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VALQUA O-ring



VALQUA, LTD.

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List of Trademarks

This catalog has omitted trademark-related displays, but the following is a list of trademarks belonging to VALQUA, LTD. registered in Japan.

• ARCURY • ARMOR CRYSTAL • ULTIC ARMOR • SPOQ ARMOR • VALFLON • VALFLON CRYSTAL RUBBER
• FLID ARMOR • FLUORITZ • RUBBERFLON • VALQUA • VALQUA (company logo)

1 About O-rings

Since our founding, our company has been engaged in the production of rubber packing, and we also quickly began the production of O-rings due to our devoted manufacturing of synthetic rubber V-packing for aircraft hydraulic systems. We were the first in Japan to receive Ⓢ certification with respect to general O-rings (JIS B 2401), after which we received approval from the Defense Agency on April 23, 1964 for our MIL-standard aircraft O-rings as AN6227 and AN6230 hydraulic O-rings via MIL-P-5516B Class B, and subsequently began domestic production of O-rings for MIL-standard aircraft. We also received approval from the Defense Agency for the MIL-R-8791E, our backup rings for MIL-standard aircraft, on June 26, 1964, and are currently engaged in the production of series of packing for aircraft use and packing for general industrial use using the latest equipment and under the strictest quality control. In addition to the production of various synthetic rubber O-rings, which are now the standard, we are engaged in the production of products adapted to a wide array of uses and made of various materials, such as silicone rubber, fluoro-rubber, urethane rubber, polytetrafluoroethylene, and even metal.

2 O-ring types

Table 1 indicates VALQUA's O-ring standards.

The dimensions of VALQUA O-rings are configured according to JIS/VALQUA SG standards, and JASO/AS dimensions.

Table 1 VALQUA O-ring Standards

Type \ Standard		For general equipment		For automobiles	For aircraft
		JIS B 2401	VALQUA SG standard ⁽¹⁾	JASO F404(Reference)	AS568
By material	For general mineral hydraulic oil	NBR-70-1 NBR-90	Nitrile rubber (NBR)	1A(NBR-70-1)	Nitrile rubber (NBR)
	For fuel	NBR-70-2	Nitrile rubber (NBR) Fluoro-rubber (FKM) Fluorosilicone rubber (FVMQ)	2(NBR-70-2)	Nitrile rubber (NBR) Fluoro-rubber (FKM) Fluorosilicone rubber (FVMQ)
	For animal and vegetable oils	EPDM-70	Ethylene propylene rubber (EPDM) Styrene-butadiene rubber(SBR)	3(EPDM-70)	Ethylene propylene rubber (EPDM) Styrene-butadiene rubber(SBR)
	For heat resistance	VMQ-70	Silicone rubber (VMQ)	4C(VMQ-70)	Silicone rubber (VMQ)
	For heat and oil resistance	FKM-70	Fluoro-rubber (FKM) Acrylic rubber (ACM)	4D(FKM-70) 4E(ACM)	Fluoro-rubber (FKM)
	For coolant	—	—	5(-)	—
By application		P (for dynamic application) G (for static application) V (for vacuum application) ISO (General industrial application)	For static application	For dynamic application For static application	For dynamic application For static application

Note (1) The VALQUA SG series is a series of O-rings with particularly small cross-section made to accommodate needs for smaller equipment.

3 O-ring material types

3.1 O-ring rubber material types and characteristics (Table 2)

Type	Applicable standard Symbols equivalent to JIS standards, etc.	Type of rubber	Type A Durometer hardness	Material symbol	Uses and characteristics	VALQUA product number	
Standard material	NBR-70-1	Nitrile rubber (NBR)	70	B0570	Material with oil, heat, and friction-resistant characteristics, and is standard for hydraulic and pneumatic applications.	640	
	NBR-90	Nitrile rubber (NBR)	90	B0390	Almost equivalent to B0570, and is a material with excellent pressure resistance.		
	NBR-70-2	Nitrile rubber (NBR)	70	B0170	Excellent material for general fuel oil such as kerosene and gasoline.		
	EPDM-70	Ethylene propylene rubber (EPDM)	70	H0970	Material for ethylene glycol, brake fluid, and animal and vegetable oils.		
	–	Silicone rubber (VMQ)	70	E0170	Material with superior heat and cold resistance.	5640	
	FKM-70	Fluoro-rubber (FKM)	70	D2770	Material with superior heat and mineral oil resistance that exhibits a low compression set.	4640	
	General industrial use (ISO)	Nitrile rubber (NBR)	70	B0570	Material with oil, heat, and friction-resistant characteristics, and is standard for hydraulic and pneumatic applications.		
Main special materials ⁽¹⁾		Nitrile rubber (NBR)	70	B1370	Nitrile rubber with superior cold resistance.	640	
		Nitrile rubber (NBR)	70	B2070	Nitrile rubber with particularly excellent oil and gasoline resistance.		
		Super rubber (HNBR)	70	B5170	Material with superior heat, oil, and abrasion resistance, and excellent durability.		
			Fluoro-rubber (FKM)	70	D0270	Has a low compression set, and is meant for vacuum application.	4640
			Fluoro-rubber (FKM)	70	D2570	Possesses superior heat resistance due to a much lower compression set when compared against conventional fluoro-rubber.	H4640
			Fluoro-rubber (FKM)	70	D2470	Material with superior acid resistance.	4640
			Fluoro-rubber (FKM)	90	D0290	Almost equivalent to D0270, and is a material with excellent pressure resistance.	
			Fluoro-rubber (FKM)	70	D0970	Material with excellent hot water and alkaline resistance.	
			Fluoro-rubber (FKM)	75	D0875	Material with greater cold resistance than D0270.	
			Fluorosilicone rubber (FVMQ)	70	E0470	Material with excellent resistance to various oils, such as fuel and mineral oils, ranging from low to high temperatures.	5640
			Ethylene propylene rubber (EPDM)	70	H0970	Three types of materials with excellent resistance to steam, vegetable oil, brake oil, and flame-retardant hydraulic oil.	640
			Chloroprene rubber (CR)	70	J0170	Material with excellent fluorocarbon gas and weather resistance.	
			Butyl rubber (IIR)	75	F0075	Material with excellent hot water and steam resistance for joint seals of stainless steel pipes for waterworks.	
			Butyl rubber (IIR)	85	F0180	Almost equivalent to F0075, and is a material with excellent pressure resistance.	
	JASOF404 4E	Acrylic rubber (ACM)	70	L0770	Material that can withstand higher temperatures than nitrile rubber and has excellent oil resistance.		
		Urethane rubber (AU, EU)	90	R0490	Material with highly superior oil and abrasion resistance, and durability.	TP9640	

Note (1) We do not have all of the molds available for the special materials, so please check with us when ordering.

Type	Product group	Type A Durometer hardness	Component number or name	Characteristics	VALQUA product number	
High performance rubber material ⁽²⁾	VALFLON CRYSTAL RUBBER	60 70	D9160 D9170	Fluoro-rubber with superior transparency and stain resistance.	C4640	
	FLUORITZ (perfluoroelastomer)		75	FLUORITZ SB (standard black type)	Material with extremely high resistance to most chemicals and solvents.	VP4640
			72	FLUORITZ TR	Material graded for plasma-resistance with excellent purity, non-adherence to metals, and excellent compression set.	VPTR4640
			77	FLUORITZ HS	Material graded for heat-resistance with excellent purity, non-adherence to metals, and plasma-resistance.	VPHS4640
			60 · 70	ARMOR CRYSTAL	Material graded with particle countermeasures with excellent purity and plasma-resistance.	AC4640
	ARMOR series		71	SPOQ ARMOR	Material graded with plasma-resistance that resists adherence to quartz.	SA4640
			73	FLID	Standard graded material with superior abrasion resistance.	F4640
			73	FLID ARMOR	Material graded with special low abrasion with superior low abrasion, abrasion resistance, and non-adherence to metals.	FA4640
			58	HYREC ARMOR	Material graded with plasma and heat-resistance with highly superior purity, and non-adherence to metals. (exclusively for static application)	HA4640
			70	ULTIC ARMOR	Material graded with plasma and heat-resistance with highly superior purity, and non-adherence to metals.	UA4640
			67	ULTIC ARMOR F	Material graded with plasma and heat-resistance with highly superior purity, and non-adherence to metals.	UAF4640
			75	LABE ARMOR	Material exclusively graded with oxygen plasma-resistance that resists adherence to quartz.	LA4640
	ARCURY series		70	ARCURY AD	Material with superior resistance to acidic solutions, and has excellent purity due to reduced metallic and organic matter elution.	WD4640
			75	ARCURY AL	Material with superior resistance to alkaline solutions including ammonia, which was difficult to use with conventional fluoro-rubber.	WL4640
			60 · 70	ARCURY OZT	Material with superior resistance to ozone gas and ozonated water, and has excellent purity due to reduced metallic and organic matter elution.	OZT4640
			70	ARCURY OZW	Material with superior resistance to ozone gas and ozonated water. Material with improved heat resistance compared to OZT.	OZW4640

Note (2) We can also manufacture gate seal plates that are integrally molded with metals. (limited to certain high performance rubber materials)

3.2 O-ring material physical characteristics (Table 3)

Type of material		Standard material						
		JIS symbol	NBR-70-1	NBR-90	NBR-70-2	EPDM-70	—	FKM-70
		VALQUA material indication	B0570	B0390	B0170	H0970	E0170	D2770
Test items		Use details	For mineral oil resistance	For mineral oil resistance	For gasoline resistance	For animal and vegetable oil resistance	For heat resistance	For heat resistance
Normal state	Type A durometer hardness		72	89	71	72	74	73
	Tensile strength MPa		17.6	16.8	16.1	17.6	8.3	15.2
	Elongation (%)		340	190	310	230	240	300
	Tensile stress MPa At 100% Elongation		5.2	—	5.7	—	—	4,2
Aging resistance	Temperature and time		120°C 72h	120°C 72h	100°C 72h	100°C 72h	230°C 72h	230°C 72h
	Change to type A durometer hardness		+5	+5	+2	+1	-1	+1
	Tensile strength change rate (%)		+21	-12	+4	+9	-14	+8
	Elongation change (%)		-21	-42	-17	+10	-6	+6
Compression propensity	Temperature and time		120°C 72h	120°C 72h	100°C 72h	100°C 72h	175°C 72h	200°C 72h
	Compression set (%)		13	21	7.7	12.3	15.2	26
Oil resistance	Temperature and time		120°C 72h	120°C 72h	23°C 72h	100°C 72h	175°C 72h	175°C 72h
	Test oil		Lubricating oil No.1	Lubricating oil No.1	Fuel oil No.1	Brake fluid	Lubricating oil No.1	Lubricating oil No.1
	Change to type A durometer hardness		+3	+3	-2	-4	-7	-1
	Tensile strength change rate (%)		+10	+13	-9	+2	-3	-1
	Elongation change (%)		-18	-22	-14	+4	+6	-2
	Volume change (%)		-2.7	-3.3	+0.5	+4.0	+5.5	+0.3
	Temperature and time		120°C 72h	120°C 72h	23°C 72h	—	—	175°C 72h
	Test oil		Lubricating oil No.3	Lubricating oil No.3	Fuel oil No. 2	—	—	Lubricating oil No.3
	Change to type A durometer hardness		-5	-7	-5	—	—	-1
	Tensile strength change rate (%)		+12	+11	-21	—	—	-13
Elongation change (%)		-9	-18	-22	—	—	-6	
Volume change (%)		+6.5	+10.1	+13.3	—	—	+1.9	
Low temperature	TR ₁₀ value (°C) elongation rate 50%		-28	-30	-27	-49	-47	-17

3.3 Type and color tone of colored O-ring materials (Table 4)

Rubber material	Material symbol	Color tone
Silicone rubber (VMQ)	E0170	Reddish brown
	E0870	White
Fluoro-rubber (FKM)	D9070	Brown
	D9270	White

Special materials							
—	—	—	—	—	—	—	—
B5170 (super rubber)	D2470	D2570	D0970	D9160 (VALFLON CRYSTAL RUBBER)	J0170	L0770	
For heat resistance, high strength, and abrasion resistance	For acid resistance	For heat resistance	For high temperature steam and alkaline resistance	For transparency, non-staining, and chemical resistance	For weather and fluorocarbon resistance	For weather and oil resistance	
73	69	72	73	61	68	71	
28.1	21	13.6	15.7	14.4	19.4	10.8	
290	450	230	290	500	350	200	
6.2	3.5	3.2	3.8	1.5	4.1	—	
150°C 70h	230°C 72h	230°C 24h	150°C 70h	150°C 70h	100°C 70h	150°C 70h	
+8	-1	+1	0	+1	+4	+6	
+3	-22	-4	+8	-17	+2	-2	
-26	+13	-2	+1	+6	-12	0	
150°C 70h	175°C 70h	175°C 22h	175°C 22h	150°C 70h	100°C 70h	150°C 22h	
14	30	3.8	23	30	20	20	
150°C 70h	80°C 168h	175°C 70h	230°C 168h	100°C 504h	100°C 70h	150°C 70h	
Lubricating oil No.1	96% sulfuric acid	Lubricating oil No.1	Hot water	35% hydrochloric acid	Brake fluid	Lubricating oil No.1	
+1	+1	-4	-5	-1	-4	+2	
+3	+1	-8.2	-33	-18	-14	+2	
-9	-4	-2	-8	-3	-27	-8	
-0.8	+0.5	+2.3	+31.9	+0.4	+4.8	-0.6	
150°C 70h	80°C 168h	175°C 70h	70°C 1000h	100°C 504h	—	150°C 70h	
Lubricating oil No.3	37% hydrochloric acid	Lubricating oil No.3	Water/glycol solution	30% H ₂ O ₂	—	Lubricating oil No.3	
-8	0	-3	-2	+1	—	-10	
-15	-13	-13.5	+11	-1	—	-16	
-15	0	+3	+17	+3	—	-20	
+21.0	+0.7	+3	+2.1	-0.3	—	+15.1	
-22	-6	—	+2	-6	-38	-19	

Remarks The physical property values in this table are examples of measured values, and are not standard values.

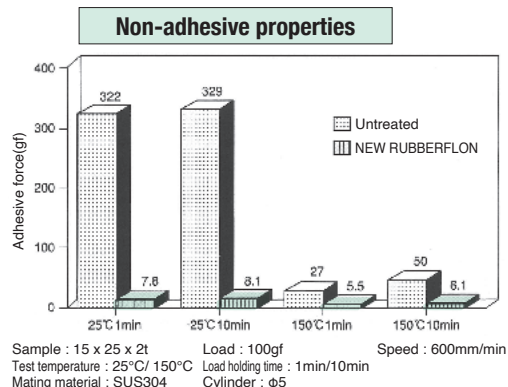
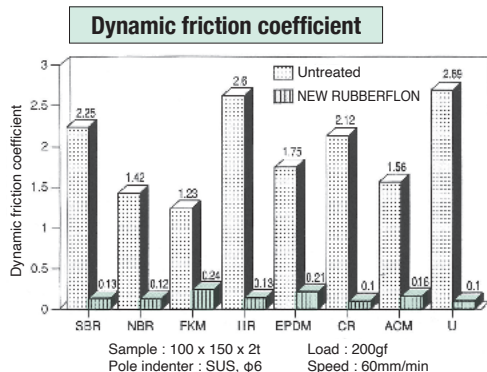
3.4 Low friction/adhesion, anti-sticking “NEW RUBBERFLON”

Characteristics Reactive surface modification product

NEW RUBBERFLON boasts superior surface coating adhesion, and exhibits low friction and non-adhesive properties on each rubber surface without losing its characteristics as a rubber seal, thus eliminating the need to apply grease or oil during installation. Suitable for static sealing (gaskets).

Use

- 1) Reduces resistance when attaching rubber components
- 2) Prevents components from adhering to each other on a component supply line
- 3) Prevents staining by grease or oil
- 4) Prevents rubber products from sticking to device seals

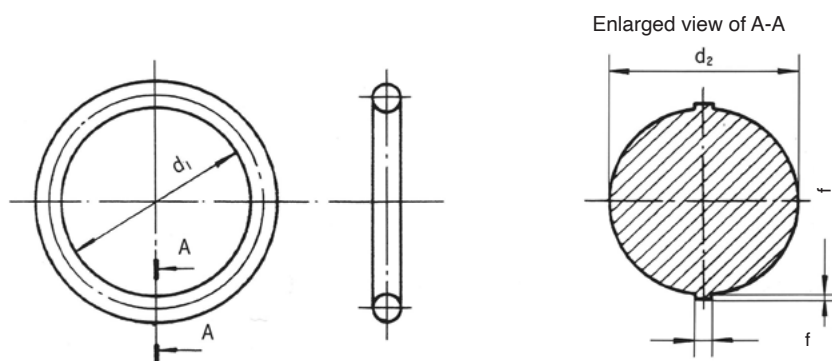


Remarks NEW RUBBERFLON does not involve fluorine-based surface modification.

4 O-ring and backup ring dimension table

4.1 O-ring dimensions

4.1.1 Shape and dimensions of O-rings for dynamic application (JIS P series) (Attached Table 1)



Unit : mm

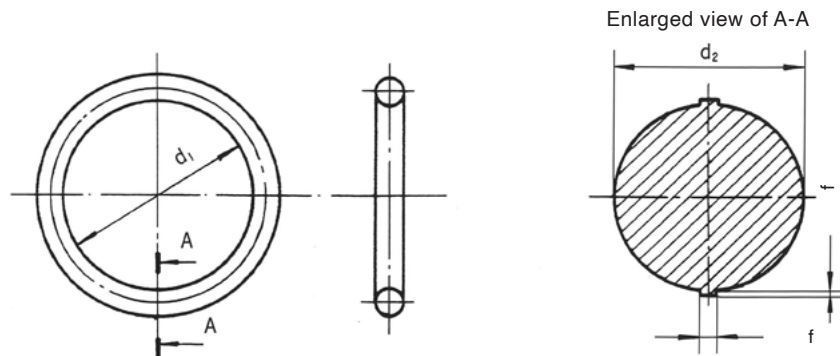
Inner diameter d_1		Thickness d_2 standard dimensions and tolerance					Groove dimensions (JIS B 2401-2)	
Standard dimensions	Tolerance	1.9±0.08	2.4±0.09	3.5±0.10	5.7±0.13	8.4±0.15	Shaft diameter	Hole diameter
		f=0.10 or less	f=0.12 or less	f=0.14 or less	f=0.16 or less	f=0.18 or less		
		Bearing number						
2.8	±0.14	P 3					3	6
3.8	±0.14	P 4					4	7
4.8	±0.15	P 5					5	8
5.8	±0.15	P 6					6	9
6.8	±0.16	P 7					7	10
7.8	±0.16	P 8					8	11
8.8	±0.17	P 9					9	12
9.8	±0.17	P10					10	13
9.8	±0.17		P10A				10	14
10.8	±0.18		P11				11	15
11.0	±0.18		P11.2				11.2	15.2
11.8	±0.19		P12				12	16
12.3	±0.19		P12.5				12.5	16.5
13.8	±0.19		P14				14	18
14.8	±0.20		P15				15	19
15.8	±0.20		P16				16	20
17.8	±0.21		P18				18	22
19.8	±0.22		P20				20	24
20.8	±0.23		P21				21	25
21.8	±0.24		P22				22	26
21.7	±0.24			P22A			22	28
22.1	±0.24			P22.4			22.4	28.4
23.7	±0.24			P24			24	30
24.7	±0.25			P25			25	31
25.2	±0.25			P25.5			25.5	31.5
25.7	±0.26			P26			26	32
27.7	±0.28			P28			28	34
28.7	±0.29			P29			29	35
29.2	±0.29			P29.5			29.5	35.5
29.7	±0.29			P30			30	36
30.7	±0.30			P31			31	37
31.2	±0.31			P31.5			31.5	37.5
31.7	±0.31			P32			32	38
33.7	±0.33			P34			34	40
34.7	±0.34			P35			35	41
35.2	±0.34			P35.5			35.5	41.5
35.7	±0.34			P36			36	42
37.7	±0.37			P38			38	44
38.7	±0.37			P39			39	45
39.7	±0.37			P40			40	46
40.7	±0.38			P41			41	47
41.7	±0.39			P42			42	48
43.7	±0.41			P44			44	50
44.7	±0.41			P45			45	51
45.7	±0.42			P46			46	52
47.7	±0.44			P48			48	54
48.7	±0.45			P49			49	55
49.7	±0.45			P50			50	56

