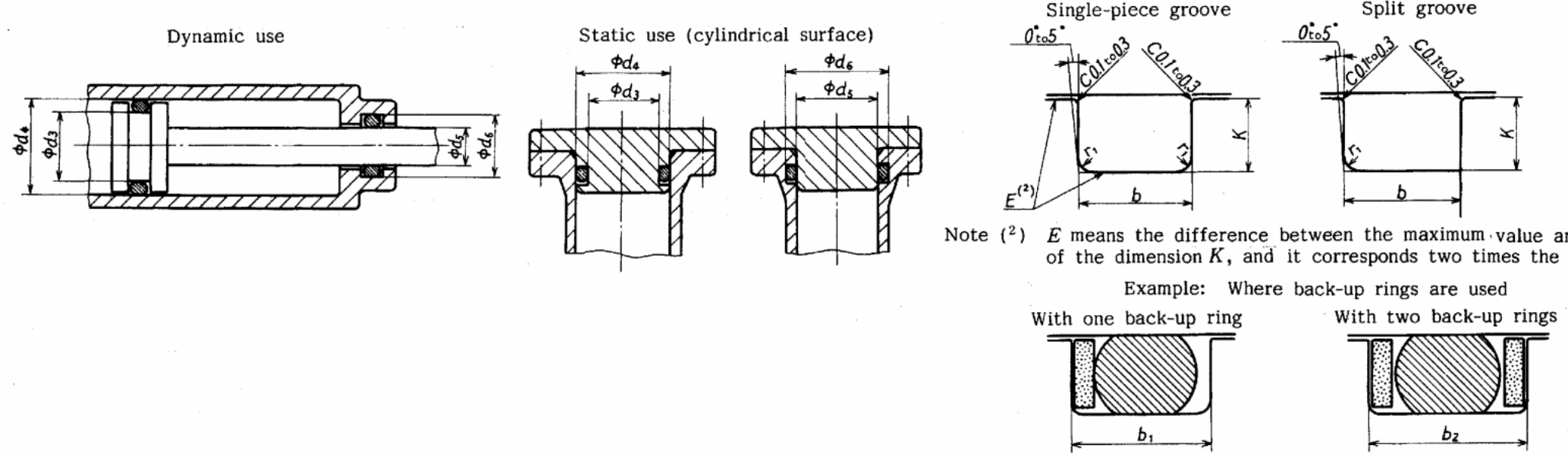
Table 2. Surface roughnesses of groove parts

Unit: mm

Parts of machine and instrument	Application	Behavior of pressure		Surface roughness	
				R_a	(Informative reference) R_{max}
Side faces and bottom faces of grooves	Static use	Without pulsation	Plane	3.2	12.5
			Cylindrical plane	1.6	6.3
		With pulsation		1.6	6.3
	Dynamic use	Where a back-up ring is used		1.6	6.3
		Where no back-up ring is used		0.8	3.2
Contact surfaces of sealing parts of O-rings	Static use	Without pulsation		1.6	6.3
		With pulsation		0.8	3.2
	Dynamic use	—		0.4	1.6
Chamfered part for mounting of O-ring	—	—		3.2	12.5

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Attached Table 1. Shapes and dimensions of groove parts for dynamic use and static use (cylindrical surface)



Unit: mm

Nominal number of O-ring	Dimensions of groove part												Informative reference										
	d_3, d_5		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_3 and d_5			d_4, d_6		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_4 and d_6	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance				
									$+0.25$ 0														
									Back-up ring - zero	Back-up ring - one	Back-up ring - two			Tetrafluorethylen resin			Thickness	Inside diameter ⁽³⁾	Maximum		Minimum		
														Spiral	Bias-cut	Endless							
P 3	3	0 -0.05	h 9	f 8	e 9	6	+0.05 0	H 10	2.5	3.9	5.4	0.4	0.05	0.7±0.05	1.25±0.1	1.25±0.1	1.9±0.08	2.8	±0.14	0.48	0.27	24.2	14.8
P 4	4					7												3.8	±0.14				
P 5	5					8												4.8	±0.15				
P 6	6					9												5.8	±0.15				
P 7	7				e 8	10		6.8										±0.16					
P 8	8					11		7.8										±0.16					
P 9	9					12		8.8										±0.17					
P 10	10					13		9.8										±0.17					
P 10 A	10	0 -0.06	h 9	f 8	e 8	14	+0.06 0	H 9	3.2	4.4	6.0	0.4	0.05	0.7±0.05	1.25±0.1	1.25±0.1	2.4±0.09	9.8	±0.17	0.49	0.25	19.7	10.8
P 11	11					15												10.8	±0.18				
P 11.2	11.2					15.2												11.0	±0.18				
P 12	12					16												11.8	±0.19				
P 12.5	12.5				16.5	12.3		±0.19															
P 14	14				18	13.8		±0.19															
P 15	15				19	14.8		±0.20															
P 16	16				20	15.8		±0.20															
P 18	18				22	17.8		±0.21															
P 20	20				e 7	24		19.8										±0.22					
P 21	21					25		20.8										±0.23					
P 22	22					26		21.8										±0.24					