Remarks With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

Inner diameter d_1		Thickness d_2 standard dimensions and tolerance					Groove dimensions (JIS B 2401-2)	
Standard dimensions	Tolerance	1.9±0.08	2.4±0.09	3.5±0.10	5.7±0.13	8.4±0.15	Shaft diameter	Hole diameter
		f=0.10 or less	f=0.12 or less	f=0.14 or less	f=0.16 or less	f=0.18 or less		
Bearing number								
47.6	±0.44				P 48A		48	58
49.6	±0.45				P 50A		50	60
51.6	±0.47				P 52		52	62
52.6	±0.48				P 53		53	63
54.6	±0.49				P 55		55	65
55.6	±0.50				P 56		56	66
57.6	±0.52				P 58		58	68
59.6	±0.53				P 60		60	70
61.6	±0.55				P 62		62	72
62.6	±0.56				P 63		63	73
64.6	±0.57				P 65		65	75
66.6	±0.59				P 67		67	77
69.6	±0.61				P 70		70	80
70.6	±0.62				P 71		71	81
74.6	±0.65				P 75		75	85
79.6	±0.69				P 80		80	90
84.6	±0.73				P 85		85	95
89.6	±0.77				P 90		90	100
94.6	±0.81				P 95		95	105
99.6	±0.84				P100		100	110
101.6	±0.85				P102		102	112
104.6	±0.87				P105		105	115
109.6	±0.91				P110		110	120
111.6	±0.92				P112		112	122
114.6	±0.94				P115		115	125
119.6	±0.98				P120		120	130
124.6	±1.01				P125		125	135
129.6	±1.05				P130		130	140
131.6	±1.06				P132		132	142
134.6	±1.09				P135		135	145
139.6	±1.12				P140		140	150
144.6	±1.16				P145		145	155
149.6	±1.19				P150		150	160
149.5	±1.19					P150A	150	165
154.5	±1.23					P155	155	170
159.5	±1.26					P160	160	175
164.5	±1.30					P165	165	180
169.5	±1.33					P170	170	185
174.5	±1.37					P175	175	190
179.5	±1.40					P180	180	195
184.5	±1.44					P185	185	200
189.5	±1.48					P190	190	205
194.5	±1.51					P195	195	210
199.5	±1.55					P200	200	215
204.5	±1.58					P205	205	220
208.5	±1.61					P209	209	224
209.5	±1.62					P210	210	225
214.5	±1.65					P215	215	230
219.5	±1.68					P220	220	235
224.5	±1.71					P225	225	240
229.5	±1.75					P230	230	245
234.5	±1.78					P235	235	250
239.5	±1.81					P240	240	255
244.5	±1.84					P245	245	260
249.5	±1.88					P250	250	265
254.5	±1.91					P255	255	270
259.5	±1.94					P260	260	275
264.5	±1.97					P265	266	280
269.5	±2.01					P270	270	285
274.5	±2.04					P275	275	290
279.5	±2.07					P280	280	295
284.5	±2.10					P285	285	300
289.5	±2.14					P290	290	305
294.5	±2.17					P295	295	310
299.5	±2.20					P300	300	315
314.5	±2.30					P315	315	330
319.5	±2.33					P320	320	335
334.5	±2.42					P335	335	350
339.5	±2.45					P340	340	355
354.5	±2.54					P355	355	370
359.5	±2.57					P360	360	375
374.5	±2.67					P375	375	390
384.5	±2.73					P385	385	400
399.5	±2.82					P400	400	415

4.1.2 Shape and dimensions of O-rings for static application (JIS G series) (Attached Table 2)

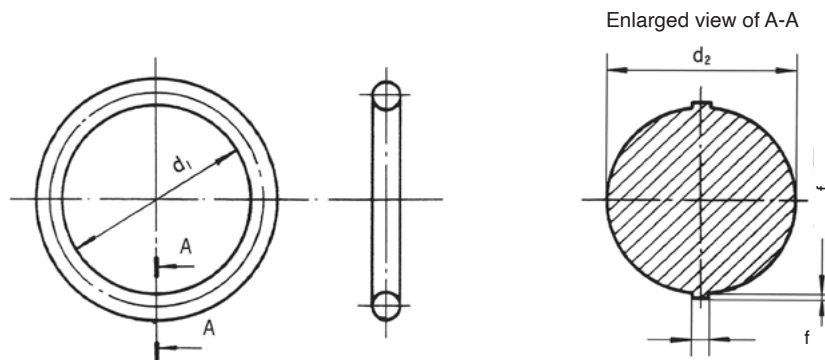


Unit : mm

Inner diameter d_1		Thickness d_2 standard dimensions and tolerance		Groove dimensions (JIS B 2401-2)	
Standard dimensions	Tolerance	3.1±0.10	5.7±0.13	Shaft diameter	Hole diameter
		f=0.12 or less	f=0.16 or less		
		Bearing number			
24.4	±0.25	G 25		25	30
29.4	±0.29	G 30		30	35
34.4	±0.33	G 35		35	40
39.4	±0.37	G 40		40	45
44.4	±0.41	G 45		45	50
49.4	±0.45	G 50		50	55
54.4	±0.49	G 55		55	60
59.4	±0.53	G 60		60	65
64.4	±0.57	G 65		65	70
69.4	±0.61	G 70		70	75
74.4	±0.65	G 75		75	80
79.4	±0.69	G 80		80	85
84.4	±0.73	G 85		85	90
89.4	±0.77	G 90		90	95
94.4	±0.81	G 95		95	100
99.4	±0.85	G100		100	105
104.4	±0.87	G105		105	110
109.4	±0.91	G110		110	115
114.4	±0.94	G115		115	120
119.4	±0.98	G120		120	125
124.4	±1.01	G125		125	130
129.4	±1.05	G130		130	135
134.4	±1.08	G135		135	140
139.4	±1.12	G140		140	145
144.4	±1.16	G145		145	150
149.3	±1.19		G150	150	160
154.3	±1.23		G155	155	165
159.3	±1.26		G160	160	170
164.3	±1.30		G165	165	175
169.3	±1.33		G170	170	180
174.3	±1.37		G175	175	185
179.3	±1.40		G180	180	190
184.3	±1.44		G185	185	195
189.3	±1.47		G190	190	200
194.3	±1.51		G195	195	205
199.3	±1.55		G200	200	210
209.3	±1.61		G210	210	220
219.3	±1.68		G220	220	230
229.3	±1.73		G230	230	240
239.3	±1.81		G240	240	250
249.3	±1.88		G250	250	260
259.3	±1.94		G260	260	270
269.3	±2.01		G270	270	280
279.3	±2.07		G280	280	290
289.3	±2.14		G290	290	300
299.3	±2.20		G300	300	310

Remarks With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

4.1.3 Shape and dimensions of O-rings for vacuum flanges (JIS V series) (Attached Table 3)

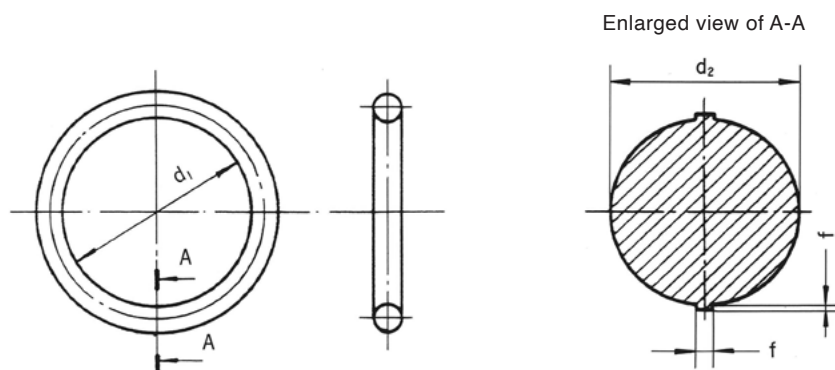


Unit : mm

Inner diameter d_1		Thickness d_2 standard dimensions and tolerance		
Standard dimensions	Tolerance	4±0.10	6±0.15	10±0.30
		f=0.14 or less	f=0.16 or less	f=0.18 or less
Bearing number				
14.5	±0.20	V 15		
23.5	±0.24	V 24		
33.5	±0.33	V 34		
39.5	±0.37	V 40		
54.5	±0.49	V 55		
69.0	±0.61	V 70		
84.0	±0.72	V 85		
99.0	±0.83	V100		
119.0	±0.97	V120		
148.5	±1.18	V150		
173.0	±1.36	V175		
222.5	±1.70		V225	
272.0	±2.02		V275	
321.5	±2.34		V325	
376.0	±2.68		V380	
425.5	±2.99		V430	
475.0	±3.30			V 480
524.5	±3.60			V 530
579.0	±3.92			V 585
633.5	±4.24			V 640
683.0	±4.54			V 690
732.5	±4.83			V 740
782.0	±5.12			V 790
836.5	±5.44			V 845
940.5	±6.06			V 950
1044.0	±6.67			V1055

Remarks With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

4.1.4 Shape and dimensions of series G O-rings for general industrial application (JIS ISO-2005) (Attached Table 4)



Unit : mm

Thickness d_2 standard dimensions and tolerance		1.80±0.08	2.65±0.09	3.55±0.10	5.30±0.13	7.00±0.15
Symbol		A	B	C	D	E
f		0.1 or less	0.12 or less	0.14 or less	0.16 or less	0.18 or less
Inner diameter d_1		Bearing number				
Standard dimensions	Tolerance					
1.80	±0.13	A0018G				
2.00	±0.13	A0020G				
2.24	±0.13	A0022G				
2.50	±0.13	A0025G				
2.80	±0.14	A0028G				
3.15	±0.14	A0031G				
3.55	±0.14	A0035G				
3.75	±0.14	A0037G				
4.00	±0.14	A0040G				
4.50	±0.14	A0045G				
4.87	±0.15	A0048G				
5.00	±0.15	A0050G				
5.15	±0.15	A0051G				
5.30	±0.15	A0053G				
5.60	±0.15	A0056G				
6.00	±0.15	A0060G				
6.30	±0.15	A0063G				
6.70	±0.16	A0067G				
6.90	±0.16	A0069G				
7.10	±0.16	A0071G				
7.50	±0.16	A0075G				
8.00	±0.16	A0080G				
8.50	±0.16	A0085G				
8.75	±0.17	A0087G				
9.00	±0.17	A0090G				
9.50	±0.17	A0095G				
10.0	±0.17	A0100G				
10.6	±0.18	A0106G				
11.2	±0.18	A0112G				
11.8	±0.19	A0118G				
12.5	±0.19	A0125G				
13.2	±0.19	A0132G				
14.0	±0.19	A0140G	B0140G			
15.0	±0.20	A0150G	B0150G			
16.0	±0.20	A0160G	B0160G			
17.0	±0.21	A0170G	B0170G			

Remarks 1 A G at the end of the bearing number means general industrial use.

Remarks 2 As some molds for some of the products described in the above dimensions table may not be available, please consult with us separately when placing an order.

Unit : mm

Thickness d_2 standard dimensions and tolerance		1.80±0.08	2.65±0.09	3.55±0.10	5.30±0.13	7.00±0.15
Symbol		A	B	C	D	E
f		0.1 or less	0.12 or less	0.14 or less	0.16 or less	0.18 or less
Inner diameter d_1		Bearing number				
Standard dimensions	Tolerance					
18.0	±0.21		B0180G	C0180G		
19.0	±0.22		B0190G	C0190G		
20.0	±0.22		B0200G	C0200G		
21.2	±0.23		B0212G	C0212G		
22.4	±0.24		B0224G	C0224G		
23.6	±0.24		B0236G	C0236G		
25.0	±0.25		B0250G	C0250G		
25.8	±0.26		B0258G	C0258G		
26.5	±0.26		B0265G	C0265G		
28.0	±0.28		B0280G	C0280G		
30.0	±0.29		B0300G	C0300G		
31.5	±0.31		B0315G	C0315G		
32.5	±0.32		B0325G	C0325G		
33.5	±0.32		B0335G	C0335G		
34.5	±0.33		B0345G	C0345G		
35.5	±0.34		B0355G	C0355G		
36.5	±0.35		B0365G	C0365G		
37.5	±0.36		B0375G	C0375G		
38.7	±0.37		B0387G	C0387G		
40.0	±0.38			C0400G	D0400G	
41.2	±0.39			C0412G	D0412G	
42.5	±0.40			C0425G	D0425G	
43.7	±0.41			C0437G	D0437G	
45.0	±0.42			C0450G	D0450G	
46.2	±0.43			C0462G	D0462G	
47.5	±0.44			C0475G	D0475G	
48.7	±0.45			C0487G	D0487G	
50.0	±0.46			C0500G	D0500G	
51.5	±0.47			C0515G	D0515G	
53.0	±0.48			C0530G	D0530G	
54.5	±0.50			C0545G	D0545G	
56.0	±0.51			C0560G	D0560G	
58.0	±0.52			C0580G	D0580G	
60.0	±0.54			C0600G	D0600G	
61.5	±0.55			C0615G	D0615G	
63.0	±0.56			C0630G	D0630G	
65.0	±0.58			C0650G	D0650G	
67.0	±0.59			C0670G	D0670G	
69.0	±0.61			C0690G	D0690G	
71.0	±0.63			C0710G	D0710G	
73.0	±0.64			C0730G	D0730G	
75.0	±0.66			C0750G	D0750G	
77.5	±0.67			C0775G	D0775G	
80.0	±0.69			C0800G	D0800G	
82.5	±0.71			C0825G	D0825G	
85.0	±0.73			C0850G	D0850G	
87.5	±0.75			C0875G	D0875G	
90.0	±0.77			C0900G	D0900G	

Unit : mm

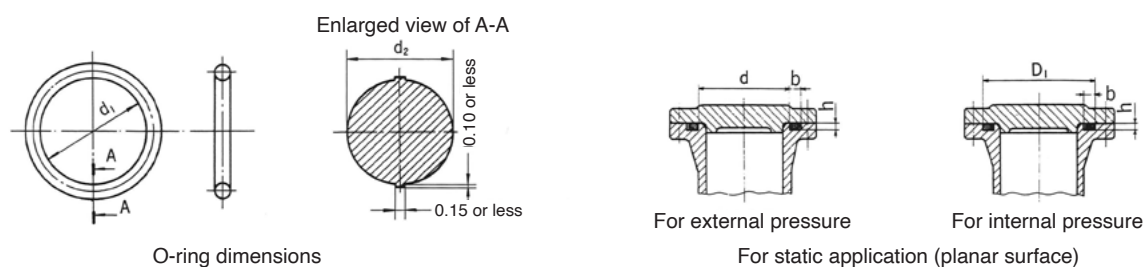
Thickness d_2 standard dimensions and tolerance		1.80±0.08	2.65±0.09	3.55±0.10	5.30±0.13	7.00±0.15
Symbol		A	B	C	D	E
f		0.1 or less	0.12 or less	0.14 or less	0.16 or less	0.18 or less
Inner diameter d_1		Bearing number				
Standard dimensions	Tolerance					
92.5	±0.79			C0925G	D0925G	
95.0	±0.81			C0950G	D0950G	
97.5	±0.83			C0975G	D0975G	
100	±0.84			C1000G	D1000G	
103	±0.87			C1030G	D1030G	
106	±0.89			C1060G	D1060G	
109	±0.91			C1090G	D1090G	E1090G
112	±0.93			C1120G	D1120G	E1120G
115	±0.95			C1150G	D1150G	E1150G
118	±0.97			C1180G	D1180G	E1180G
122	±1.00			C1220G	D1220G	E1220G
125	±1.03			C1250G	D1250G	E1250G
128	±1.05			C1280G	D1280G	E1280G
132	±1.08			C1320G	D1320G	E1320G
136	±1.10			C1360G	D1360G	E1360G
140	±1.13			C1400G	D1400G	E1400G
145	±1.17			C1450G	D1450G	E1450G
150	±1.20			C1500G	D1500G	E1500G
155	±1.24			C1550G	D1550G	E1550G
160	±1.27			C1600G	D1600G	E1600G
165	±1.31			C1650G	D1650G	E1650G
170	±1.34			C1700G	D1700G	E1700G
175	±1.38			C1750G	D1750G	E1750G
180	±1.41			C1800G	D1800G	E1800G
185	±1.44			C1850G	D1850G	E1850G
190	±1.48			C1900G	D1900G	E1900G
195	±1.51			C1950G	D1950G	E1950G
200	±1.55			C2000G	D2000G	E2000G
206	±1.59				D2060G	E2060G
212	±1.63				D2120G	E2120G
218	±1.67				D2180G	E2180G
224	±1.71				D2240G	E2240G
230	±1.75				D2300G	E2300G
236	±1.79				D2360G	E2360G
243	±1.83				D2430G	E2430G
250	±1.88				D2500G	E2500G
258	±1.93				D2580G	E2580G
265	±1.98				D2650G	E2650G
272	±2.02				D2720G	E2720G
280	±2.08				D2800G	E2800G
290	±2.14				D2900G	E2900G
300	±2.21				D3000G	E3000G

Remarks 1 A G at the end of the bearing number means general industrial use.

Remarks 2 As some molds for some of the products described in the above dimensions table may not be available, please consult with us separately when placing an order.

Unit : mm

Thickness d_2 standard dimensions and tolerance		1.80±0.08	2.65±0.09	3.55±0.10	5.30±0.13	7.00±0.15
Symbol		A	B	C	D	E
f		0.1 or less	0.12 or less	0.14 or less	0.16 or less	0.18 or less
Inner diameter d_1		Bearing number				
Standard dimensions	Tolerance					
307	±2.25				D3070G	E3070G
315	±2.30				D3150G	E3150G
325	±2.37				D3250G	E3250G
335	±2.43				D3350G	E3350G
345	±2.49				D3450G	E3450G
355	±2.56				D3550G	E3550G
365	±2.62				D3650G	E3650G
375	±2.68				D3750G	E3750G
387	±2.76				D3870G	E3870G
400	±2.84				D4000G	E4000G
412	±2.91					E4120G
425	±2.99					E4250G
437	±3.07					E4370G
450	±3.15					E4500G
462	±3.22					E4620G
475	±3.30					E4750G
487	±3.37					E4870G
500	±3.45					E5000G
515	±3.54					E5150G
530	±3.63					E5300G
545	±3.72					E5450G
560	±3.81					E5600G
580	±3.93					E5800G
600	±4.05					E6000G
615	±4.13					E6150G
630	±4.22					E6300G
650	±4.34					E6500G
670	±4.46					E6700G

4.1.5 Shape and dimensions of small wire diameter O-rings for static application (SG series) (Attached Table 5)


Unit : mm

Bearing number	O-ring dimensions		Groove dimensions (reference)					
	Thickness d_2	Inner diameter d_1	$d \begin{smallmatrix} 0 \\ -0.05 \end{smallmatrix}$	D_1	$D \begin{smallmatrix} +0.05 \\ 0 \end{smallmatrix}$	$b \begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	$h \begin{smallmatrix} 0 \\ -0.1 \end{smallmatrix}$	
SG 3 ⁽¹⁾	1.5±0.1	2.5	±0.15	3	—	5	2.5	1.0
SG 4		3.5		4	6.3	6		
SG 5		4.5		5	7.3	7		
SG 6		5.5		6	8.3	8		
SG 7		6.5		7	9.3	9		
SG 8		7.5		8	10.3	10		
SG 9		8.5		9	11.3	11		
SG10		9.5		10	12.3	12		
SG11.2		10.7		11.2	13.5	13.2		
SG12		11.5		12	14.3	14		
SG12.5		12.0		12.5	14.8	14.5		
SG14		13.5		14	16.3	16		
SG15		14.5		15	17.3	17		
SG16		15.5		16	18.3	18		
SG18		17.5		18	20.3	20		
SG20		19.5		20	22.3	22		
SG22		21.5		22	24.3	24		
SG22.4	2.0±0.1	21.9	±0.15	22.4	25.9	25.4	2.7	1.5
SG24		23.5		24	27.5	27		
SG25		24.5		25	28.5	28		
SG26		25.5		26	29.5	29		
SG28		27.5		28	31.5	31		
SG29		28.5		29	32.5	32		
SG30		29.5		30	33.5	33		
SG31.5		31.0		31.5	35	34.5		
SG32		31.5		32	35.5	35		
SG34		33.5		34	37.5	37		
SG35		34.5		35	38.5	38		
SG35.5		35.0		35.5	39	38.5		
SG36		35.5		36	39.5	39		
SG38		37.5		38	41.5	41		
SG39	38.5	39	42.5	42				
SG40	39.5	40	43.5	43				

Note (1) SG3 is limited to use with cylindrical surfaces.

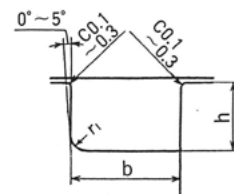
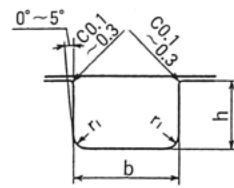
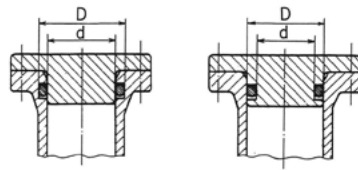
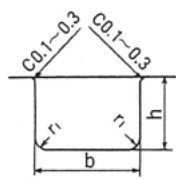
Remarks 1 Tolerances for inner diameter d_1 shown in this table apply to O-rings made of nitrile rubber and styrene-butadiene rubber. Refer to the reference table for other materials.

Remarks 2 As some molds for some of the products described in the above dimensions table may not be available, please consult with us separately when placing an order.

Remarks 3 D_1 indicates standard dimensions, and tolerances are not specified.

<Reference>

Material	Tolerance
Fluoro-rubber Ethylene propylene rubber Acrylic rubber	Double the value in the above table
Silicone rubber Fluorosilicone rubber	Triple the value in the above table



For static application (cylindrical surface)

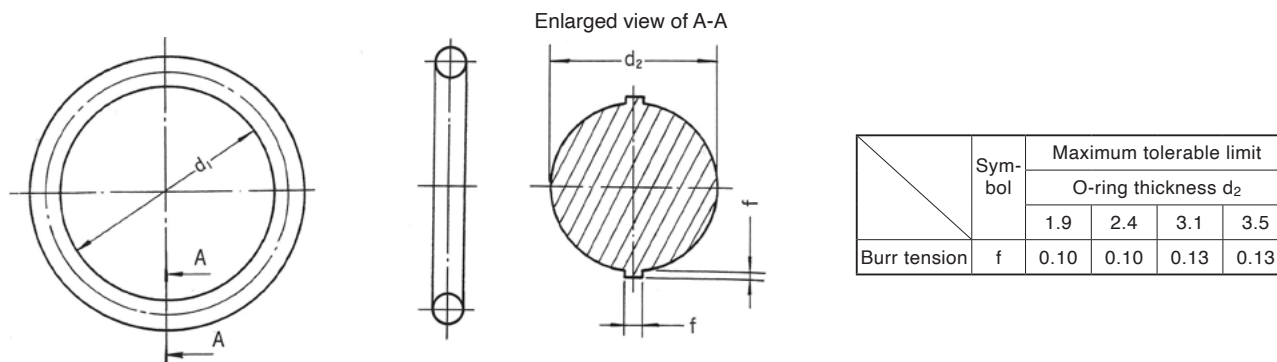
Integral groove

Split groove

Unit : mm

Bearing number	O-ring dimensions		Groove dimensions (reference)					
	Thickness d_2	Inner diameter d_1	$d \begin{smallmatrix} 0 \\ -0.05 \end{smallmatrix}$	D_1	$D \begin{smallmatrix} +0.05 \\ 0 \end{smallmatrix}$	$b \begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	$h \begin{smallmatrix} 0 \\ -0.1 \end{smallmatrix}$	
SG 42	2.0±0.1	41.5	±0.25	42	45.5	45	2.7	1.5
SG 44		43.5		44	47.5	47		
SG 45		44.5		45	48.5	48		
SG 46		45.5		46	49.5	49		
SG 48		47.5		48	51	51		
SG 50		49.5		50	53	53		
SG 53		52.5		53	56	56		
SG 55		54.5		55	58	58		
SG 56		55.5		56	59	59		
SG 60		59.5		60	63	63		
SG 63		62.5	63	66	66			
SG 65		64.5	65	68	68			
SG 67		66.5	67	70	70			
SG 70		69.5	70	73	73			
SG 71		70.5	±0.4	71	74	74		
SG 75		74.5		75	78	78		
SG 80		79.5		80	83	83		
SG 85		84.5		85	88	88		
SG 90		89.5		90	93	93		
SG 95		94.5		95	98	98		
SG100	99.5	100		103	103			
SG105	104.5	105		108	108			
SG110	109.5	110		113	113			
SG112	111.5	112		115	115			
SG115	114.5	115	118	118				
SG120	119.5	120	123	123				
SG125	124.5	125	128	128				
SG130	129.5	±0.6	130	133	133			
SG132	131.5		132	135	135			
SG135	134.5		135	138	138			
SG140	139.5		140	143	143			
SG145	144.5		145	148	148			
SG150	149.5		150	153	153			

4.1.6 Shape and dimensions of O-rings for automobiles (JASO F 404-96) (Attached Table 6)



Unit : mm

Nominal bore diameter ⁽¹⁾	Standard dimensions and tolerance							
	Thickness		Inner diameter					
	d_2	Tolerance	d_1	Tolerance by type of material ⁽²⁾				
				1, 2	3, 4D	4C, 4E, 5		
3	1.9	± 0.07	2.8	± 0.12	± 0.24	± 0.36		
4								
5								
6								
7								
8								
9								
10								
11.2								
12.5								
13.2								
14								
15								
16								
17								
18								
19								
20								
21.2			2.4	± 0.07	21.0	± 0.15	± 0.30	± 0.45
22.4								
23.6								
25								
26.5								
28								
30								
31.5								
33.5								
35.5								
35.2								
9.8								
11.2								
12.5								
13.2								
14								
15								
16								
17								
18								
19								
20								
21								
22.4								
23.6								
25								
26.5								
28								
30								
31.5								
33.5								
35.5								
37.5								
40								
42.5								
45								
47.5								
50								
53								
			42.2	± 0.25	± 0.50	± 0.75		
			44.7					
			47.2					
			49.7					
			52.6					

Note (1) The nominal bore diameter values are equivalent to groove dimensions d_3 and d_5 .

Note (2) Parties involved in the delivery may reach agreements among themselves for special circumstances.

Remarks As some molds for some of the products described in the above dimensions table may not be available, please consult with us separately when placing an order.

Unit : mm

Nominal bore diameter ⁽¹⁾	Standard dimensions and tolerance					
	Thickness		Inner diameter			
	d ₂	Tolerance	d ₁	Tolerance by type of material ⁽²⁾		
				1, 2	3, 4D	4C, 4E, 5
56	2.4	±0.07	55.6	±0.25	±0.05	±0.75
60			59.6			
63			62.6			
67			66.6			
71			70.6			
25	3.1	±0.10	24.4	±0.15	±0.30	±0.45
30			29.4			
35			34.4			
40			39.4			
45			44.4			
50			49.4	±0.25	±0.50	±0.75
55			54.4			
60			59.4			
65			64.4			
70			69.4			
75			74.4	±0.40	±0.80	±1.20
80			79.4			
85			84.4			
90			89.4			
95			94.4			
100			99.4	±0.60	±1.20	±1.80
105			104.4			
110			109.4			
115			114.4			
120			119.4			
125	124.4	±0.60	±1.20	±1.80		
130	129.4					
135	134.4					
140	139.4					
145	144.4					
22.4	3.5	±0.10	22.1	±0.15	±0.30	±0.45
24			23.7			
25			24.7			
26			25.7			
28			27.7			
30			29.7			
31.5			31.2			
34			33.7			
35.5			35.2			
38			37.7			
39			38.7			
40			39.7			
42			41.7	±0.25	±0.50	±0.75
44			43.7			
45			44.7			
48			47.7			
50			49.7			
53			52.6			
56			55.6			
60			59.6			
63			62.6			
67			66.6			
71			70.6	±0.40	±0.80	±1.20
75			74.6			
80			79.6			
85			84.6			
90			89.6			
95			94.6			
100			99.6			
106			105.6			
112			111.6			
118			117.6			
125			124.6	±0.60	±1.20	±1.80
132			131.6			
140			139.6			
150			149.6			

4.1.7 AS568 O-ring dimensions table and components comparison table (Attached Table 7)

(1) Packing and gaskets

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d_2	Inner diameter d_1
001			001		001	001		001		1.02±0.07	0.74±0.10
002			002		002	002		002		1.27±0.07	1.07±0.10
003			003		003	003		003		1.52±0.07	1.42±0.10
004			004		004	004		004	004	1.78±0.07	1.78±0.12
005			005		005	005		005	005	1.78±0.07	2.57±0.12
006	1		006	AN123956	006	006	AN123856	006	006	1.78±0.07	2.90±0.12
007	2		007	AN123957	007	007	AN123857	007	007	1.78±0.07	3.68±0.12
008	3		008	AN123958	008	008	AN123858	008	008	1.78±0.07	4.47±0.12
009	4		009	AN123959	009	009	AN123859	009	009	1.78±0.07	5.28±0.12
010	5		010	AN123960	010	010	AN123860	010	010	1.78±0.07	6.07±0.12
011	6		011	AN123961	011	011	AN123861	011	011	1.78±0.07	7.65±0.12
012	7		012	AN123962	012	012	AN123862	012	012	1.78±0.07	9.25±0.12
013			013		013	013		013	013	1.78±0.07	10.82±0.13
014			014		014	014		014	014	1.78±0.07	12.42±0.13
015			015		015	015		015	015	1.78±0.07	14.00±0.17
016			016		016	016		016	016	1.78±0.07	15.60±0.22
017			017		017	017		017	017	1.78±0.07	17.17±0.22
018			018		018	018		018	018	1.78±0.07	18.77±0.22
019			019		019	019		019	019	1.78±0.07	20.35±0.22
020			020		020	020		020	020	1.78±0.07	21.95±0.22
021			021		021	021		021	021	1.78±0.07	23.52±0.22
022			022		022	022		022	022	1.78±0.07	25.12±0.25
023			023		023	023		023	023	1.78±0.07	26.70±0.25
024			024		024	024		024	024	1.78±0.07	28.30±0.25
025			025		025	025		025	025	1.78±0.07	29.87±0.28
026			026		026	026		026	026	1.78±0.07	31.47±0.28
027			027		027	027		027	027	1.78±0.07	33.05±0.27
028			028		028	028		028	028	1.78±0.07	34.65±0.33
029					029	029		029	029	1.78±0.07	37.82±0.33
030					030	030		030	030	1.78±0.07	41.00±0.33
031					031	031		031	031	1.78±0.07	44.17±0.38
032					032	032		032	032	1.78±0.07	47.35±0.38
033					033	033		033	033	1.78±0.07	50.52±0.45
034					034	034		034	034	1.78±0.07	53.70±0.45
035					035	035		035	035	1.78±0.07	56.87±0.45
036					036	036		036	036	1.78±0.07	60.05±0.45
037					037	037		037	037	1.78±0.07	63.22±0.45
038					038	038		038	038	1.78±0.07	66.40±0.50
039					039	039		039	039	1.78±0.07	69.60±0.50
040					040	040		040	040	1.78±0.07	72.75±0.55
041					041	041		041		1.78±0.07	75.92±0.60
042					042	042		042		1.78±0.07	82.30±0.60
043					043	043		043		1.78±0.07	88.60±0.60
044					044	044		044		1.78±0.07	95.00±0.70
045					045	045		045		1.78±0.07	101.30±0.70
046					046	046		046		1.78±0.07	107.65±0.75
047					047	047		047		1.78±0.07	114.05±0.75
048					048	048		048		1.78±0.07	120.35±0.75
049					049	049		049		1.78±0.07	126.75±0.95
050					050	050		050		1.78±0.07	133.05±0.95
102										2.62±0.07	1.24±0.12
103										2.62±0.07	2.05±0.12
104										2.62±0.07	2.84±0.12
105										2.62±0.07	3.63±0.12
106					106			106		2.62±0.07	4.42±0.12
107					107			107		2.62±0.07	5.23±0.12
108					108			108		2.62±0.07	6.02±0.12
109					109			109		2.62±0.07	7.59±0.12
110	8		110	AN123963	110	110	AN123863	110	110	2.62±0.07	9.19±0.12
111	9		111	AN123964	111	111	AN123864	111	111	2.62±0.07	10.77±0.12
112	10		112	AN123965	112	112	AN123865	112	112	2.62±0.07	12.37±0.12
113	11		113	AN123966	113	113	AN123866	113	113	2.62±0.07	13.94±0.17
114	12		114	AN123967	114	114	AN123867	114	114	2.62±0.07	15.54±0.22
115	13		115	AN123968	115	115	AN123868	115	115	2.62±0.07	17.12±0.23

Remarks 1 These actual dimensions are for AS568. They are not standard values.

Remarks 2 Since these actual dimensions are converted from inches to millimeters, they may differ from the standard inch-based values.

Remarks 3 With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d ₂	Inner diameter d ₁
116	14		116	AN123969	116	116	AN123869	116	116	2.62±0.07	18.72±0.23
117			117		117	117		117	117	2.62±0.07	20.29±0.25
118			118		118	118		118	118	2.62±0.07	21.89±0.25
119			119		119	119		119	119	2.62±0.07	23.47±0.25
120			120		120	120		120	120	2.62±0.07	25.07±0.25
121			121		121	121		121	121	2.62±0.07	26.64±0.25
122			122		122	122		122	122	2.62±0.07	28.24±0.25
123			123		123	123		123	123	2.62±0.07	29.82±0.30
124			124		124	124		124	124	2.62±0.07	31.42±0.30
125			125		125	125		125	125	2.62±0.07	32.99±0.30
126			126		126	126		126	126	2.62±0.07	34.59±0.30
127			127		127	127		127	127	2.62±0.07	36.17±0.30
128			128		128	128		128	128	2.62±0.07	37.77±0.30
129			129		129	129		129	129	2.62±0.07	39.34±0.38
130			130		130	130		130	130	2.62±0.07	40.94±0.38
131			131		131	131		131	131	2.62±0.07	42.52±0.38
132			132		132	132		132	132	2.62±0.07	44.12±0.38
133			133		133	133		133	133	2.62±0.07	45.69±0.38
134			134		134	134		134	134	2.62±0.07	47.29±0.38
135			135		135	135		135	135	2.62±0.07	48.89±0.43
136			136		136	136		136	136	2.62±0.07	50.47±0.43
137			137		137	137		137	137	2.62±0.07	52.07±0.43
138			138		138	138		138	138	2.62±0.07	53.64±0.43
139			139		139	139		139	139	2.62±0.07	55.24±0.43
140			140		140	140		140	140	2.62±0.07	56.82±0.43
141			141		141	141		141	141	2.62±0.07	58.40±0.50
142			142		142	142		142	142	2.62±0.07	60.00±0.50
143			143		143	143		143	143	2.62±0.07	61.60±0.50
144			144		144	144		144	144	2.62±0.07	63.20±0.50
145			145		145	145		145	145	2.62±0.07	64.80±0.50
146			146		146	146		146	146	2.62±0.07	66.35±0.55
147			147		147	147		147	147	2.62±0.07	67.95±0.55
148			148		148	148		148	148	2.62±0.07	69.55±0.55
149			149		149	149		149	149	2.62±0.07	71.15±0.55
150					150	150		150		2.62±0.07	72.70±0.60
151					151	151		151		2.62±0.07	75.90±0.60
152					152	152		152		2.62±0.07	82.20±0.60
153					153	153		153		2.62±0.07	88.60±0.60
154					154	154		154		2.62±0.07	94.90±0.70
155					155	155		155		2.62±0.07	101.30±0.70
156					156	156		156		2.62±0.07	107.65±0.75
157					157	157		157		2.62±0.07	113.95±0.75
158					158	158		158		2.62±0.07	120.35±0.75
159					159	159		159		2.62±0.07	126.70±0.90
160					160	160		160		2.62±0.07	133.00±0.90
161					161	161		161		2.62±0.07	139.40±0.90
162					162	162		162		2.62±0.07	145.70±0.90
163					163	163		163		2.62±0.07	152.10±0.90
164					164	164		164		2.62±0.07	158.40±1.00
165					165	165		165		2.62±0.07	164.80±1.00
166					166	166		166		2.62±0.07	171.10±1.00
167					167	167		167		2.62±0.07	177.50±1.00
168					168	168		168		2.62±0.07	183.85±1.15
169					169	169		169		2.62±0.07	190.15±1.15
170					170	170		170		2.62±0.07	196.55±1.15
171					171	171		171		2.62±0.07	202.85±1.15
172					172	172		172		2.62±0.07	209.20±1.25
173					173	173		173		2.62±0.07	215.55±1.25
174					174	174		174		2.62±0.07	221.90±1.25
175					175	175		175		2.62±0.07	228.25±1.25
176					176	176		176		2.62±0.07	234.60±1.40
177					177	177		177		2.62±0.07	241.00±1.40
178					178	178		178		2.62±0.07	247.30±1.40

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d_2	Inner diameter d_1
201										3.53±0.10	4.34±0.12
202										3.53±0.10	5.94±0.12
203										3.53±0.10	7.52±0.12
204										3.53±0.10	9.12±0.12
205										3.53±0.10	10.69±0.12
206										3.53±0.10	12.29±0.12
207										3.53±0.10	13.87±0.18
208										3.53±0.10	15.47±0.23
209										3.53±0.10	17.04±0.23
210	15		210	AN123970	210	210	AN123870	210	210	3.53±0.10	18.64±0.25
211	16		211	AN123971	211	211	AN123871	211	211	3.53±0.10	20.22±0.25
212	17		212	AN123972	212	212	AN123872	212	212	3.53±0.10	21.82±0.25
213	18		213	AN123973	213	213	AN123873	213	213	3.53±0.10	23.39±0.25
214	19		214	AN123974	214	214	AN123874	214	214	3.53±0.10	24.99±0.25
215	20		215	AN123975	215	215	AN123875	215	215	3.53±0.10	26.57±0.25
216	21		216	AN123976	216	216	AN123876	216	216	3.53±0.10	28.17±0.30
217	22		217	AN123977	217	217	AN123877	217	217	3.53±0.10	29.74±0.30
218	23		218	AN123978	218	218	AN123878	218	218	3.53±0.10	31.34±0.30
219	24		219	AN123979	219	219	AN123879	219	219	3.53±0.10	32.92±0.30
220	25		220	AN123980	220	220	AN123880	220	220	3.53±0.10	34.52±0.30
221	26		221	AN123981	221	221	AN123881	221	221	3.53±0.10	36.09±0.30
222	27		222	AN123982	222	222	AN123882	222	222	3.53±0.10	37.69±0.38
223		1	223	AN123983	223	223	AN123883	223	223	3.53±0.10	40.87±0.38
224		2	224	AN123984	224	224	AN123884	224	224	3.53±0.10	44.04±0.38
225		3	225	AN123985	225	225	AN123885	225	225	3.53±0.10	47.22±0.45
226		4	226	AN123986	226	226	AN123886	226	226	3.53±0.10	50.39±0.45
227		5	227	AN123987	227	227	AN123887	227	227	3.53±0.10	53.57±0.45
228		6	228	AN123988	228	228	AN123888	228	228	3.53±0.10	56.75±0.45
229		7	229	AN123989	229	229	AN123889	229	229	3.53±0.10	59.90±0.50
230		8	230	AN123990	230	230	AN123890	230	230	3.53±0.10	63.10±0.50
231		9	231	AN123991	231	231	AN123891	231	231	3.53±0.10	66.30±0.50
232		10	232	AN123992	232	232	AN123892	232	232	3.53±0.10	69.45±0.60
233		11	233	AN123993	233	233	AN123893	233	233	3.53±0.10	72.60±0.60
234		12	234	AN123994	234	234	AN123894	234	234	3.53±0.10	75.80±0.60
235		13	235	AN123995	235	235	AN123895	235	235	3.53±0.10	79.00±0.60
236		14	236	AN123996	236	236	AN123896	236	236	3.53±0.10	82.15±0.60
237		15	237	AN123997	237	237	AN123897	237	237	3.53±0.10	85.30±0.60
238		16	238	AN123998	238	238	AN123898	238	238	3.53±0.10	88.50±0.60
239		17	239	AN123999	239	239	AN123899	239	239	3.53±0.10	91.70±0.70
240		18	240	AN124000	240	240	AN123900	240	240	3.53±0.10	94.85±0.70
241		19	241	AN124001	241	241	AN123901	241	241	3.53±0.10	98.00±0.70
242		20	242	AN124002	242	242	AN123902	242	242	3.53±0.10	101.20±0.70
243		21	243	AN124003	243	243	AN123903	243	243	3.53±0.10	104.40±0.70
244		22	244	AN124004	244	244	AN123904	244	244	3.53±0.10	107.55±0.75
245		23	245	AN124005	245	245	AN123905	245	245	3.53±0.10	110.75±0.75
246		24	246	AN124006	246	246	AN123906	246	246	3.53±0.10	113.90±0.75
247		25	247	AN124007	247	247	AN123907	247	247	3.53±0.10	117.05±0.75
248		26		AN124008	248	248	AN123908	248	248	3.53±0.10	120.25±0.75
249		27		AN124009	249	249	AN123909	249	249	3.53±0.10	123.40±0.85
250		28		AN124010	250	250	AN123910	250	250	3.53±0.10	126.60±0.85
251		29		AN124011	251	251	AN123911	251	251	3.53±0.10	129.80±0.85
252		30		AN124012	252	252	AN123912	252	252	3.53±0.10	132.95±0.85
253		31		AN124013	253	253	AN123913	253	253	3.53±0.10	136.10±0.85
254		32		AN124014	254	254	AN123914	254	254	3.53±0.10	139.30±0.85
255		33		AN124015	255	255	AN123915	255	255	3.53±0.10	142.50±0.85
256		34		AN124016	256	256	AN123916	256	256	3.53±0.10	145.65±0.85
257		35		AN124017	257	257	AN123917	257	257	3.53±0.10	148.80±0.90
258		36		AN124018	258	258	AN123918	258	258	3.53±0.10	152.00±0.90
259		37		AN124019	259	259	AN123919	259	259	3.53±0.10	158.35±1.00
260		38		AN124020	260	260	AN123920	260	260	3.53±0.10	164.70±1.00
261		39		AN124021	261	261	AN123921	261	261	3.53±0.10	171.05±1.00
262		40		AN124022	262	262	AN123922	262	262	3.53±0.10	177.40±1.00
263		41		AN124023	263	263	AN123923	263	263	3.53±0.10	183.75±1.10
264		42		AN124024	264	264	AN123924	264	264	3.53±0.10	190.10±1.10
265		43		AN124025	265	265	AN123925	265	265	3.53±0.10	196.45±1.10

Remarks 1 These actual dimensions are for AS568. They are not standard values.