- Remarks 1. P 3 to P 400 of JIS B 2401 shall be used for dynamic and static applications, and G 25 to G 300 shall be used only for static application and shall not be used for dynamic application. A material such as Class 4 C, which has less mechanical strength should not be used for dynamic application even with P 3 to P 400.
2. The dimensional tolerances given in Informative Reference shall be in accordance with JIS B 0401.
3. Even though the e 7 $\begin{pmatrix} -0.040 \\ -0.061 \end{pmatrix}$ of P 20 to P 22 exceed the permissible deviations $\begin{pmatrix} 0 \\ -0.06 \end{pmatrix}$ of d_3 and d_5 , e 7 may also be used.

Attached Table 1 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove part												Informative reference												
	d_3, d_5		Informative reference		d_4, d_6		Informative reference	Dimensional tolerance symbols corresponding to the permissible deviations for d_4 and d_6	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance						
														+0.25 0			Tetrafluorethylen resin			Thickness	Inside diameter $(^3)$			($\%$)	
														Back-up ring - zero	Back-up ring - one	Back-up ring - two	Spiral	Bias-cut	Endless			Maximum	Minimum	Maximum	Minimum
P 22 A	22	0 -0.08	h 9	f 8	e 8	28	+0.08 0	H 9	4.7	6.0	7.8	0.8	0.08	0.7±0.05	1.25±0.1	1.25±0.1	3.5±0.10	21.7	±0.24	0.60	0.32	16.7	9.4		
P 22.4	22.4					28.4												22.1	±0.24						
P 24	24					30												23.7	±0.24						
P 25	25					31												24.7	±0.25						
P 25.5	25.5					31.5												25.2	±0.25						
P 26	26					32												25.7	±0.26						
P 28	28					34												27.7	±0.28						
P 29	29					35												28.7	±0.29						
P 29.5	29.5					35.5												29.2	±0.29						
P 30	30					36												29.7	±0.29						
P 31	31				e 7	37												30.7	±0.30						
P 31.5	31.5					37.5												31.2	±0.31						
P 32	32					38												31.7	±0.31						
P 34	34					40												33.7	±0.33						
P 35	35					41												34.7	±0.34						
P 35.5	35.5					41.5												35.2	±0.34						
P 36	36					42												35.7	±0.34						
P 38	38					44												37.7	±0.37						
P 39	39					45												38.7	±0.37						
P 40	40					46												39.7	±0.37						
P 41	41					47												40.7	±0.38						
P 42	42					48												41.7	±0.39						
P 44	44					50												43.7	±0.41						
P 45	45					51												44.7	±0.41						
P 46	46					52												45.7	±0.42						
P 48	48					54												47.7	±0.44						
P 49	49					55												48.7	±0.45						
P 50	50					56												49.7	±0.45						
P 48 A	48	0 -0.10	h 9	f 8	e 8	58	+0.10 0	H 9	7.5	9.0	11.5	0.8	0.10	0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	47.6	±0.44	0.83	0.47	14.2	8.4		
P 50 A	50					60												49.6	±0.45						
P 52	52				e 7	62												51.6	±0.47						
P 53	53					63												52.6	±0.48						
P 55	55					65												54.6	±0.49						
P 56	56					66												55.6	±0.50						
P 58	58					68												57.6	±0.52						
P 60	60					70												59.6	±0.53						