Remarks 2 Since these actual dimensions are converted from inches to millimeters, they may differ from the standard inch-based values.

Remarks 3 With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d ₂	Inner diameter d ₁
266		44		AN124026	266	266	AN123926	266	266	3.53±0.10	202.80±1.10
267		45		AN124027	267	267	AN123927	267	267	3.53±0.10	209.15±1.25
268		46		AN124028	268	268	AN123928	268	268	3.53±0.10	215.50±1.25
269		47		AN124029	269	269	AN123929	269	269	3.53±0.10	221.85±1.25
270		48		AN124030	270	270	AN123930	270	270	3.53±0.10	228.20±1.30
271		49		AN124031	271	271	AN123931	271	271	3.53±0.10	234.55±1.40
272		50		AN124032	272	272	AN123932	272	272	3.53±0.10	240.90±1.40
273		51		AN124033	273	273	AN123933	273	273	3.53±0.10	247.20±1.40
274		52		AN124034	274	274	AN123934	274	274	3.53±0.10	253.60±1.40
275					275	275		275		3.53±0.10	266.30±1.40
276					276	276		276		3.53±0.10	278.95±1.65
277					277	277		277		3.53±0.10	291.65±1.65
278					278	278		278		3.53±0.10	304.35±1.65
279					279	279		279		3.53±0.10	329.75±1.65
280					280	280		280		3.53±0.10	355.15±1.65
281					281	281		281		3.53±0.10	380.55±1.65
282					282	282		282		3.53±0.10	405.30±1.90
283					283	283		283		3.53±0.10	430.65±2.05
284					284	284		284		3.53±0.10	456.05±2.15
309										5.33±0.12	10.46±0.12
310										5.33±0.12	12.06±0.12
311										5.33±0.12	13.64±0.18
312										5.33±0.12	15.24±0.22
313										5.33±0.12	16.81±0.22
314										5.33±0.12	18.41±0.25
315										5.33±0.12	19.99±0.25
316										5.33±0.12	21.59±0.25
317										5.33±0.12	23.16±0.25
318										5.33±0.12	24.76±0.25
319										5.33±0.12	26.34±0.25
320										5.33±0.12	27.94±0.30
321										5.33±0.12	29.51±0.30
322										5.33±0.12	31.11±0.30
323										5.33±0.12	32.68±0.30
324										5.33±0.12	34.29±0.30
325	28		325		325	325		325	325	5.33±0.12	37.46±0.38
326	29		326		326	326		326	326	5.33±0.12	40.64±0.38
327	30		327		327	327		327	327	5.33±0.12	43.82±0.38
328	31		328		328	328		328	328	5.33±0.12	46.99±0.38
329	32		329		329	329		329	329	5.33±0.12	50.16±0.45
330	33		330		330	330		330	330	5.33±0.12	53.34±0.45
331	34		331		331	331		331	331	5.33±0.12	56.51±0.45
332	35		332		332	332		332	332	5.33±0.12	59.69±0.45
333	36		333		333	333		333	333	5.33±0.12	62.90±0.50
334	37		334		334	334		334	334	5.33±0.12	66.00±0.50
335	38		335		335	335		335	335	5.33±0.12	69.20±0.50
336	39		336		336	336		336	336	5.33±0.12	72.40±0.50
337	40		337		337	337		337	337	5.33±0.12	75.60±0.60
338	41		338		338	338		338	338	5.33±0.12	78.70±0.60
339	42		339		339	339		339	339	5.33±0.12	81.90±0.60
340	43		340		340	340		340	340	5.33±0.12	85.10±0.60
341	44		341		341	341		341	341	5.33±0.12	88.30±0.60
342	45		342		342	342		342	342	5.33±0.12	91.45±0.70
343	46		343		343	343		343	343	5.33±0.12	94.60±0.70
344	47		344		344	344		344	344	5.33±0.12	97.80±0.70
345	48		345		345	345		345	345	5.33±0.12	101.00±0.70
346	49		346		346	346		346	346	5.33±0.12	104.15±0.75
347	50		347		347	347		347	347	5.33±0.12	107.35±0.75
348	51		348		348	348		348	348	5.33±0.12	110.50±0.75
349	52		349		349	349		349	349	5.33±0.12	113.65±0.75
350					350	350		350		5.33±0.12	116.85±0.75
351					351	351		351		5.33±0.12	120.05±0.75
352					352	352		352		5.33±0.12	123.20±0.80
353					353	353		353		5.33±0.12	126.35±0.90

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d_2	Inner diameter d_1
354					354	354		354		5.33±0.12	129.55±0.90
355					355	355		355		5.33±0.12	132.75±0.90
356					356	356		356		5.33±0.12	135.90±0.90
357					357	357		357		5.33±0.12	139.05±0.90
358					358	358		358		5.33±0.12	142.25±0.90
359					359	359		359		5.33±0.12	145.45±0.90
360					360	360		360		5.33±0.12	148.60±0.90
361					361	361		361		5.33±0.12	151.75±0.90
362					362	362		362		5.33±0.12	158.10±1.00
363					363	363		363		5.33±0.12	164.45±1.00
364					364	364		364		5.33±0.12	170.80±1.00
365					365	365		365		5.33±0.12	177.15±1.05
366					366	366		366		5.33±0.12	183.55±1.15
367					367	367		367		5.33±0.12	189.85±1.15
368					368	368		368		5.33±0.12	196.25±1.15
369					369	369		369		5.33±0.12	202.55±1.15
370					370	370		370		5.33±0.12	208.90±1.25
371					371	371		371		5.33±0.12	215.25±1.25
372					372	372		372		5.33±0.12	221.60±1.25
373					373	373		373		5.33±0.12	227.95±1.25
374					374	374		374		5.33±0.12	234.30±1.40
375					375	375		375		5.33±0.12	240.70±1.40
376					376	376		376		5.33±0.12	247.00±1.40
377					377	377		377		5.33±0.12	253.40±1.40
378					378	378		378		5.33±0.12	266.05±1.55
379					379	379		379		5.33±0.12	278.75±1.55
380					380	380		380		5.33±0.12	291.45±1.65
381					381	381		381		5.33±0.12	304.15±1.65
382					382	382		382		5.33±0.12	329.55±1.65
383					383	383		383		5.33±0.12	354.95±1.75
384					384	384		384		5.33±0.12	380.35±1.75
385					385	385		385		5.33±0.12	405.30±1.90
386					386	386		386		5.33±0.12	430.65±2.05
387					387	387		387		5.33±0.12	456.05±2.15
388					388	388		388		5.33±0.12	481.45±2.25
389					389	389		389		5.33±0.12	506.85±2.45
390					390	390		390		5.33±0.12	532.25±2.45
391					391	391		391		5.33±0.12	557.65±2.55
392					392	392		392		5.33±0.12	582.65±2.65
393					393	393		393		5.33±0.12	608.10±2.80
394					394	394		394		5.33±0.12	633.50±2.90
395					395	395		395		5.33±0.12	658.85±3.05
425	88		425		425	425		425	425	6.98±0.15	113.65±0.80
426	53		426		426	426		426	426	6.98±0.15	116.86±0.80
427	54		427		427	427		427	427	6.98±0.15	120.05±0.80
428	55		428		428	428		428	428	6.98±0.15	123.20±0.80
429	56		429		429	429		429	429	6.98±0.15	126.35±0.90
430	57		430		430	430		430	430	6.98±0.15	129.55±0.90
431	58		431		431	431		431	431	6.98±0.15	132.75±0.90
432	59		432		432	432		432	432	6.98±0.15	135.90±0.90
433	60		433		433	433		433	433	6.98±0.15	139.05±0.90
434	61		434		434	434		434	434	6.98±0.15	142.25±0.90
435	62		435		435	435		435	435	6.98±0.15	145.45±0.90
436	63		436		436	436		436	436	6.98±0.15	148.60±0.90
437	64		437		437	437		437	437	6.98±0.15	151.75±0.90
438	65		438		438	438		438	438	6.98±0.15	158.10±1.00
439	66		439		439	439		439	439	6.98±0.15	164.45±1.00
440	67		440		440	440		440	440	6.98±0.15	170.80±1.00
441	68		441		441	441		441	441	6.98±0.15	177.15±1.05
442	69		442		442	442		442	442	6.98±0.15	183.55±1.15
443	70		443		443	443		443	443	6.98±0.15	189.85±1.15
444	71		444		444	444		444	444	6.98±0.15	196.25±1.15
445	72		445		445	445		445	445	6.98±0.15	202.55±1.15
446	73		446		446	446		446	446	6.98±0.15	215.30±1.40

Remarks 1 These actual dimensions are for AS568. They are not standard values.

Remarks 2 Since these actual dimensions are converted from inches to millimeters, they may differ from the standard inch-based values.

Remarks 3 With respect to tolerance d_1 for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

AS568	For hydraulic pressure			For fuel			For lubricating oil			Actual dimensions of O-ring	
	AN 6227	AN 6230	MS 28775	AN123951 THRU AN124050	MS 9021	MS 29513	AN123851 THRU AN123950	MS 9241	MS 29561	Thickness d ₂	Inner diameter d ₁
447	74		447		447	447		447	447	6.98±0.15	228.00±1.40
448	75		448		448	448		448	448	6.98±0.15	240.70±1.40
449	76		449		449	449		449	449	6.98±0.15	253.40±1.40
450	77		450		450	450		450	450	6.98±0.15	266.05±1.55
451	78		451		451	451		451	451	6.98±0.15	278.75±1.55
452	79		452		452	452		452	452	6.98±0.15	291.45±1.55
453	80		453		453	453		453	453	6.98±0.15	304.15±1.55
454	81		454		454	454		454	454	6.98±0.15	316.85±1.55
455	82		455		455	455		455	455	6.98±0.15	329.55±1.55
456	83		456		456	456		456	456	6.98±0.15	342.25±1.75
457	84		457		457	457		457	457	6.98±0.15	354.95±1.75
458	85		458		458	458		458	458	6.98±0.15	367.65±1.75
459	86		459		459	459		459	459	6.98±0.15	380.35±1.75
460	87		460		460	460		460	460	6.98±0.15	393.05±1.75
461					461	461		461		6.98±0.15	405.30±1.90
462					462	462		462		6.98±0.15	418.00±1.90
463					463	463		463		6.98±0.15	430.65±2.05
464					464	464		464		6.98±0.15	443.35±2.15
465					465	465		465		6.98±0.15	456.05±2.15
466					466	466		466		6.98±0.15	468.75±2.15
467					467	467		467		6.98±0.15	481.45±2.25
468					468	468		468		6.98±0.15	494.15±2.25
469					469	469		469		6.98±0.15	506.85±2.45
470					470	470		470		6.98±0.15	532.25±2.45
471					471	471		471		6.98±0.15	557.65±2.55
472					472	472		472		6.98±0.15	582.65±2.65
473					473	473		473		6.98±0.15	608.10±2.80
474					474	474		474		6.98±0.15	633.50±2.90
475					475	475		475		6.98±0.15	658.85±3.05

(2) Gaskets for pipe fittings

Unit : mm

AS568	For hydraulic pressure	For fuel		For lubricating oil	Actual dimensions of O-ring	
	MS28778	MS9020	MS29512	NAS617	Thickness d ₂	Inner diameter d ₁
901		01	01		1.42±0.07	4.70±0.13
902	2	02	02	2	1.63±0.07	6.07±0.13
903	3	03	03	3	1.63±0.07	7.65±0.12
904	4	04	04	4	1.83±0.07	8.92±0.12
905	5	05	05	5	1.83±0.07	10.52±0.12
906	6	06	06	6	1.98±0.07	11.89±0.12
907		07	07		2.08±0.07	13.46±0.18
908	8	08	08	8	2.21±0.07	16.36±0.23
909		09	09		2.46±0.07	17.93±0.23
910	10	10	10	10	2.46±0.07	19.18±0.23
911		11	11		2.95±0.10	21.92±0.23
912	12	12	12	12	2.95±0.10	23.47±0.23
913		13	13		2.95±0.10	25.05±0.25
914	14	14	14		2.95±0.10	26.60±0.25
916	16	16	16	16	2.95±0.10	29.75±0.25
918		18	18		2.95±0.10	34.42±0.30
920	20	20	20	20	3.00±0.10	37.47±0.35
924	24	24	24	24	3.00±0.10	43.69±0.35
928	28	28	28	28	3.00±0.10	53.09±0.45
932	32	32	32	32	3.00±0.10	59.36±0.46

Remarks 1 These actual dimensions are for AS568. They are not standard values.

Remarks 2 Since these actual dimensions are converted from inches to millimeters, they may differ from the standard inch-based values.

Remarks 3 With respect to tolerance d₁ for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

4.1.8 Dimensions of super rubber O-ring and EPDM O-ring (Attached Table 8)

(1) P series

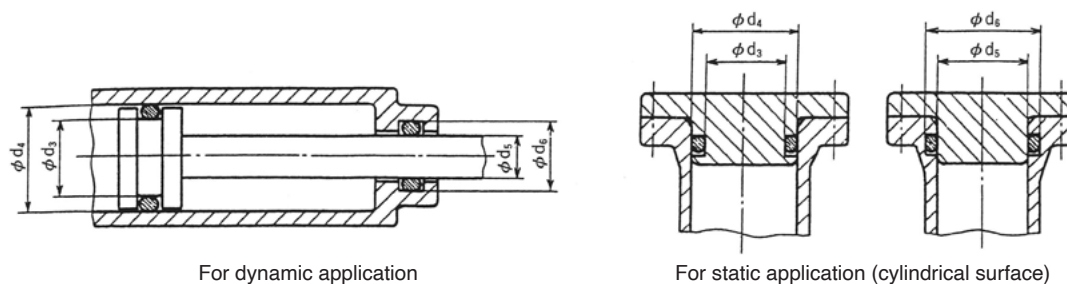
Unit : mm

Bearing number	Thickness d ₂		Inner diameter d ₁				
	Standard dimensions	Tolerance	Standard dimensions	Tolerance			
P 3	1.9	±0.08	2.8	+0.15 -0.3			
P 4			3.8				
P 5			4.8				
P 6			5.8				
P 7			6.8				
P 8			7.8				
P 9			8.8				
P10			9.8				
P10A			2.4		±0.09	9.8	+0.2 -0.4
P11						10.8	
P11.2	11.0						
P12	11.8						
P12.5	12.3						
P14	13.8						
P15	14.8						
P16	15.8						
P18	17.8	+0.25 -0.5					
P20	19.8						
P21	20.8						
P22	21.8						
P22A	3.5		±0.1	21.7	+0.3 -0.7		
P22.4				22.1			
P24				23.7			
P25				24.7			
P25.5				25.2			
P26				25.7			
P28		27.7					
P29		28.7					
P29.5		29.2					
P30		29.7					
P31	30.7	+0.35 -0.8					
P31.5	31.2						
P32	31.7						
P34	33.7						
P35	34.7						
P35.5	35.2						
P36	35.7		+0.4 -0.9				
P38	37.7						
P39	38.7						
P40	39.7						
P41	40.7	+0.45 -1.0					
P42	41.7						
P44	43.7						
P45	44.7						
P46	45.7			+0.5 -1.2			
P48	47.7						
P49	48.7						
P50	49.7						
P48A	5.7		±0.13		47.6	+0.6 -1.5	
P50A					49.6		
P52		51.6					
P53		52.6					
P55		54.6					
P56		55.6					
P58		57.6					
P60		59.6					
P62		61.6					
P63		62.6		+0.7 -1.7			
P65	64.6						
P67	66.6						
P70	69.6						

Unit : mm

Bearing number	Thickness d ₂		Inner diameter d ₁	
	Standard dimensions	Tolerance	Standard dimensions	Tolerance
P 71	5.7	±0.13	70.6	+0.7
P 75			74.6	-1.7
P 80			79.6	+0.8
P 85			84.6	-1.9
P 90			89.6	+0.9
P 95			94.6	-2.1
P100			99.6	+1.0 -2.4
P102			101.6	
P105			104.6	
P110			109.6	+1.1 -2.7
p112			111.6	
P115			114.6	
P120			119.6	
P125			124.6	
P130			129.6	+1.3 -3.0
P132	131.6			
P135	134.6			
P140	139.6	+1.5 -3.5		
P145	144.6			
P150	149.6			
P150A	149.5			
P155	154.5			
P160	159.5			
P165	164.5			
P170	169.5			
P175	174.5		+1.7 -4.0	
P180	179.5			
P185	184.5			
P190	189.5	+1.9 -4.5		
p195	194.5			
P200	199.5			
P205	204.5			
P209	208.5			
P210	209.5			
P215	214.5		+2.1 -5.0	
P220	219.5			
P225	224.5			
P230	229.5		+2.3 -5.5	
P235	234.5			
P240	239.5			
P245	244.5			
P250	249.5			
P255	254.5			
P260	259.5			
P265	264.5			
P270	269.5	+2.6 -6.5		
P275	274.5			
P280	279.5			
P285	284.5			
P290	289.5			
P295	294.5	+3.0 -7.5		
P300	299.5			
P315	314.5			
P320	319.5			
P335	334.5			
P340	339.5			
P355	354.5			
P360	359.5			
P375	374.5		+3.4 -8.5	
P385	384.5			
P400	399.5			

4.2 For dynamic and static application (cylindrical surface) Shape and dimensions of O-ring attachment groove (Attached Table 9)



Unit : mm

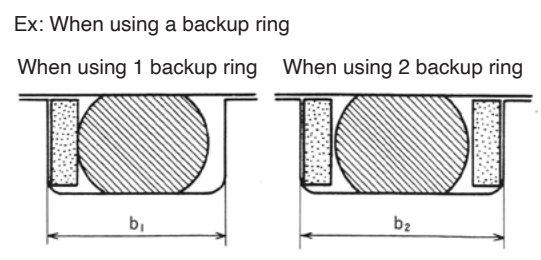
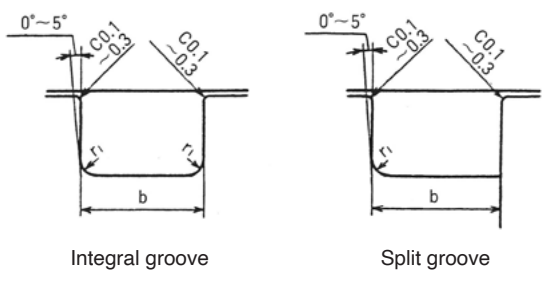
O-ring bearing number	Groove dimensions											
	d ₃ , d ₅		Reference			d ₄ , d ₆	Reference	b	b ₁	b ₂	r ₁ (maximum)	
			Dimensional tolerance symbols equivalent to d ₃ and d ₅ tolerance				Dimensional tolerance symbols equivalent to d ₄ and d ₆ tolerance	+0.25 0				
							No backup ring	1 backup ring	2 backup rings			
P 3	3	0 -0.05	h9	f8	e9	6	+0.05 0	H 10	2.5	3.9	5.4	0.4
P 4	4					7						
P 5	5					8						
P 6	6					9						
P 7	7					10						
P 8	8					11						
P 9	9					12						
P10	10	13										
P10A	10	0 -0.06	h9	f8	e8	14	+0.06 0	H 9	3.2	4.4	6.0	0.4
P11	11					15						
P11.2	11.2					15.2						
P12	12					16						
P12.5	12.5					16.5						
P14	14					18						
P15	15					19						
P16	16					20						
P18	18					22						
P20	20					24						
P21	21	e7 ⁽¹⁾	25	+0.08 0	H 9	4.7	6.0	7.8	0.8			
P22	22		26									
P22A	22		28									
P22.4	22.4		28.4									
P24	24	30										
P25	25	31										
P25.5	25.5	31.5										
P26	26	32										
P28	28	34										
P29	29	35										

Note (1) $e7^{(-0.049/-0.061)}$ for P20 to P22 exceeds the tolerance of d₃ and d₅(-0.06), but e7 may still be used.

Remarks 1 With respect to tolerance d₁ for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Remarks 2 P3 through P400 of JIS B 2401 are used for dynamic and for static application, but G25 through G300 are used for static application only, and not for dynamic application. However, even for P3 to P400, it is preferable not to use materials

Remarks 3 The dimensional tolerance shown in the reference is based on JIS B 0401.



Unit : mm

Reference									
Thickness of backup ring			Actual dimensions of O-ring				Squeeze		
Polytetrafluoroethylene			Thickness	Inner diameter		mm		%	
Spiral	Bias cut	Endless				Maximum	Minimum	Maximum	Minimum
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
				3.8	±0.14				
				4.8	±0.15				
				5.8	±0.15				
				6.8	±0.16				
				7.8	±0.16				
				8.8	±0.17				
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
				10.8	±0.18				
				11.0	±0.18				
				11.8	±0.19				
				12.3	±0.19				
				13.8	±0.19				
				14.8	±0.20				
				15.8	±0.20				
				17.8	±0.21				
				19.8	±0.22				
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
				22.1	±0.24				
				23.7	±0.24				
				24.7	±0.25				
				25.2	±0.25				
				25.7	±0.26				
				27.7	±0.28				
28.7	±0.29								

Unit : mm

O-ring bearing number	Groove dimensions											
	d ₃ , d ₅		Reference			d ₄ , d ₆		Reference	b	b ₁	b ₂	r ₁ (maximum)
			Dimensional tolerance symbols equivalent to d ₃ and d ₅ tolerance	Dimensional tolerance symbols equivalent to d ₄ and d ₆ tolerance	+0.25 0							
	No backup ring	1 backup ring			2 backup rings							
P 29.5	29.5	0 -0.08	h9	f8	e8	35.5	+0.08 0	H9	4.7	6.0	7.8	0.8
P 30	30					36						
P 31	31					37						
P 31.5	31.5					37.5						
P 32	32					38						
P 34	34					40						
P 35	35					41						
P 35.5	35.5					41.5						
P 36	36					42						
P 38	38					44						
P 39	39					45						
P 40	40					46						
P 41	41					47						
P 42	42					48						
P 44	44					50						
P 45	45					51						
P 46	46					52						
P 48	48					54						
P 49	49					55						
P 50	50	56										
P 48A	48	0 -0.10	h9	f8	e8	58	+0.10 0	H9	7.5	9.0	11.5	0.8
P 50A	50					60						
P 52	52					62						
P 53	53					63						
P 55	55					65						
P 56	56					66						
P 58	58					68						
P 60	60					70						
P 62	62					72						
P 63	63					73						
P 65	65				e7	75						
P 67	67					77						
P 70	70					80						
P 71	71					81						
P 75	75					85						
P 80	80					90						
P 85	85					95						
P 90	90					100						
P 95	95					105						
P100	100					110						
P102	102	e6	112									
P105	105		115									
P110	110		120									

Remarks 1 With respect to tolerance d_i for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Remarks 2 P3 through P400 of JIS B 2401 are used for dynamic and for static application, but G25 through G300 are used for static application only, and not for dynamic application. However, even for P3 to P400, it is preferable not to use materials with low mechanical strength such as VMQ-70 for dynamic application.

Remarks 3 The dimensional tolerance shown in the reference is based on JIS B 0401.

Unit : mm

Reference										
Thickness of backup ring			Actual dimensions of O-ring				Squeeze			
Polytetrafluoroethylene			Thickness	Inner diameter		mm		%		
Spiral	Bias cut	Endless				Maximum	Minimum	Maximum	Minimum	
0.7±0.05	1.25±0.1	1.25±0.1	3.5±0.10	29.2	±0.29	0.60	0.32	16.7	9.4	
				29.7	±0.29					
				30.7	±0.30					
				31.2	±0.31					
				31.7	±0.31					
				33.7	±0.33					
				34.7	±0.34					
				35.2	±0.34					
				35.7	±0.34					
				37.7	±0.37					
				38.7	±0.37					
				39.7	±0.37					
				40.7	±0.38					
				41.7	±0.39					
				43.7	±0.41					
				44.7	±0.41					
				45.7	±0.42					
47.7	±0.44									
48.7	±0.45									
49.7	±0.45									
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	
				49.6	±0.45					
				51.6	±0.47					
				52.6	±0.48					
				54.6	±0.49					
				55.6	±0.50					
				57.6	±0.52					
				59.6	±0.53					
				61.6	±0.55					
				62.6	±0.56					
				64.6	±0.57					
				66.6	±0.59					
				69.6	±0.61					
				70.6	±0.62					
				74.6	±0.65					
				79.6	±0.69					
				84.6	±0.73					
89.6	±0.77									
94.6	±0.81									
99.6	±0.84									
101.6	±0.85									
104.6	±0.87									
109.6	±0.91									

Unit : mm

O-ring bearing number	Groove dimensions											
	d ₃ , d ₅		Reference		d ₄ , d ₆		Reference	b	b ₁	b ₂	r ₁ (maximum)	
								+0.25 0				
	Dimensional tolerance symbols equivalent to d ₃ and d ₅ tolerance		Dimensional tolerance symbols equivalent to d ₄ and d ₆ tolerance		No backup ring	1 backup ring	2 backup rings					
P112	112	0 -0.10	h9	f8	e6	122	+0.10 0	H9	7.5	9.0	11.5	0.8
P115	115					125						
P120	120					130						
P125	125			135								
P130	130			140								
P132	132			142								
P135	135			145								
P140	140			150								
P145	145			155								
P150	150			160	h9	f7						
P150A	150	170										
P155	155	175										
P160	160	180										
P165	165	185										
P170	170	190										
P175	175	195										
P180	180	200										
P185	185	205										
P190	190	210										
P195	195	215										
P200	200	220	h8	f7	-	224	+0.10 0	H8	11.0	13.0	17.0	1.2
P205	205	225										
P209	209	230										
P210	210	235										
P215	215	240										
P220	220	245										
P225	225	250										
P230	230	255										
P235	235	260										
P240	240	265										
P245	245	270										
P250	250	275	h8	f6	-	280	+0.10 0	H8	11.0	13.0	17.0	1.2
P255	255	285										
P260	260	290										
P265	265	295										
P270	270	300										
P275	275	305										
P280	280	310										
P285	285	315										
P290	290	320										
P295	295	325										
P300	300	330										
P315	315	335										

Remarks 1 With respect to tolerance d_i for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Remarks 2 P3 through P400 of JIS B 2401 are used for dynamic and for static application, but G25 through G300 are used for static application only, and not for dynamic application. However, even for P3 to P400, it is preferable not to use materials with low mechanical strength such as VMQ-70 for dynamic application.

Remarks 3 The dimensional tolerance shown in the reference is based on JIS B 0401.

Unit : mm

Reference										
Thickness of backup ring			Actual dimensions of O-ring				Squeeze			
Polytetrafluoroethylene			Thickness	Inner diameter		mm		%		
Spiral	Bias cut	Endless				Maximum	Minimum	Maximum	Minimum	
0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	111.6	±0.92	0.83	0.47	14.2	8.4	
				114.6	±0.94					
				119.6	±0.98					
				124.6	±1.01					
				129.6	±1.05					
				131.6	±1.06					
				134.6	±1.09					
				139.6	±1.12					
				144.6	±1.16					
				149.6	±1.19					
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	
				154.5	±1.23					
				159.5	±1.26					
				164.5	±1.30					
				169.5	±1.33					
				174.5	±1.37					
				179.5	±1.40					
				184.5	±1.44					
				189.5	±1.48					
				194.5	±1.51					
				199.5	±1.55					
				204.5	±1.58					
				208.5	±1.61					
				209.5	±1.62					
				214.5	±1.65					
				219.5	±1.68					
				224.5	±1.71					
				229.5	±1.75					
				234.5	±1.78					
				239.5	±1.81					
				244.5	±1.84					
				249.5	±1.88					
				254.5	±1.91					
259.5	±1.94									
264.5	±1.97									
269.5	±2.01									
274.5	±2.04									
279.5	±2.07									
284.5	±2.10									
289.5	±2.14									
294.5	±2.17									
299.5	±2.20									
314.5	±2.30									

Unit : mm

O-ring bearing number	Groove dimensions											
	d ₃ , d ₅		Reference			d ₄ , d ₆		Reference	b	b ₁	b ₂	r ₁ (maximum)
			Dimensional tolerance symbols equivalent to d ₃ and d ₅ tolerance	Dimensional tolerance symbols equivalent to d ₄ and d ₆ tolerance	+0.25 0							
	No backup ring	1 backup ring			2 backup rings							
P320	320	0 -0.10	h8	f6	-	335	+0.10 0	H 8	11.0	13.0	17.0	1.2
P335	335					350						
P340	340					355						
P355	355					370						
P360	360					375						
P375	375					390						
P385	385					400						
P400	400					415						
G 25	25	0 -0.10	h9	f8	e9	30	+0.10 0	H10	4.1	5.6	7.3	0.7
G 30	30					35						
G 35	35					40						
G 40	40					45						
G 45	45					50						
G 50	50					55						
G 55	55					60						
G 60	60					65						
G 65	65					70						
G 70	70					75						
G 75	75					80						
G 80	80					85						
G 85	85			90								
G 90	90			95								
G 95	95			100								
G100	100			105								
G105	105			110								
G110	110			115								
G115	115			120								
G120	120			125								
G125	125			130								
G130	130			135								
G135	135			140								
G140	140			145								
G145	145	150										
G150	150	0 -0.10	h9	f7	-	160	+0.10 0	H 9	7.5	9.0	11.5	0.8
G155	155					165						
G160	160					170						
G165	165					175						
G170	170					180						
G175	175		185									
G180	180		190									
G185	185		195									
G190	190		200									
G195	195		205									
			h8					H 8				

Remarks 1 With respect to tolerance d_i for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Remarks 2 P3 through P400 of JIS B 2401 are used for dynamic and for static application, but G25 through G300 are used for static application only, and not for dynamic application. However, even for P3 to P400, it is preferable not to use materials with low mechanical strength such as VMQ-70 for dynamic application.

Remarks 3 The dimensional tolerance shown in the reference is based on JIS B 0401.

Unit : mm

Reference																	
Thickness of backup ring			Actual dimensions of O-ring				Squeeze										
Polytetrafluoroethylene			Thickness	Inner diameter		mm		%									
Spiral	Bias cut	Endless				Maximum	Minimum	Maximum	Minimum								
1.4±0.08	2.75±0.15	2.75±0.15	8.4±0.15	319.5	±2.33	1.05	0.65	12.3	7.9								
				334.5	±2.42												
				339.5	±2.45												
				354.5	±2.54												
				359.5	±2.57												
				374.5	±2.67												
				384.5	±2.73												
				399.5	±2.82												
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								
				29.4	±0.29												
				34.4	±0.33												
				39.4	±0.37												
				44.4	±0.41												
				49.4	±0.45												
				54.4	±0.49												
				59.4	±0.53												
				64.4	±0.57												
				69.4	±0.61												
				74.4	±0.65												
				79.4	±0.69												
				84.4	±0.73												
				89.4	±0.77												
				94.4	±0.81												
				99.4	±0.85												
				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
												154.3	±1.23				
159.3	±1.26																
164.3	±1.30																
169.3	±1.33																
174.3	±1.37																
179.3	±1.40																
184.3	±1.44																
189.3	±1.47																
194.3	±1.51																

Unit : mm

O-ring bearing number	Groove dimensions											
	d ₃ , d ₅		Reference			d ₄ , d ₆		Reference	b	b ₁	b ₂	r ₁ (maximum)
			Dimensional tolerance symbols equivalent to d ₃ and d ₅ tolerance					Dimensional tolerance symbols equivalent to d ₄ and d ₆ tolerance	+0.25 0			
				No backup ring	1 backup ring	2 backup rings						
G200	200	0 -0.10	h8	f7	—	210	+0.10 0	H8	7.5	9.0	11.5	0.8
G210	210					220						
G220	220					230						
G230	230					240						
G240	240					250						
G250	250			260								
G260	260			270								
G270	270			280								
G280	280			290								
G290	290			300								
G300	300			310								

Remarks 1 With respect to tolerance d_i for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

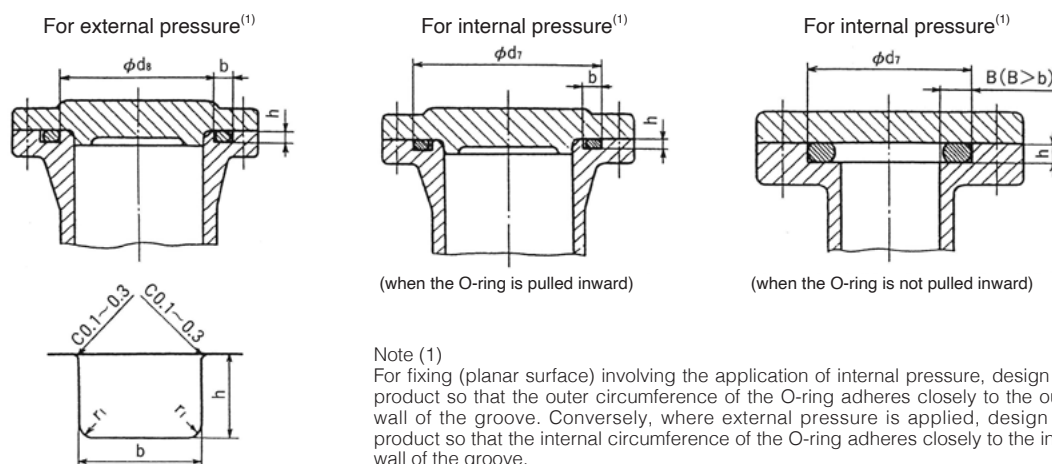
Remarks 2 P3 through P400 of JIS B 2401 are used for dynamic and for static application, but G25 through G300 are used for static application only, and not for dynamic application. However, even for P3 to P400, it is preferable not to use materials with low mechanical strength such as VMQ-70 for dynamic application.

Remarks 3 The dimensional tolerance shown in the reference is based on JIS B 0401.

Unit : mm

Reference									
Thickness of backup ring			Actual dimensions of O-ring				Squeeze		
Polytetrafluoroethylene			Thickness	Inner diameter		mm		%	
Spiral	Bias cut	Endless				Maximum	Minimum	Maximum	Minimum
0.9±0.06	1.9±0.13	1.9±0.13	5.7±0.13	199.3	±1.55	0.83	0.47	14.2	8.4
				209.3	±1.61				
				219.3	±1.68				
				229.3	±1.73				
				239.3	±1.81				
				249.3	±1.88				
				259.3	±1.94				
				269.3	±2.01				
				279.3	±2.07				
				289.3	±2.14				
				299.3	±2.20				

4.3 Shape and dimensions of attachment groove for O-ring for static application (planar surface) (Attached Table 10)



O-ring bearing number	Groove dimensions					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				
						Thickness	Inner diameter	mm		%		
								Maximum	Minimum	Maximum	Minimum	
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				
P10	10	13.2					9.8	± 0.17				
P10A	10	14	3.2	1.8	0.4	2.4 ± 0.09	9.8	± 0.17	0.74	0.46	29.7	19.9
P11	11	15					10.8	± 0.18				
P11.2	11.2	15.2					11.0	± 0.18				
P12	12	16					11.8	± 0.19				
P12.5	12.5	16.5					12.3	± 0.19				
P14	14	18					13.8	± 0.19				
P15	15	19					14.8	± 0.20				
P16	16	20					15.8	± 0.20				
P18	18	22					17.8	± 0.21				
P20	20	24					19.8	± 0.22				
P21	21	25	20.8	± 0.23								
P22	22	26	21.8	± 0.24								
P22A	22	28	4.7	2.7	0.8	3.5 ± 0.10	21.7	± 0.24	0.95	0.65	26.4	19.1
P22.4	22.4	28.4					22.1	± 0.24				
P24	24	30					23.7	± 0.24				
P25	25	31					24.7	± 0.25				
P25.5	25.5	31.5					25.2	± 0.25				
P26	26	32					25.7	± 0.26				
P28	28	34					27.7	± 0.28				
P29	29	35					28.7	± 0.29				
P29.5	29.5	35.5					29.2	± 0.29				

Remarks With respect to the inner diameter tolerance for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

O-ring bearing number	Groove dimensions					Reference						
	d _e (For external pressure)	d _i (For internal pressure)	b +0.25 0	h ±0.05	r ₁ (maximum)	Actual dimensions of O-ring		Squeeze				
						Thickness	Inner diameter	mm		%		
								Maximum	Minimum	Maximum	Minimum	
P 30	30	36	4.7	2.7	0.8	3.5±0.10	29.7	±0.29	0.95	0.65	26.4	19.1
P 31	31	37										
P 31.5	31.5	37.5										
P 32	32	38										
P 34	34	40										
P 35	35	41										
P 35.5	35.5	41.5										
P 36	36	42										
P 38	38	44										
P 39	39	45										
P 40	40	46										
P 41	41	47										
P 42	42	48										
P 44	44	50										
P 45	45	51										
P 46	46	52										
P 48	48	54										
P 49	49	55										
P 50	50	56										
P 48A	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 50A	50	60										
P 52	52	62										
P 53	53	63										
P 55	55	65										
P 56	56	66										
P 58	58	68										
P 60	60	70										
P 62	62	72										
P 63	63	73										
P 65	65	75										
P 67	67	77										
P 70	70	80										
P 71	71	81										
P 75	75	85										
P 80	80	90										
P 85	85	95										
P 90	90	100										
P 95	95	105										
P100	100	110										
P102	102	112										
P105	105	115										
P110	110	120										
P112	112	122										
P115	115	125										
P120	120	130										
P125	125	135										

Remarks d_e and d_i indicate standard dimensions, and tolerances are not specified.

Unit : mm

O-ring bearing number	Groove dimensions					Reference						
	d ₆ (For external pressure)	d ₇ (For internal pressure)	b +0.25 0	h ±0.05	r ₁ (maximum)	Actual dimensions of O-ring		Squeeze				
						Thickness	Inner diameter	mm		%		
	Maximum	Minimum	Maximum	Minimum								
P130	130	140	7.5	4.6	0.8	5.7±0.13	129.6	±1.05	1.28	0.92	22.0	16.5
P132	132	142					131.6	±1.06				
P135	135	145					134.6	±1.09				
P140	140	150					139.6	±1.12				
P145	145	155					144.6	±1.16				
P150	150	160					149.6	±1.19				
P150A	150	165	11.0	6.9	1.2	8.4±0.15	149.5	±1.19	1.7	1.3	19.9	15.8
P155	155	170					154.5	±1.23				
P160	160	175					159.5	±1.26				
P165	165	180					164.5	±1.30				
P170	170	185					169.5	±1.33				
P175	175	190					174.5	±1.37				
P180	180	195					179.5	±1.40				
P185	185	200					184.5	±1.44				
P190	190	205					189.5	±1.48				
P195	195	210					194.5	±1.51				
P200	200	215					199.5	±1.55				
P205	205	220					204.5	±1.58				
P209	209	224					208.5	±1.61				
P210	210	225					209.5	±1.62				
P215	215	230					214.5	±1.65				
P220	220	235					219.5	±1.68				
P225	225	240					224.5	±1.71				
P230	230	245					229.5	±1.75				
P235	235	250					234.5	±1.78				
P240	240	255					239.5	±1.81				
P245	245	260					244.5	±1.84				
P250	250	265					249.5	±1.88				
P255	255	270					254.5	±1.91				
P260	260	275					259.5	±1.94				
P265	265	280					264.5	±1.97				
P270	270	285					269.5	±2.01				
P275	275	290					274.5	±2.04				
P280	280	295					279.5	±2.07				
P285	285	300					284.5	±2.10				
P290	290	305					289.5	±2.14				
P295	295	310	294.5	±2.17								
P300	300	315	299.5	±2.20								
P315	315	330	314.5	±2.30								
P320	320	335	319.5	±2.33								
P335	335	350	334.5	±2.42								
P340	340	355	339.5	±2.45								
P355	355	370	354.5	±2.54								
P360	360	375	359.5	±2.57								
P375	375	390	374.5	±2.67								
P385	385	400	384.5	±2.73								
P400	400	415	399.5	±2.82								

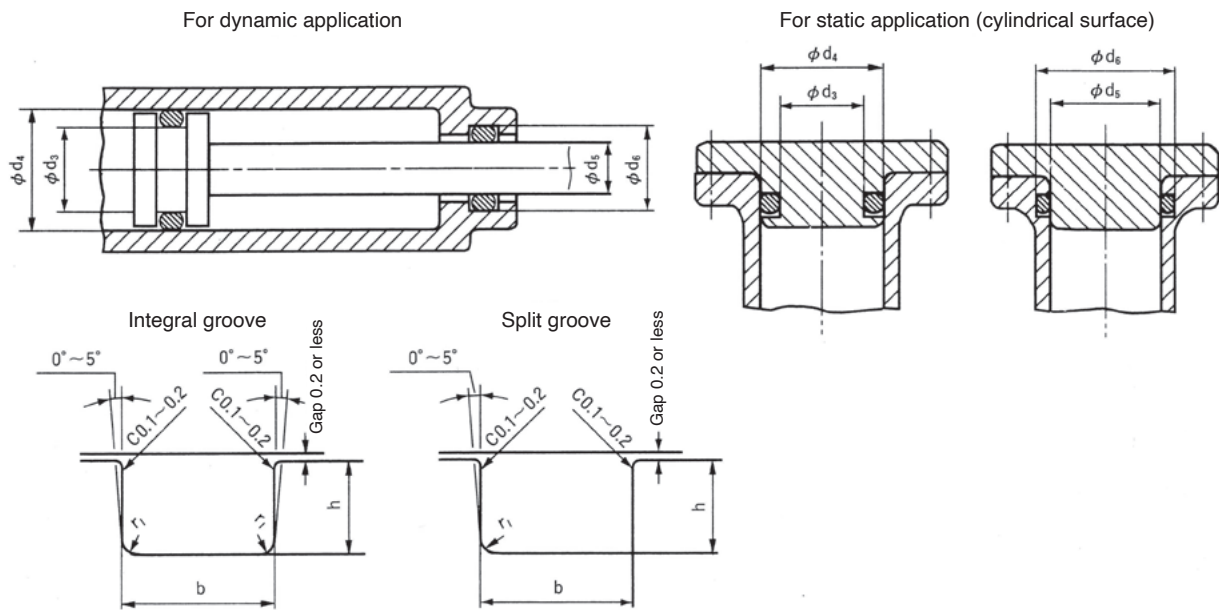
Remarks With respect to the inner diameter tolerance for material types FKM, VMQ, HNBR, EPDM, and ACM, this value shall be 1.5 times the tolerance described above for VMQ and 1.2 times the tolerance described above for the remaining materials.