Attached Table 1 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove part												Informative reference												
	d_3, d_5		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_3 and d_5			d_4, d_6		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_4 and d_6	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance						
									+0.25 0																
									Back-up ring - zero	Back-up ring - one	Back-up ring - two			Tetrafluorethylen resin			Thickness	Inside diameter (³)	Maximum		Minimum				
														Spiral	Bias-cut	Endless									
P 62	62	0 -0.10	h 9	f 8	e 7	72	+0.10 0	H 9	7.5	9.0	11.5	0.8	0.10	0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	61.6	±0.55	0.83	0.47	14.2	8.4		
P 63	63					73												62.6	±0.56						
P 65	65					75												64.6	±0.57						
P 67	67					77												66.6	±0.59						
P 70	70					80												69.6	±0.61						
P 71	71					81												70.6	±0.62						
P 75	75					85												74.6	±0.65						
P 80	80					90												79.6	±0.69						
P 85	85					e 6												95	84.6					±0.73	
P 90	90																	100	89.6					±0.77	
P 95	95																	105	94.6					±0.81	
P 100	100																	110	99.6					±0.84	
P 102	102																	112	101.6					±0.85	
P 105	105																	115	104.6					±0.87	
P 110	110																	120	109.6					±0.91	
P 112	112																	122	111.6					±0.92	
P 115	115																	125	114.6					±0.94	
P 120	120																	130	119.6					±0.98	
P 125	125					f 7												—	135					124.6	±1.01
P 130	130																		140					129.6	±1.05
P 132	132	142	131.6	±1.06																					
P 135	135	145	134.6	±1.09																					
P 140	140	150	139.6	±1.12																					
P 145	145	155	144.6	±1.16																					
P 150	150	160	149.6	±1.19																					
P 150 A	150	0 -0.10	h 9	f 7	—		165	+0.10 0	H 9	11.0	13.0	17.0	1.2	0.12	1.4±0.08	2.75±0.15	2.75±0.15		8.4±0.15	149.5	±1.19	1.05	0.65	12.3	7.9
P 155	155						170													154.5	±1.23				
P 160	160						175													159.5	±1.26				
P 165	165					180	164.5											±1.30							
P 170	170					185	169.5											±1.33							
P 175	175					190	174.5											±1.37							
P 180	180					195	179.5											±1.40							
P 185	185					h 8	200											184.5		±1.44					
P 190	190						205											189.5		±1.48					
P 195	195						210											194.5		±1.51					
P 200	200	215	199.5	±1.55																					

Attached Table 1 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove part										Informative reference																						
	d_3, d_5		Informative reference			d_4, d_6		Informative reference	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance														
									+0.25 0																								
			Dimensional tolerance symbols corresponding to the permissible deviations for d_3 and d_5						Back-up ring - zero	Back-up ring - one	Back-up ring - two			Tetrafluorethylen resin			Thickness	Inside diameter ⁽³⁾	Maximum		Minimum												
Spiral						Bias-cut	Endless																										
G 25	25	0 -0.10	h 9	f 8	e 9	30	+0.10 0	H 10	4.1	5.6	7.3	0.7	0.08	0.7±0.05	1.25±0.1	1.25±0.1	3.1±0.10	24.4	±0.25	0.70	0.40	21.85	13.3										
G 30	30				35																												
G 35	35					e 8		40																									
G 40	40							45																									
G 45	45							50																									
G 50	50							55																									
G 55	55							e 7	60		H 9																						
G 60	60								65																								
G 65	65								70																								
G 70	70								75																								
G 75	75								80																								
G 80	80								85																								
G 85	85								e 6	90																							
G 90	90									95																							
G 95	95									100																							
G 100	100									105																							
G 105	105									110																							
G 110	110									115																							
G 115	115									120																							
G 120	120									125																							
G 125	125			f 7	—	130																											
G 130	130					135																											
G 135	135					140																											
G 140	140					145																											
G 145	145					150																											
G 150	150	0 -0.10	h 9	f 7	—	160	+0.10 0	H 9	7.5	9.0	11.5	0.8	0.10	0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	149.3	±1.19	0.83	0.47	14.2	8.4										
G 155	155					165																											
G 160	160					170																											
G 165	165					175																											
G 170	170					180																											
G 175	175					185							H 8																				
G 180	180					190																											
G 185	185					195																											
G 190	190					200		h 8																									
G 195	195					205																											
G 200	200					210																											