Unit : mm

O-ring bearing number	Groove dimensions					Reference						
	d _s (For external pressure)	d _r (For internal pressure)	b +0.25 0	h ±0.05	r ₁ (maximum)	Actual dimensions of O-ring		Squeeze				
						Thickness	Inner diameter	mm		%		
								Maximum	Minimum	Maximum	Minimum	
G25	25	30	4.1	2.4	0.7	3.1±0.10	24.4	±0.25	0.85	0.55	26.6	18.3
G30	30	35					29.4	±0.29				
G35	35	40					34.4	±0.33				
G40	40	45					39.4	±0.37				
G45	45	50					44.4	±0.41				
G50	50	55					49.4	±0.45				
G55	55	60					54.4	±0.49				
G60	60	65					59.4	±0.53				
G65	65	70					64.4	±0.57				
G70	70	75					69.4	±0.61				
G75	75	80					74.4	±0.65				
G80	80	85					79.4	±0.69				
G85	85	90					84.4	±0.73				
G90	90	95					89.4	±0.77				
G95	95	100					94.4	±0.81				
G100	100	105	99.4	±0.85								
G105	105	110	104.4	±0.87								
G110	110	115	109.4	±0.91								
G115	115	120	114.4	±0.94								
G120	120	125	119.4	±0.98								
G125	125	130	124.4	±1.01								
G130	130	135	129.4	±1.05								
G135	135	140	134.4	±1.08								
G140	140	145	139.4	±1.12								
G145	145	150	144.4	±1.16								
G150	150	160	149.3	±1.19	1.28	0.92	22.0	16.5				
G155	155	165	154.3	±1.23								
G160	160	170	159.3	±1.26								
G165	165	175	164.3	±1.30								
G170	170	180	169.3	±1.33								
G175	175	185	174.3	±1.37								
G180	180	190	179.3	±1.40								
G185	185	195	184.3	±1.44								
G190	190	200	189.3	±1.47								
G195	195	205	194.3	±1.51								
G200	200	210	199.3	±1.55								
G210	210	220	209.3	±1.61								
G220	220	230	219.3	±1.68								
G230	230	240	229.3	±1.73								
G240	240	250	239.3	±1.81								
G250	250	260	249.3	±1.88								
G260	260	270	259.3	±1.94								
G270	270	280	269.3	±2.01								
G280	280	290	279.3	±2.07								
G290	290	300	289.3	±2.14								
G300	300	310	299.3	±2.20								

Remarks d_s and d_r indicate standard dimensions, and tolerances are not specified.

4.4 Shape and dimensions of attachment groove for O-rings for automobiles (JASO, for static and dynamic application) (Attached Table 11)



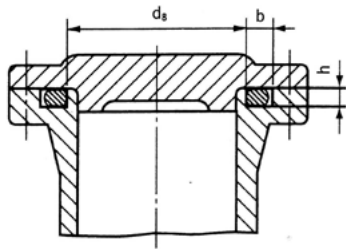
Unit : mm

O-ring		d_5, d_6	d_3	Tolerances with respect to d_3 and d_5	d_4	d_6	d_7	Tolerances with respect to d_4 and d_6	b ($+0.25$ 0)	r_1 (maximum)	h (± 0.05)	
Nominal bore diameter	Thickness d_2											
3	1.9	3	3.1	0 -0.05	6	5.9	6.3	+0.05 0	2.5	0.4	1.4	
4		4	4.1		7	6.9	7.3					
5		5	5.1		8	7.9	8.3					
6		6	6.1		9	8.9	9.3					
7		7	7.1		10	9.9	10.3					
8		8	8.1		11	10.9	11.3					
9		9	9.1		12	11.9	12.3					
10		10	10.1		13	12.9	13.3					
11.2		11.2	11.3		14.2	14.1	14.4					+0.06 0
12.5		12.5	12.6		15.5	15.4	15.7					
13.2		13.2	13.3	16.2	16.1	16.4						
14		14	14.1	17	16.9	17.2						
15		15	15.1	18	17.9	18.2						
16		16	16.1	19	18.9	19.2						
17		17	17.1	20	19.2	20.2						
18		18	18.1	21	20.9	21.2						
19		19	19.1	22	21.9	22.2						
20		20	20.1	23	22.9	23.2						
21.2		21.2	21.3	24.2	24.1	24.4	+0.08 0					
22.4		22.4	22.5	25.4	25.3	25.5						
23.6	23.6	23.7	26.6	26.5	26.7							
25	25	25.1	28	27.9	28.1							
26.5	26.5	26.6	29.5	29.4	29.6							
28	28	28.1	31	30.9	31.1							
30	30	30.1	33	32.9	33.1							
31.5	31.5	31.6	34.5	32.9	34.6							
33.5	33.5	33.6	36.5	36.4	36.6							
35.5	35.5	35.6	38.5	38.4	38.6							

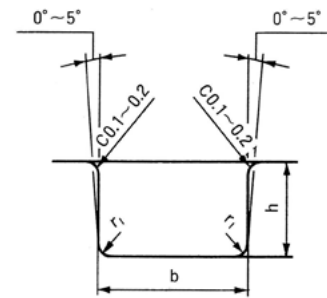
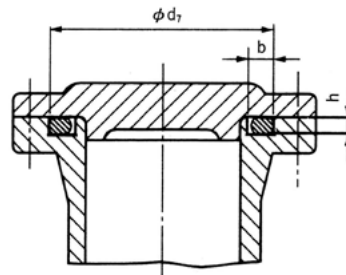
Remarks As some molds for some of the products described in the above dimensions table may not be available, please consult with us separately when placing an order.

For static application (planar surface)

For external pressure⁽¹⁾



For internal pressure⁽¹⁾



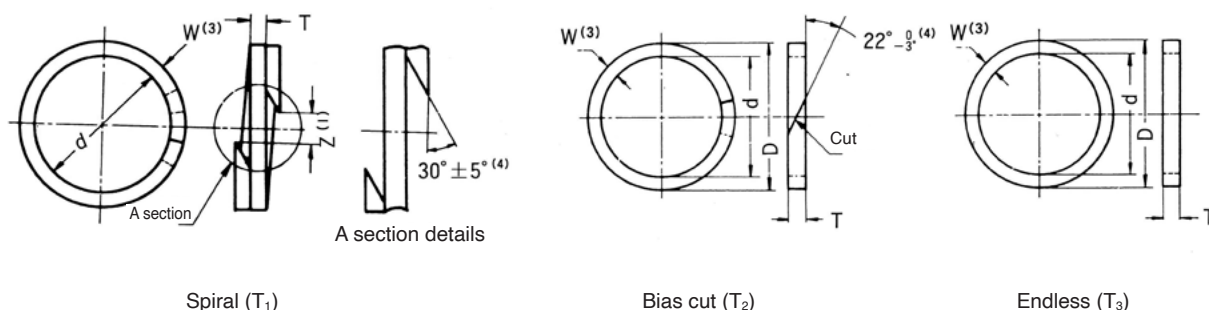
Note (1) For planar surface fixing involving the application of internal pressure, design the product so that the outer circumference of the O-ring adheres closely to the outer wall of the groove. Conversely, where external pressure is applied, design the product so that the internal circumference of the O-ring adheres closely to the inner wall of the groove.

Unit : mm

O-ring		d ₅ , d ₆	d ₃	Tolerances with respect to d ₃ and d ₅	d ₄	d ₆	d ₇	Tolerances with respect to d ₄ and d ₆	b ($\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$)	r ₁ (maximum)	h (± 0.05)
Nominal bore diameter	Thickness d ₂										
10	2.4	10	10.2	0 -0.06	14	13.8	14.1	+0.06 0	3.2	0.4	1.8
11.2		11.2	11.4		15.2	15	15.3				
12.5		12.5	12.7		16.5	16.3	16.6				
13.2		13.2	13.4		17.2	17	17.3				
14		14	14.2		18	17.8	18.1				
15		15	15.2		19	18.8	19.1				
16		16	16.2		20	19.8	20.1				
17		17	17.2		21	20.8	21.1				
18		18	18.2		22	21.8	22.1				
19		19	19.2		23	22.8	23.1				
20		20	20.2	24	23.8	24.1					
21		21	21.2	25	24.8	25.1					
22.4		22.4	22.6	26.4	26.2	26.4	+0.08 0				
23.6		23.6	23.8	27.6	27.4	27.6					
25		25	25.2	29	28.8	29					
26.5		26.5	26.7	30.5	30.3	30.5					
28		28	28.2	32	31.8	32					
30		30	30.2	34	33.8	34					
31.5		31.5	31.7	35.5	35.3	35.5					
33.5		33.5	33.7	37.5	37.3	37.5					
35.5		35.5	35.7	39.5	39.3	39.5					
37.5	37.5	37.7	41.5	41.3	41.5						
40	40	40.2	44	43.8	44						
42.5	42.5	42.7	46.5	46.3	46.5						
45	45	45.2	49	48.8	49						
47.5	47.5	47.7	51.5	51.3	51.5						
50	50	50.2	54	53.8	54						
53	53	53.2	57	56.8	57	+0.10 0					
56	56	56.2	60	59.8	60						
60	60	60.2	64	63.8	64						
63	63	63.2	67	66.8	67						
67	67	67.2	71	70.8	71						
71	71	71.2	75	74.8	75						
25	3.1	25	25.3	0 -0.08	30.3	30.1	30.3	+0.08 0	4.3	0.5	2.4
30		30	30.3		35.3	35.1	35.3				
35		35	35.3		40.3	40.1	40.3				
40		40	40.3		45.3	45.1	45.3				
45		45	45.3		50.3	50.1	50.3				
50		50	50.3	55.3	55.1	55.3	+0.10 0				
55		55	55.3	60.3	60.1	60.3					
60		60	60.3	65.3	65.1	65.3					
65		65	65.3	70.3	70.1	70.3					
70		70	70.3	75.3	75.1	75.3					

4.5 Shape and dimensions of the O-ring polytetrafluoroethylene backup ring (Attached Table 12)

(VALQUA No. 7645)



Unit : mm

Ring bearing number	Spiral				Bias cut and endless ⁽²⁾				
	Inner diameter d	Width W ⁽³⁾	Thickness T	Gap Z ⁽¹⁾	Inner diameter d	External diameter D	Thickness T		
P 3	3	1.5 ^{+0.03} / _{-0.06}	0.7±0.05	1.2±0.4	3	+0.15 0	6	0 -0.15	1.25±0.1
P 4	4								
P 5	5								
P 6	6								
P 7	7								
P 8	8								
P 9	9								
P 10	10								
P 10A	10								
P 11	11				2.0 ^{+0.03} / _{-0.06}				
P 11.2	11.2								
P 12	12								
P 12.5	12.5								
P 14	14								
P 15	15								
P 16	16								
P 18	18								
P 20	20								
P 21	21								
P 22	22	3.0 ^{+0.03} / _{-0.06}	0.7±0.05	2.5±1.5	+0.20 0	28	0 -0.20	1.25±0.1	
P 22A	22								
P 22.4	22.4								
P 24	24								
P 25	25								
P 25.5	25.5								
P 26	26								
P 28	28								
P 29	29								
P 29.5	29.5								

Note (1) Z is the gap when installed in a shaft of (standard dimension of shaft diameter) -0.05

Note (2) The dimensions in the bias cut and endless sections represent the endless dimensions. The bias cut is an endless that has been cut.

Note (3) Where both a bias cut and endless are involved, please ensure the gap between the maximum and minimum W within 1 unit is no greater than 0.05 mm.

Note (4) The cut angle of P3 through P10 will be 40° 0-5°.

Unit : mm

Ring bearing number	Spiral				Bias cut and endless ⁽²⁾				
	Inner diameter d	Width W ⁽³⁾	Thicknes T	Gap Z ⁽¹⁾	Inner diameter d	External diameter D	Thickness T		
P 30	30	3.0 ^{+0.03} _{-0.06}	0.7±0.05	2.5±1.5	30	+0.20 0	36	0 - 0.20	1.25±0.1
P 31	31				37				
P 31.5	31.5				37.5				
P 32	32				38				
P 34	34				40				
P 35	35				41				
P 35.5	35.5				41.5				
P 36	36				42				
P 38	38				44				
P 39	39				45				
P 40	40				46				
P 41	41				47				
P 42	42				48				
P 44	44				50				
P 45	45				51				
P 46	46				52				
P 48	48				54				
P 49	49				55				
P 50	50				56				
P 48A	48				5.0 ^{+0.03} _{-0.06}		0.9±0.06		
P 50A	50	60							
P 52	52	62							
P 53	53	63							
P 55	55	65							
P 56	56	66							
P 58	58	68							
P 60	60	70							
P 62	62	72							
P 63	63	73							
P 65	65	75							
P 67	67	77							
P 70	70	80							
P 71	71	81							
P 75	75	85							
P 80	80	90							
P 85	85	95							
P 90	90	100							
P 95	95	105							
P 100	100	110							
P 102	102	112							
P 105	105	115							
P 110	110	120							
P 112	112	122							
P 115	115	125							
P 120	120	130							

Note (1) Z is the gap when installed in a shaft of (standard dimension of shaft diameter) $0_{-0.05}$

Note (2) The dimensions in the bias cut and endless sections represent the endless dimensions. The bias cut is an endless that has been cut.

Note (3) Where both a bias cut and endless are involved, please ensure the gap between the maximum and minimum W within 1 unit is no greater than 0.05 mm.

Unit : mm

Ring bearing number	Spiral				Bias cut and endless ⁽²⁾				
	Inner diameter d	Width W ⁽³⁾	Thicknes T	Gap Z ⁽¹⁾	Inner diameter d		External diameter D		Thickness T
P 125	125	5.0 $\begin{smallmatrix} +0.03 \\ -0.06 \end{smallmatrix}$	0.9±0.06	4.5±1.5	125	+0.25 0	135	0 - 0.25	1.9±0.13
P 130	130								
P 132	132								
P 135	135								
P 140	140								
P 145	145								
P 150	150								
P 150A	150	7.5 $\begin{smallmatrix} +0.03 \\ -0.06 \end{smallmatrix}$	1.4±0.08	6.0±2.0	150	+0.30 0	165	0 - 0.30	2.75±0.15
P 155	155								
P 160	160								
P 165	165								
P 170	170								
P 175	175								
P 180	180								
P 185	185								
P 190	190								
P 195	195								
P 200	200								
P 205	205								
P 209	209								
P 210	210								
P 215	215								
P 220	220								
P 225	225								
P 230	230								
P 235	235								
P 240	240								
P 245	245								
P 250	250								
P 255	255								
P 260	260								
P 265	265								
P 270	270								
P 275	275								
P 280	280								
P 285	285								
P 290	290								
P 295	295								
P 300	300								
P 315	315								
P 320	320								
P 335	335								
P 340	340								
P 355	355								
P 360	360								
P 375	375								
P 385	385								
P 400	400								

Unit : mm

Ring bearing number	Spiral				Bias cut and endless ⁽²⁾				
	Inner diameter d	Width W ⁽³⁾	Thicknes T	Gap Z ⁽¹⁾	Inner diameter d		External diameter D		Thickness T
G 25	25	2.5 ^{+0.03} _{-0.06}	0.7±0.05	4.5±1.5	25	^{+0.20} 0	30	0 _{-0.20}	1.25±0.1
G 30	30				35				
G 35	35				40				
G 40	40				45				
G 45	45				50				
G 50	50				55				
G 55	55				60				
G 60	60				65				
G 65	65				70				
G 70	70				75				
G 75	75				80				
G 80	80				85				
G 85	85				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	130							
G 130	130	135							
G 135	135	140							
G 140	140	145							
G 145	145	150							
G 150	150	5.0 ^{+0.03} _{-0.06}	0.9±0.06	6.0±2.0	150	^{+0.25} 0	160	0 _{-0.25}	1.9±0.13
G 155	155				165				
G 160	160				170				
G 165	165				175				
G 170	170				180				
G 175	175				185				
G 180	180				190				
G 185	185				195				
G 190	190				200				
G 195	195				205				
G 200	200				210				
G 210	210				220				
G 220	220				230				
G 230	230				240				
G 240	240				250				
G 250	250				260				
G 260	260				270				
G 270	270				280				
G 280	280				290				
G 290	290				300				
G 300	300	310							

Note (1) Z is the gap when installed in a shaft of (standard dimension of shaft diameter) $0_{-0.05}$

Note (2) The dimensions in the bias cut and endless sections represent the endless dimensions. The bias cut is an endless that has been cut.

Note (3) Where both a bias cut and endless are involved, please ensure the gap between the maximum and minimum W within 1 unit is no greater than 0.05 mm.

5 Reference documents

5.1 Metric and inch standards for O-rings

Metric standards for O-rings are as denoted in Table 5, while inch standards are denoted in Table 6. Compatible components are indicated for inch standards, but materials are also automatically determined when using those components. Therefore, when you need to use different materials (for example, JIS B 2401-1 NBR-70-1), but only the dimensions are in inches, please use AS568. The inch-based dimension table (Attached Table 7) in this catalog is based on AS568 for both actual dimensions and dimensional tolerances.

Table 5 Millimeter standard

Standard number and name	
JIS B 2401-1: 2012	O-ring
JIS B 2401-2: 2012	Shape and dimensions of O-ring attachment groove
JIS B 2401-1-3: 2012	O-ring appearance quality standards
JIS B 2401-4: 2012	Backup rings for O-rings
JASO F 404-14	O-rings for automobiles
JIS B 2290-1998	Flanges for vacuum devices

Table 6 Inch standard

Standard number and name		Corresponding components	Material symbol	Reference
		Backup ring		
MIL-P-5315	O-rings for hydrocarbon fuel	MS 29512 MS 29513	B0265	MS 9484,28773,28777 MS 27595,28774,28782,35803
MIL-P-25732	275°F (135°C) packings and gaskets for petroleum-based hydraulic oil	MS 28775· AN 6227	B0475	MS 27595,28774,28782,35803 LS 4564,4565,4764
MIL-P-5510	Gasket for parallel screw pipe joint boss	MS 28778	B0490	MS 9484,28773,28777
MIL-R-7362	Synthetic rubber moldings for synthetic lubricating oil	MS 29561 NAS 617	B2370	MS 27595,28774,28782,35803 MS 9484,28773,28777
MIL-R-25897	Fluoro-rubber for high temperature fluids	NAS 1593· 1595 NAS 1594· 1596	D1475 D0290	
AMS 7270	Synthetic rubber packings and gaskets for fuel	AN 123951 ~ 124050	B0970	MS 27595,28774,28782,35803
AMS 7271	Synthetic rubber packings and gaskets for fuel and low temperatures	MS 9020 MS 9021	B0165	MS 9484,28773,28777 MS 27595,28774,28782,35803
AMS 7272	Synthetic rubber packings and gaskets for synthetic lubricating oil	MS 9241	B1570	MS 27595,28774,28782,35803
AMS 7274	Synthetic rubber packings and gaskets for petroleum-based lubricating oil	AN 123851 ~ 123950	B1070	MS 27595,28774,28782,35803
MIL-R-25988	Oil and fuel resistance	M 25988/1	E0470	
MIL-R-83248	For high temperature and fuel resistance Low compression set	M 83248/1 NAS 1593 NAS 1595 M 83248/2 NAS 1594 NAS 1596	D0375 D0290	MS 28774 MS28773,27595,9484,2166,9058,V7M59 MS 28774 MS28773, 27595,9484,2166,9058,V7M59
MIL-P-83461	For high temperature hydraulic oil	M 83461/1	B0575	
AMS 3304	For heat resistance and cold resistance	MS 9068	E0170	
AMS 7267	For heat-resistant low compression set	MS 9386 MS 9385	E0175	
AMS 7273	For heat and fuel resistance	MS 9966 MS 9967	E0375	
AMS 7278	For high temperature fluid resistance (air, fuel, hydraulic oil)	MS 9388· MS 9387· MS 17413	D0375	
AMS 7280	Heat-resistant and oil-resistant low compression set	AS 3084 AS 3085	D0375	
NAS 1613	For phosphate ester hydraulic oil	NAS 1611 AAS 1612	H0480	

Remarks MIL-P-5516 Class B has transitioned to MIL-P-25732.

5.2 Characteristics of O-ring materials and backup rings (Table 7)

Type	Material name	VALQUA material symbol	Physical properties				Operating temperature range ⁽¹⁾ (Reference) °C
			Type A durometer hardness	Tensile strength MPa	Elongation %	Compression set % (°C×hr)	
O-ring	Styrene rubber	A0170	72	15.7	380	17 (100x70)	- 40 ~ 120
	Nitrile rubber	B0170	71	16.1	310	8 (100x72)	- 30 ~ 120
		B0570	72	17.6	340	20 (120x72)	- 35 ~ 120
		B1370	70	13.2	210	-	- 50 ~ 120
		B2670	70	20.6	270	11 (100x70)	- 20 ~ 120
		B0180	83	21.1	240	14 (100x70)	- 20 ~ 120
		B0390	89	16.8	190	16 (120x72)	- 35 ~ 120
		B0490	89	16.2	160	-	- 50 ~ 100
		Super rubber	B5170	71	24.3	270	14 (150x70)
	Fluoro-rubber	D2770	73	15.2	300	26 (200x72)	- 15 ~ 200
		D0270	71	13.9	230	4 (175x22)	- 15 ~ 200
		D2570	72	13.6	230	3.8 (175x22)	- 15 ~ 230
		D2470	69	21.0	450	30 (175x30)	- 20 ~ 200
		D0970	73	15.7	290	23 (175x22)	0 ~ 200
		D0675	75	18.6	160	15 (175x22)	0 ~ 200
		D0875	78	18.6	190	8 (175x22)	- 30 ~ 200
		D0290	88	15.0	162	8 (175x22)	- 15 ~ 200
	VALFLON CRYSTAL RUBBER	D9160	61	14.4	500	30 (150x70)	- 10 ~ 150
	Silicone rubber	E0170	72	6.0	190	19 (175x22)	- 60 ~ 200
	Fluorosilicone rubber	E0470	73	7.8	280	29 (175x22)	- 60 ~ 200
Ethylene propylene rubber	H0970	72	16.2	230	15 (150x70)	- 50 ~ 150	
Chloroprene rubber	J0170	68	19.4	350	20 (100x70)	- 30 ~ 120	
Butyl rubber	F0075	74	12.3	170	4 (100x70)	- 20 ~ 150	
Acrylic rubber	L0770	71	10.8	200	20 (150x22)	- 25 ~ 150	
Backup ring	Polyamide		117 (Rockwell R)	78.5	30	-	- 55 ~ 120
	Polytetrafluoroethylene	VALFLON	58 (durometer D)	18.6	350	-	- 100 ~ 200
		VALFLON 2N0	65 (durometer D)	16.7	280	-	- 100 ~ 200
		VALFLON 3U8	73 (durometer D)	18.6	240	-	- 100 ~ 200

Note (1) Operating temperature ranges change depending on usage conditions, such as fluids and pressure, and required performance. Please consult with us for details.

Remarks The physical property values in this table are examples of measured values, and are not standard values.

Oil resistance ○ Compatible △ Requires confirmation × Not compatible														Characteristics/Use
Hydraulic oil					Lubricating oil					Grease		Water type		
General mineral oil	Emulsion type	Water / glycol type	Phosphoric ester type	Brake oil	Engine oil	Gear oil	Machine oil	Spindle oil	Silicone oil	Lithium grease	Silicone grease	Water	Steam hot water	
×	×	×	×	○	×	×	×	×	○	×	○	○	×	For brake fluid
○	○	○	×	×	○	○	○	○	○	○	○	○	×	JIS B 2401 NBR-70-2
○	○	○	×	×	○	○	○	○	○	○	○	○	×	JIS B 2401 NBR-70-1 NBR standard compound
△	△	△	×	×	△	△	△	△	○	△	○	△	×	NBR for low temperatures
○	○	○	×	×	○	○	○	○	○	○	○	○	×	For oil free, materials of the same family B0880, B0385
○	○	○	×	×	○	○	○	△	○	○	○	○	×	NBR for mineral oils
○	○	○	×	×	○	○	○	○	○	○	○	○	×	JIS B 2401 NBR-90
△	△	△	×	×	△	△	△	△	○	△	○	△	×	NBR for low temperatures
○	○	○	×	×	○	○	○	○	○	○	○	○	○	Heat resistance, high strength, and abrasion resistance, materials of the same family B5290
○	△	×	○	×	○	○	○	○	○	○	○	○	×	JIS B 2401 FKM-70
○	△	×	○	×	○	○	○	○	○	○	○	○	×	Materials of the same family D0260, D0280
○	△	×	○	×	○	○	○	○	○	○	○	○	×	For heat resistance
○	△	×	△	×	○	○	○	○	○	○	○	○	△	For acid resistance
○	△	○	○	×	○	○	○	○	○	○	○	○	○	Acid resistance, alkaline resistance, steam resistance, hot water
○	△	○	○	×	○	○	○	○	○	○	○	○	○	For steam resistance
○	△	×	○	×	○	○	○	○	○	○	○	○	×	For low temperature fluoro-rubber
○	△	×	○	×	○	○	○	○	○	○	○	○	×	Fluoro-rubber
○	△	△	○	×	○	○	○	○	○	○	○	○	○	For transparency, non-staining, and semi-conductor devices, materials of the same family D9170
○	×	×	×	○	○	○	○	△	×	○	×	○	×	Heat resistance, cold resistance
○	×	×	×	○	○	○	△	△	○	○	○	○	×	For heat resistance, cold resistance, oil resistance, and gasoline resistance
×	×	○	○	○	×	×	×	×	○	×	○	○	○	For steam resistance, brake fluid
△	×	×	×	○	×	×	×	×	○	△	○	○	×	For Freon resistance
×	○	○	○	○	×	×	×	×	○	×	○	○	○	Equivalent to G116 for tap water
○	×	×	×	×	○	○	○	△	○	○	○	×	×	For heat resistance and oil resistance, automobile-related
○	○	○	○	○	○	○	○	○	○	○	○	△	△	For ultra-high pressures
○	○	○	○	○	○	○	○	○	○	○	○	○	○	For static application
○	○	○	○	○	○	○	○	○	○	○	○	△	△	For high pressure static application (use caution when used for dynamic application)
○	○	○	○	○	○	○	○	○	○	○	○	△	△	For high pressure dynamic application (in oil)

5.3 O-ring leak-tightness principle

As indicated in Figure 1A, the principle behind the leak-tightness made possible by O-rings is as follows: by installing an O-ring into a packing groove and applying a squeeze of approximately 8 to 30%, the elasticity of the O-ring itself will create a seal on its own at low pressures. As shown in Figure 1B, when pressure increases, the O-ring is pressed against one side of the packing groove, causing the O-shape to deform into a D-shape, thus resulting in a seal caused by increased pressure on the contact surface.

As shown in Figure 1C, if pressure increases even further, the O-ring becomes extruded from a gap in the packing groove, thus damaging the O-ring itself and compromising its sealing capabilities. Using backup rings as a countermeasure for high-pressure environments like these will help prevent extrusion.

Figure 2 depicts the deformation of the O-ring that occurs due to an increase in operating pressure, and as shown in Figure 2D extrusion begins to occur with pressures of around 6.3 MPa {64 kgf/cm²}. Figure 2E depicts the use of a backup ring in response to high pressures, and despite high operating pressures pressing the O-ring to one side, no extrusion has occurred. Therefore, backup rings must be used for O-rings at operating pressures of around 6.9 MPa {70 kgf/cm²} or greater.

Figure 1
O-ring leak-tightness principle

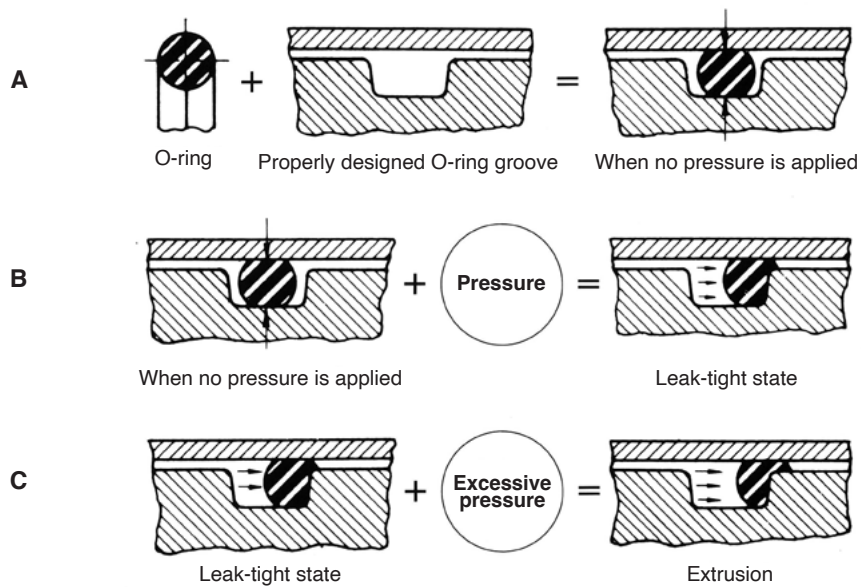
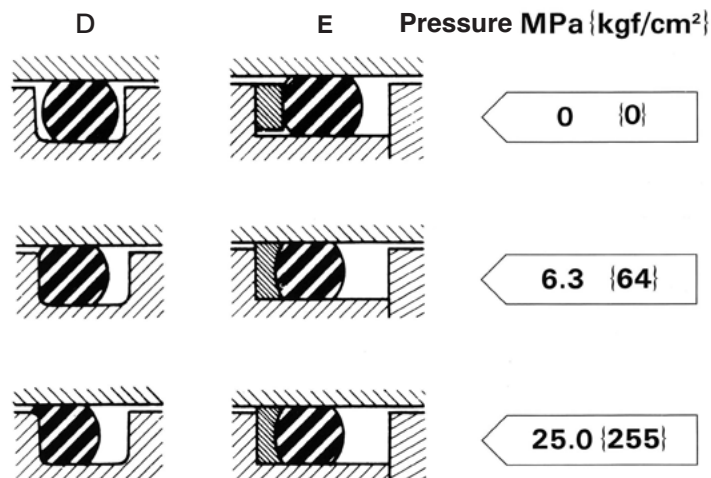


Figure 2
Status of the O-ring under each form of pressure



If the groove uses backup ring(s)

5.4 Precautions when using O-rings

5.4.1 Surface roughness of O-ring contact portion

In order to minimize frictional resistance with the portion that comes into contact with the O-ring, ensure sufficient leak-tight functionality, and extend the lifespan of the O-ring itself, the finish of the surface should be as refined as possible. JIS has stipulated that surface roughness should be as indicated in Table 8 (JIS B2401-2) for general use, and in Table 9 (MIL-G-5514F) for aircraft use. However, this will have the opposite effect for mirror finishes.

Table 8 For dynamic and static application (cylindrical surface) and static application (planar surface) (JIS B 2401-2) Surface roughness of groove portion Unit : μm

Device portion	Use	How pressure is applied	Surface roughness		
			Ra	(Reference)Rz	
Groove cross section and bottom surface	For static application	No pulsation	Planar surface	3.2	12.5
			Cylindrical surface	1.6	6.3
	For dynamic application	Pulsation		1.6	6.3
			When using a backup ring	1.6	6.3
For dynamic application	Pulsation	When not using a backup ring	0.8	3.2	
		When using a backup ring	1.6	6.3	
Contact surface of the sealing portion of the O-ring	For static application	No pulsation	1.6	6.3	
	For static application	Pulsation	0.8	3.2	
Chamfer for O-ring installation	For dynamic application	-	0.4	1.6	
	For dynamic application	-	3.2	12.5	

Table 9 Surface roughness

Device portion	Surface roughness (average roughness of center line)
Cylinder inner diameter or piston rod (diametral plane that packing slides on)	Maximum 0.4a (16)
O-ring groove diameter	
Dynamic seal	Maximum 0.8a (32)
Static seal	Maximum 1.6a (63)
O-ring groove side when not using a backup ring	
Dynamic seal	Maximum 0.8a (32)
Static seal	Maximum 1.6a (63)
O-ring groove side when using a backup ring	Maximum 1.6a (63)

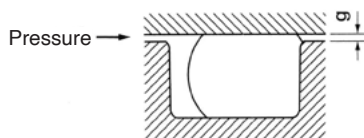
Remarks Although the relationship between S and a cannot be defined unequivocally by the surface roughness symbol, $S = 4a$ holds true for regular smooth surfaces.

5.4.2 Relationship between O-ring hardness, pressure, and gaps

O-ring extrusion will drastically reduce the service life of an O-ring unless a backup ring is used. Extrusion from the O-ring groove portion is particularly related to gaps (2g), and is also affected by fluid pressure and hardness of rubber materials.

JIS B 2401-2 recommends the joint use of backup rings if the values in Table 10 are to be exceeded.

Table 10 Maximum gap (2g) value when not using a backup ring



Unit : mm

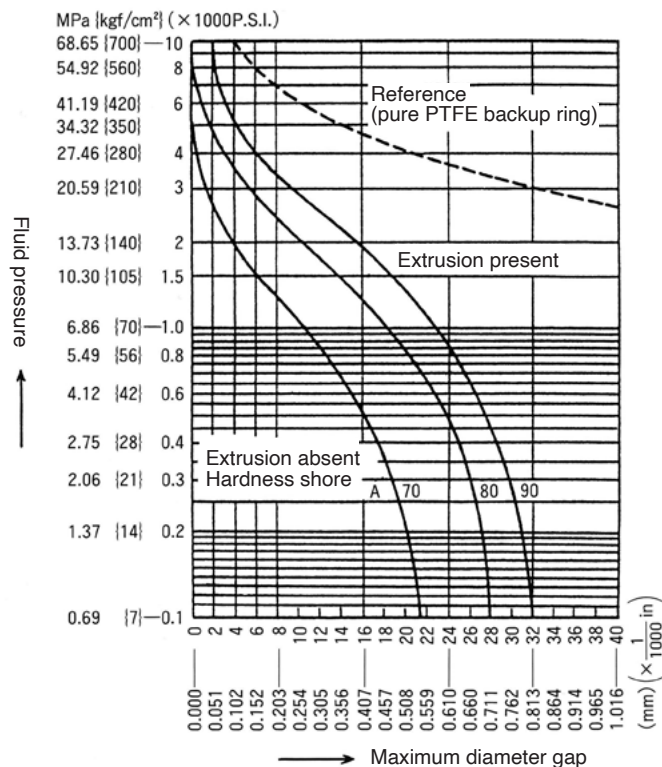
O-ring hardness Durometer hardness	Gap(2g)				
	Pressure used(MPa)(kgf/cm ²)				
A	4.0 {41} or less	Greater than 4.0 {41} but equal to or less than 6.3 {64}	Greater than 6.3 {64} but equal to or less than 10.0 {102}	Greater than 10.0 {102} but equal to or less than 15.0 {163}	Greater than 16.0 {163} but equal to or less than 25.0 {255}
	70	0.35	0.30	0.15	0.07
90	0.65	0.60	0.50	0.30	0.17

Remarks Refer to JIS K 6253-3.

Table 10 shows the limit values of the extrusion gap from the groove of the O-ring, which were determined via experimentation. These figures currently enjoy use as reference values in Japan without issue, and the pressure range in Table 10 was developed in accordance with hydraulics pressure stages used in ISO 3322. For details regarding the actual limit values for gaps corresponding to other pressures, see the values indicated in Figure 3, and conduct calculations with reference to these values.

(excerpted from JIS B 2406-1991 commentary)

Figure 3 Relationship between O-ring hardness, pressure, and gaps



Remarks 1 Testing conditions
 1) No backup ring is used.
 2) Swelling of the cylinder due to fluid pressure is assumed to be 0.
 3) Shows the results after 100,000 cycles of 150 times per minute from atmospheric pressure to the pressure indicated in the figure.

Remarks 2 If the cylinder is expected to swell due to fluid pressure, the gap must be 75% or less of the value shown in the figure.

Remarks 3 Please be aware that the hardness of the O-ring will diminish if the operating temperatures are high.

5.4.3 Relationship between O-ring squeeze and compressive force (reference)

Figure 4 O-ring cross-section

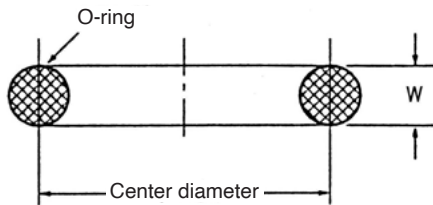


Figure 5 O-ring squeeze and compression force

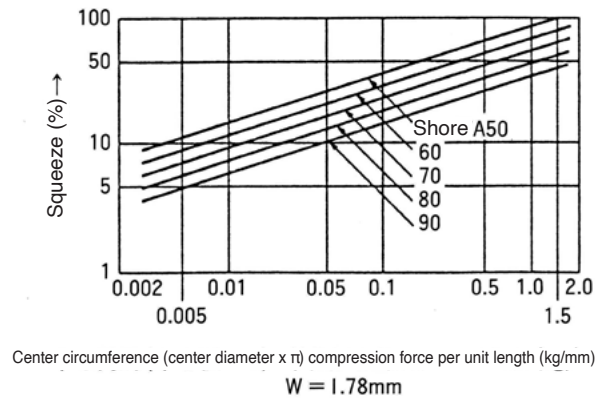


Figure 6 O-ring squeeze and compression force

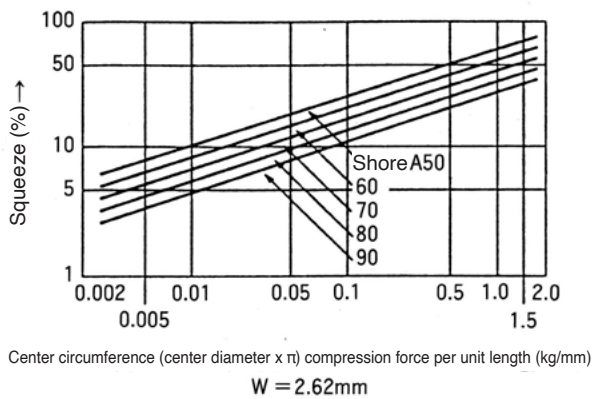


Figure 7 O-ring squeeze and compression force

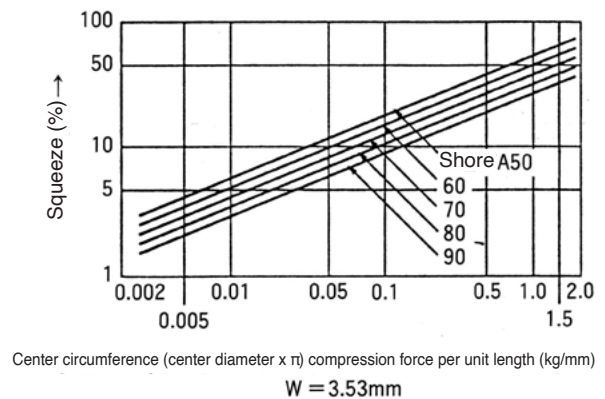


Figure 8 O-ring squeeze and compression force

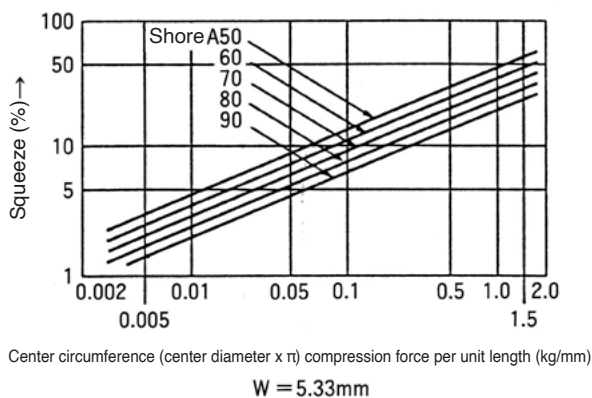
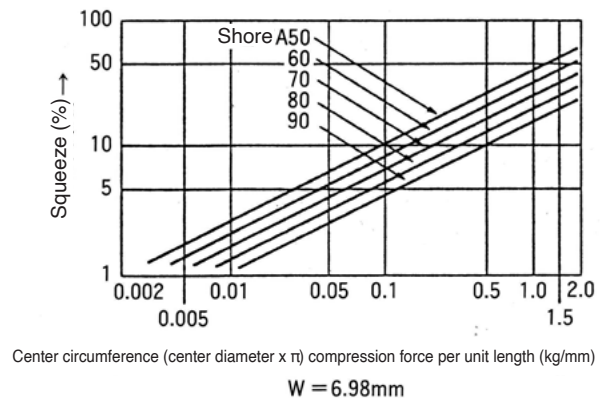


Figure 9 O-ring squeeze and compression force



Example calculation:

To find the force (F) when crushing an O-ring with W (wire diameter) of 5.33 mm, inner diameter of $\phi 100$, and rubber hardness of 70° by 10%,

$$F = (100 + 5.33) \times \pi \times 0.12 \approx 40\text{kgf}$$

According to Figure 8

5.4.4 O-ring attachment groove dimensions

(1) For static application (planar surface)

Generally, the use methods indicated in Figures 10, 11, and 12 are adopted.