Attached Table 1 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove part										Informative reference														
	d_3, d_5		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_3 and d_5			d_4, d_6		Informative reference Dimensional tolerance symbols corresponding to the permissible deviations for d_4 and d_6	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance						
									+0.25 0																
									Back-up ring - zero	Back-up ring - one	Back-up ring - two			Tetrafluorethylen resin			Thickness	Inside diameter ⁽³⁾	Maximum		Minimum				
			Spiral	Bias-cut	Endless																				
G 25	25	0 -0.10	h 9	f 8	e 9	30	+0.10 0	H 10	4.1	5.6	7.3	0.7	0.08	0.7±0.05	1.25±0.1	1.25±0.1	3.1±0.10	24.4	±0.25	0.70	0.40	21.85	13.3		
G 30	30					35													29.4					±0.29	
G 35	35					e 8												40						34.4	±0.33
G 40	40																	45						39.4	±0.37
G 45	45																	50						44.4	±0.41
G 50	50																	55						49.4	±0.45
G 55	55					e 7												60						54.4	±0.49
G 60	60																	65						59.4	±0.53
G 65	65																	70						64.4	±0.57
G 70	70																	75						69.4	±0.61
G 75	75							80											74.4					±0.65	
G 80	80							85											79.4					±0.69	
G 85	85					e 6		90											84.4					±0.73	
G 90	90							95											89.4					±0.77	
G 95	95							100											94.4					±0.81	
G 100	100							105											99.4					±0.85	
G 105	105							110											104.4					±0.87	
G 110	110							115											109.4					±0.91	
G 115	115							120											114.4					±0.94	
G 120	120							125											119.4					±0.98	
G 125	125		f 7	—	130		124.4	±1.01	0.83	0.47	14.2	8.4													
G 130	130				135		129.4	±1.05																	
G 135	135				140		134.4	±1.08																	
G 140	140				145		139.4	±1.12																	
G 145	145				150		144.4	±1.16																	
G 150	150	0 -0.10			h 9	f 7	—	160					+0.10 0	H 9	7.5	9.0	11.5	0.8	0.10	0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	149.3	±1.19
G 155	155														165										154.3
G 160	160			170					159.3	±1.26															
G 165	165			175					164.3	±1.30															
G 170	170			180					169.3	±1.33															
G 175	175			H 8			185		174.3	±1.37															
G 180	180						190		179.3	±1.40															
G 185	185		h 8				195		184.3	±1.44															
G 190	190						200		189.3	±1.47															
G 195	195						205		194.3	±1.51															
G 200	200	210			199.3	±1.55																			

Attached Table 1 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove part												Informative reference											
	d_3, d_5		informative reference			d_4, d_6		informative reference	b	b_1	b_2	r_1 (Maximum)	$E^{(2)}$ (Maximum)	Thickness of back-up ring			Actual dimensions of O-ring		Squeeze allowance					
			Dimensional tolerance symbols corresponding to the permissible deviations for d_3 and d_5	Dimensional tolerance symbols corresponding to the permissible deviations for d_4 and d_6	+0.25 0			Tetrafluorethylen resin			Thickness			Inside diameter ⁽³⁾			(%)							
					Back-up ring - zero														Back-up ring - one	Back-up ring - two				
					Spiral			Bias-cut	Endless															
G 210	210	0 -0.10	h 8	f 7	—	220	+0.10 0	H 8	7.5	9.0	11.5	0.8	0.10	0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	209.3	±1.61	0.83	0.47	14.2	8.4	
G 220	220					230												219.3	±1.68					
G 230	230					240												229.3	±1.73					
G 240	240					250												239.3	±1.81					
G 250	250					260												249.3	±1.88					
G 260	260					f 6												270	259.3					±1.94
G 270	270																	280	269.3					±2.01
G 280	280																	290	279.3					±2.07
G 290	290																	300	289.3					±2.14
G 300	300																	310	299.3					±2.20

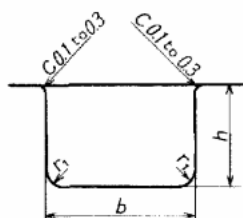
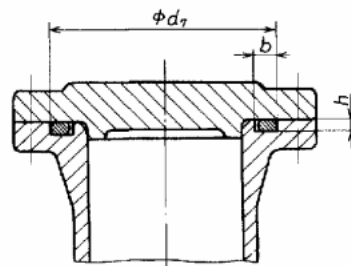
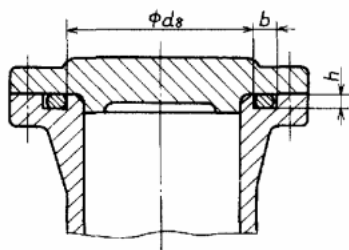
Note (3) The permissible deviations are those of Class 1 to Class 3 in JIS B 2401, and, with Class 4 C, are 1.5 times the permissible deviations given above and, with Class 4 D, are 1.2 times the permissible deviations given above.

Remarks: P 3 to P 400 of JIS B 2401 shall be used for dynamic and static applications, and G 25 to G 300 shall be used only for static application and shall not be used for dynamic application. A material such as Class 4 C, which has less mechanical strength should not be used for dynamic application even with P 3 to P 400.

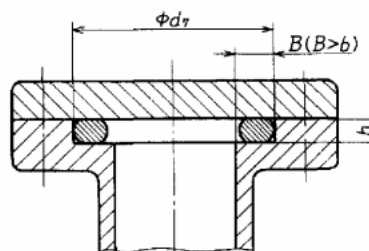
Attached Table 2. Shapes and dimensions for grooves of static use (plane)

For external pressure application (4)

For internal pressure application (4) Unit: mm



For internal pressure application (4)



Note (4) In static applications (Plane), where it is subjected to an internal pressure, it shall be designed so that the outer periphery of the O-ring comes in close contact with the outer wall of the groove, and, where it is subjected to an external pressure, it shall be designed so that the inner periphery of the O-ring comes in close contact with the inner wall of the groove.

Unit: mm

Nominal number of O-ring	Dimensions of groove					Informative reference						
	d_s	d_i	b	h	r_1	Actual dimensions of O-ring			Squeeze allowance			
	(For external pressure)	(For internal pressure)	$+0.25$ 0	± 0.05	(Maximum)	Thick-ness	Inside diameter (3)				(%)	
									Maxi-mum	Mini-mum	Maxi-mum	Mini-mum
P 3	3	6.2	2.5	1.4	0.4	1.9 ± 0.08	2.8	± 0.14	0.63	0.37	31.8	20.3
P 4	4	7.2					3.8	± 0.14				
P 5	5	8.2					4.8	± 0.15				
P 6	6	9.2					5.8	± 0.15				
P 7	7	10.2					6.8	± 0.16				
P 8	8	11.2					7.8	± 0.16				
P 9	9	12.2					8.8	± 0.17				
P 10	10	13.2					9.8	± 0.17				
P 10 A	10	14	3.2	1.8	0.4	2.4 ± 0.09	9.8	± 0.17	0.74	0.46	29.7	19.9
P 11	11	15					10.8	± 0.18				
P 11.2	11.2	15.2					11.0	± 0.18				
P 12	12	16					11.8	± 0.19				
P 12.5	12.5	16.5					12.3	± 0.19				
P 14	14	18					13.8	± 0.19				
P 15	15	19					14.8	± 0.20				
P 16	16	20					15.8	± 0.20				
P 18	18	22					17.8	± 0.21				
P 20	20	24					19.8	± 0.22				
P 21	21	25					20.8	± 0.23				
P 22	22	26					21.8	± 0.24				



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Attached Table 2 (Continued)

Unit: mm

Nominal number of O-ring	Dimensions of groove					Informative reference						
	d_8 (For external pressure)	d_7 (For internal pressure)	b +0.25 0	h ± 0.05	r_1 (Maximum)	Actual dimensions of O-ring			Squeeze allowance			
						Thick-ness	Inside diameter (3)				(%)	
									Maxi-mum	Mini-mum	Maxi-mum	Mini-mum
P 22 A	22	28	4.7	2.7	0.8	3.5 ± 0.10	21.7	± 0.24	0.95	0.65	26.4	19.1
P 22.4	22.4	28.4					22.1	± 0.24				
P 24	24	30					23.7	± 0.24				
P 25	25	31					24.7	± 0.25				
P 25.5	25.5	31.5					25.2	± 0.25				
P 26	26	32					25.7	± 0.26				
P 28	28	34					27.7	± 0.28				
P 29	29	35					28.7	± 0.29				
P 29.5	29.5	35.5					29.2	± 0.29				
P 30	30	36					29.7	± 0.29				
P 31	31	37					30.7	± 0.30				
P 31.5	31.5	37.5					31.2	± 0.31				
P 32	32	38					31.7	± 0.31				
P 34	34	40					33.7	± 0.33				
P 35	35	41					34.7	± 0.34				
P 35.5	35.5	41.5					35.2	± 0.34				
P 36	36	42					35.7	± 0.34				
P 38	38	44					37.7	± 0.37				
P 39	39	45					38.7	± 0.37				
P 40	40	46					39.7	± 0.37				
P 41	41	47				40.7	± 0.38					
P 42	42	48				41.7	± 0.39					
P 44	44	50				43.7	± 0.41					
P 45	45	51				44.7	± 0.41					
P 46	46	52				45.7	± 0.42					
P 48	48	54				47.7	± 0.44					
P 49	49	55				48.7	± 0.45					
P 50	50	56				49.7	± 0.45					
P 48 A	48	58	7.5	4.6	0.8	5.7 ± 0.13	47.6	± 0.44	1.28	0.92	22.0	16.5
P 50 A	50	60					49.6	± 0.45				
P 52	52	62					51.6	± 0.47				
P 53	53	63					52.6	± 0.48				
P 55	55	65					54.6	± 0.49				
P 56	56	66					55.6	± 0.50				
P 58	58	68					57.6	± 0.52				
P 60	60	70					59.6	± 0.53				
P 62	62	72					61.6	± 0.55				
P 63	63	73				62.6	± 0.56					