In this situation, where fluid pressure is applied from the interior of the O-ring, the groove outer diameter should be equal to the O-ring nominal outer diameter, and where external pressure is applied, the groove inner diameter should be equal to the O-ring nominal bore diameter. Groove depth and width are specified in JIS B 2401-2. Table 11 shows the groove dimensions for reference, and Table 12 shows the groove dimensions when using an inch size O-ring for the gasket.

Table 13 also indicates groove dimensions for general industrial use (ISO) O-rings for reference.

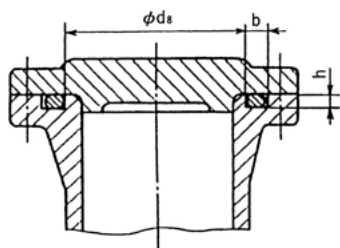
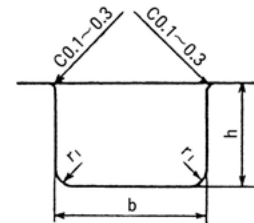


Figure 10 For external pressure

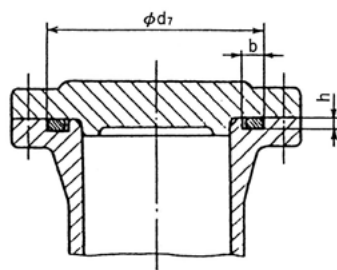


Figure 11 For internal pressure

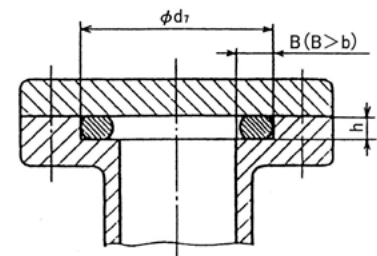


Figure 12 For internal pressure
(when the O-ring is not pulled inward)

Table 11 Groove dimensions when using millimeter-sized O-rings for gaskets

Unit : mm

O-ring thickness (d_2)	Groove depth (h)	Groove width (b)	Bottom radius (r_1)
1.9±0.08	1.4±0.05	2.5 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.4
2.4±0.09	1.8±0.05	3.2 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.4
3.1±0.10	2.4±0.05	4.1 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.7
3.5±0.10	2.7±0.05	4.7 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.8
5.7±0.13	4.6±0.05	7.5 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.8
8.4±0.15	6.9±0.05	11.0 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	1.2

Table 12 Groove dimensions when using inch-sized O-rings for gaskets

Unit : mm

O-ring thickness (d_2)	Groove depth (h)	Groove width (b)	Bottom radius (r_1)
1.78±0.07	1.27±0.05	2.39 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.4
2.62±0.07	2.06±0.05	3.58 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.6
3.53±0.10	2.82±0.05	4.78 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.7
5.33±0.12	4.32±0.05	7.14 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.7
6.98±0.15	5.74±0.05	9.53 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.7

Table 13 Groove dimensions when using a general industrial use (ISO) O-ring as a gasket (reference)

Unit : mm

O-ring thickness (d_2)	Groove depth (h)	Groove width (b)	Bottom radius (r_1)
1.80±0.08	1.28±0.05	2.6 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.2 ~ 0.4
2.65±0.09	1.97±0.05	3.8 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.2 ~ 0.4
3.55±0.10	2.75±0.05	5.0 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.4 ~ 0.8
5.30±0.13	4.24±0.05	7.3 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.4 ~ 0.8
7.00±0.15	5.72±0.05	9.7 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	0.8 ~ 1.2

(2) For dynamic and static application (cylindrical surface)

Table 14 and Table 15 indicate the values for dynamic application and cylindrical surfaces with respect to JIS B 2406 (JIS B 2401 O-ring) and MIL-G-5514-F, but based on our experience, we recommend the groove dimensions in Table 16 and Table 17 for cylindrical surfaces for static application. For reference, groove dimensions for circumstances where general industrial application (ISO) O-rings are to be used for cylindrical surfaces for dynamic and for static application are indicated in Table 18 and Table 19. Furthermore, to ensure a more complete seal, the values in Table 20 and Table 21 may be adopted as for-motion groove dimensions for circumstances where the O-ring does not rotate.

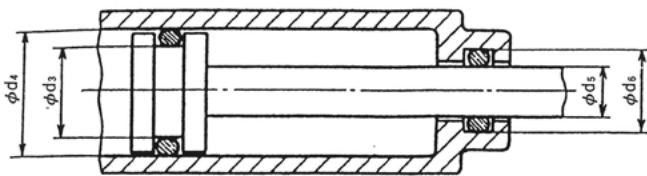


Figure 13 For dynamic application

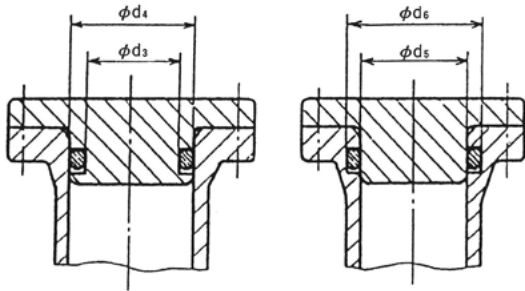
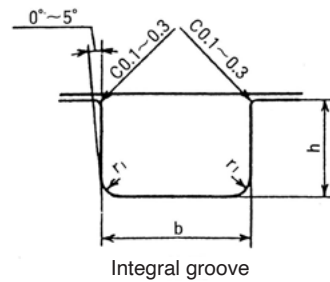
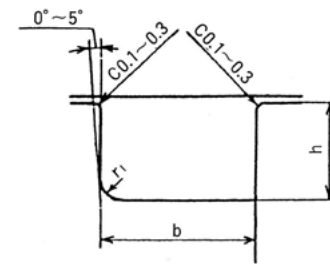


Figure 14 For static application (cylindrical surface)



Integral groove



Split groove

Table 14 Groove dimensions for when millimeter size O-rings are to be used for cylindrical surfaces for dynamic and for static application

Operating pressure 25MPa{255kgf/cm²}

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.9±0.08	1.5 ^{+0.05} / ₀	2.5 ^{+0.25} / ₀	0.4
2.4±0.09	2.0 ^{+0.05} / ₀	3.2 ^{+0.25} / ₀	0.4
3.1±0.10	2.5 ^{+0.05} / ₀	4.1 ^{+0.25} / ₀	0.7
3.5±0.10	3.0 ^{+0.05} / ₀	4.7 ^{+0.25} / ₀	0.8
5.7±0.13	5.0 ^{+0.05} / ₀	7.5 ^{+0.25} / ₀	0.8
8.4±0.15	7.5 ^{+0.05} / ₀	11.0 ^{+0.25} / ₀	1.2

Table 15 Groove dimensions for when inch size (AS568A) O-rings are to be used for cylindrical surfaces for dynamic and for static application

Operating pressure of 10.3 MPa {105 kgf/cm²} or less

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.78±0.07	1.425 ^{+0.03} / ₀	2.39 ^{+0.25} / ₀	0.4
2.62±0.07	2.265 ^{+0.05} / ₀	3.58 ^{+0.25} / ₀	0.4
3.53±0.10	3.085 ^{+0.05} / ₀	4.78 ^{+0.25} / ₀	0.6
5.33±0.12	4.725 ^{+0.05} / ₀	7.14 ^{+0.25} / ₀	0.7
6.98±0.15	6.06 ^{+0.08} / ₀	9.52 ^{+0.25} / ₀	0.7

Table 16 Groove dimensions for when millimeter size O-rings are to be used for cylindrical surfaces for fixing (VALQUA recommended)

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.9±0.08	1.43 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.65 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
2.4±0.09	1.88 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	3.11 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
3.1±0.10	2.54 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	3.76 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
3.5±0.10	2.91 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	4.16 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
5.7±0.13	4.88 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	6.51 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
8.4±0.15	7.11 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	9.70 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	1.0

Table 17 Groove dimensions for when inch size O-rings are to be used for cylindrical surfaces for fixing (VALQUA recommended)

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.78±0.07	1.32 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.54 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
2.62±0.07	2.11 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	3.18 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
3.53±0.10	2.92 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	4.32 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
5.33±0.12	4.57 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	6.10 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
6.98±0.15	5.94 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	8.00 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	1.0

Table 18 Groove dimensions when using a general industrial application (ISO) O-ring for dynamic application (reference)

Unit : mm

O-ring thickness (d ₂)	⁽¹⁾ Groove depth (h)	⁽¹⁾ Groove depth (b) $\begin{matrix} +0.25 \\ 0 \end{matrix}$	Bottom radius (r ₁)
1.8 ±0.08	1.42/1.47 (1.46/1.57)	2.4 (2.2)	0.2 ~ 0.4
2.65±0.09	2.16/2.24 (2.23/2.37)	3.6 (3.4)	0.2 ~ 0.4
3.55±0.10	2.96/3.07 (3.03/3.24)	4.8 (4.6)	0.4 ~ 0.8
5.30±0.13	4.48/4.66 (4.65/4.86)	7.1 (6.9)	0.4 ~ 0.8
7.00±0.15	5.95/6.16 (6.20/6.43)	9.5 (9.3)	0.8 ~ 1.2

Note (1) With respect to the values in the groove depth and groove width columns, the numbers in the upper row are for hydraulic pressure, while the numbers in the parentheses in the bottom row are for pneumatic pressure. Additionally, with respect to the values in the groove depth (h) column, the numbers on the left side are for pistons while the numbers on the right side are for rods.

Table 19 Groove dimensions when using a general industrial application (ISO) O-ring for cylindrical surfaces for fixing (reference)

Unit : mm

O-ring thickness (d ₂)	⁽¹⁾ Groove depth (h) $\begin{matrix} 0 \\ -0.05 \end{matrix}$	Groove depth (b) $\begin{matrix} +0.25 \\ 0 \end{matrix}$	Bottom radius (r ₁)
1.8 ±0.08	1.38 (1.42)	2.4	0.2 ~ 0.4
2.65±0.09	2.07 (2.15)	3.6	0.2 ~ 0.4
3.55±0.10	2.74 (2.85)	4.8	0.4 ~ 0.8
5.30±0.13	4.19 (4.36)	7.1	0.4 ~ 0.8
7.00±0.15	5.67 (5.89)	9.5	0.8 ~ 1.2

Note (1) With respect to groove depth (h), the dimensions in the upper row are for grooves for pistons, while the dimensions in the parentheses in the lower row are for grooves for rods.

Table 20 Dimensions of the groove for motion where the O-ring does not rotate (for millimeter sizes)

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.9±0.08	1.57 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.33 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
2.4±0.09	2.07 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.69 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
3.5±0.10	3.11 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	3.79 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
5.7±0.13	5.09 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	6.14 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
8.4±0.15	7.31 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	9.28 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	1.0

Table 21 Dimensions of the groove for motion where the O-ring does not rotate (for inch sizes)

Unit : mm

O-ring thickness (d ₂)	Groove depth (h)	Groove width (b)	Bottom radius (r ₁)
1.78±0.07	1.45 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.29 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
2.62±0.07	2.29 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	2.92 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.4
3.53±0.10	3.12 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	3.94 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
5.33±0.12	4.78 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	5.84 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	0.8
6.98±0.15	6.10 $\begin{matrix} 0 \\ -0.05 \end{matrix}$	7.75 $\begin{matrix} +0.13 \\ 0 \end{matrix}$	1.0

(3) Groove dimensions for flanges for vacuum devices
(Table 22, JIS B 2290)

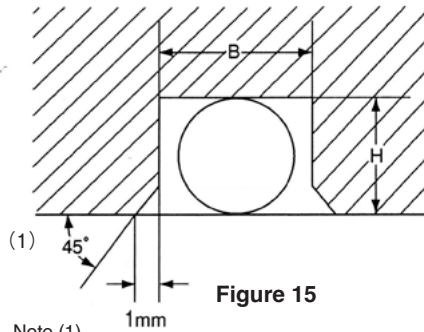


Figure 15

Note (1)

When using O-rings, the chamfer dimensions of the groove can be reduced.

Table 22

Unit : mm

O-ring thickness (d_2)	Groove depth (h)	Groove width (b)
4 ± 0.1	$3 \begin{smallmatrix} +0 \\ -0.2 \end{smallmatrix}$	$5 \begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$
6 ± 0.15	$4.5 \begin{smallmatrix} +0 \\ -0.2 \end{smallmatrix}$	$8 \begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$
10 ± 0.3	$7 \begin{smallmatrix} +0 \\ -0.2 \end{smallmatrix}$	$12 \begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$

(4) Special groove dimensions

(A) Dovetail groove dimensions (reference)

(a) For pressurization Table 23

(b) For vacuums Table 24

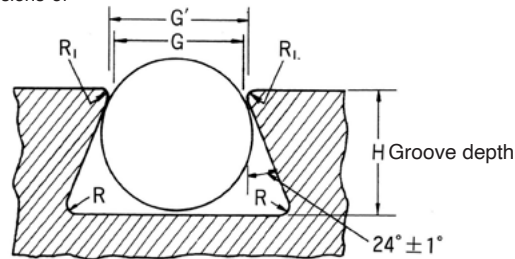


Figure 16

(a) For pressurization Table 23

Unit : mm

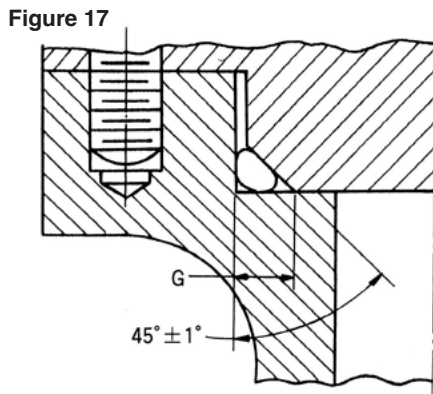
Standard	O-ring Bearing number	Thickness(d_2)	$G \pm 0.05$		G'	$H \begin{smallmatrix} 0 \\ -0.05 \end{smallmatrix}$	R_1	R MAX
			Before chamfering	After chamfering				
JIS B 2401	P 3 ~ P 10	1.9 ± 0.08	1.55	1.71	1.4	0.15	0.40	
	P 10A ~ P 22	2.4 ± 0.09	2.00	2.22	1.8	0.20	0.40	
	P 22A ~ P 50	3.5 ± 0.10	2.95	3.17	2.8	0.20	0.80	
	P 48A ~ P150	5.7 ± 0.13	4.75	5.18	4.7	0.40	0.80	
	P150A ~ P400	8.4 ± 0.15	7.10	7.64	7.0	0.50	1.60	
	G 25 ~ G145	3.1 ± 0.10	2.60	2.82	2.4	0.20	0.80	
	G150 ~ G300	5.7 ± 0.13	4.75	5.18	4.7	0.40	0.80	
AS568	004 ~ 050	1.78 ± 0.07	1.47	1.61	1.30	0.13	0.40	
	102 ~ 178	2.62 ± 0.07	2.16	2.43	2.01	0.25	0.40	
	201 ~ 284	3.53 ± 0.10	2.95	3.22	2.79	0.25	0.79	
	309 ~ 395	5.33 ± 0.12	4.45	4.86	4.34	0.38	0.79	
	425 ~ 475	6.98 ± 0.15	5.94	6.35	5.77	0.38	1.59	

(b) For vacuums Table 24

Unit : mm

Standard	O-ring Bearing number	Thickness(d_2)	$G \pm 0.05$		G'	$H \begin{smallmatrix} 0 \\ -0.05 \end{smallmatrix}$	R_1	R MAX
			Before chamfering	After chamfering				
JIS B 2401	P 22A ~ P 50	3.5 ± 0.10	3.05	3.27	2.5	0.20	0.80	
	P 48A ~ P150	5.7 ± 0.13	4.95	5.38	4.2	0.40	0.80	
	P150A ~ P400	8.4 ± 0.15	7.35	7.89	6.3	0.50	1.60	
	V 15 ~ V 175	4 ± 0.10	3.45	3.77	2.9	0.30	0.80	
	V225 ~ V 430	6 ± 0.15	5.25	5.68	4.4	0.40	0.80	
	V480 ~ V1055	10 ± 0.30	8.70	9.24	7.6	0.50	1.60	
AS568	201 ~ 284	3.53 ± 0.10	3.07	3.34	2.51	0.25	0.79	
	309 ~ 395	5.33 ± 0.12	4.62	5.03	3.91	0.38	0.79	
	425 ~ 475	6.98 ± 0.15	6.12	6.53	5.21	0.38	1.59	

(B) Triangular grooves (reference)
Triangular groove dimensions Table 25



Remarks Please consult with us separately for high-pressure seals.

Table 25

Unit : mm

O-ring bearing number		O-ring thickness(d_2)	G
		Actual dimensions	
JIS B 2401	P 3 ~ P 10	1.90±0.08	2.45 $\begin{smallmatrix} +0.10 \\ 0 \end{smallmatrix}$
	P 10A ~ P 22	2.40±0.09	3.15 $\begin{smallmatrix} +0.15 \\ 0 \end{smallmatrix}$
	P 22A ~ P 50	3.50±0.10	4.55 $\begin{smallmatrix} +0.20 \\ 0 \end{smallmatrix}$
	P 48A ~ P150	5.70±0.13	7.40 $\begin{smallmatrix} +0.30 \\ 0 \end{smallmatrix}$
	P150A ~ P400	8.40±0.15	10.95 $\begin{smallmatrix} +0.40 \\ 0 \end{smallmatrix}$
	G 25 ~ G145	3.10±0.10	4.05 $\begin{smallmatrix} +0.15 \\ 0 \end{smallmatrix}$
AS568	G150 ~ G300	5.70±0.13	7.40 $\begin{smallmatrix} +0.30 \\ 0 \end{smallmatrix}$
	004 ~ 050	1.78±0.07	2.31 $\begin{smallmatrix} +0.07 \\ 0 \end{smallmatrix}$
	102 ~ 178	2.62±0.07	3.40 $\begin{smallmatrix} +0.12 \\ 0 \end{smallmatrix}$
	201 ~ 284	3.53±0.10	4.60 $\begin{smallmatrix} +0.17 \\ 0 \end{smallmatrix}$
	309 ~ 395	5.33±0.12	6.96 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$
425 ~ 475	6.98±0.15	9.09 $\begin{smallmatrix} +0.38 \\ 0 \end{smallmatrix}$	

(C) For rotation (reference)
Groove dimensions for rotation Table 26

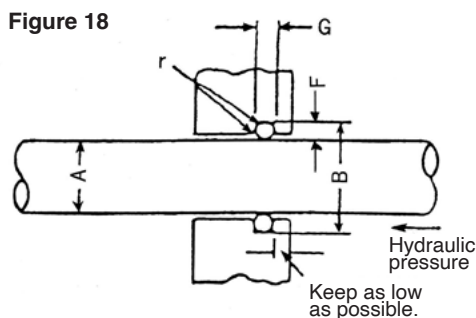


Table 26

Unit : mm

Standard	O-ring		Groove depth(F) (±0.025)	Groove width(G) ($\begin{smallmatrix} +0.13 \\ 0 \end{smallmatrix}$)
	Bearing number	O-ring thickness(d_2)		
JIS B 2401	P 3 ~ P 10	1.9 ±0.08	1.72	2.10
	P 10A ~ P 22	2.4 ±0.09	2.21	2.60
	G 25 ~ G145	3.1 ±0.10	2.87	3.40
	P 22A ~ P 50	3.5 ±0.10	3.27	3.80
	P 48A ~ P150 G150 ~ G300	5.7 ±0.13	5.39	6.10
	P150A ~ P400	8.4 ±0.15	8.02	8.80
AS568	004 ~ 050	1.78±0.07	1.60	1.95
	102 ~ 178	2.62±0.07	2.43	2.80
	201 ~ 284	3.53±0.10	3.30	3.80
	309 ~ 395	5.33±0.12	5.05	5.60
	425 ~ 475	6.98±0.15	6.64	7.40

Design installation standards

- (a) O-ring inner diameter O-ring d_1 mm = $A_{max} \times g_0$ (1.03 ~ 1.0)
 (b) Groove width (tolerance of groove width should be $\begin{smallmatrix} +0.13 \\ 0 \end{smallmatrix}$)
 (c) Groove diameter (tolerance of groove diameter should be ±0.05)

5.5 Precautions when installing O-rings

(1) Please keep the O-ring and gland portion clean, and ensure that the grease and lubricating oil are not contaminated by waste cloth, lint from gloves, cutting dust, debris, and foreign matter.

(2) To ensure easy installation, first thoroughly apply grease or lubricating oil to the O-ring.

(3) Lubrication

Lubricating oil must be applied to O-rings to ensure proper function, service life, and frictional resistance. For this purpose, a felt wiper should be attached as depicted in Figure 19, and lubricating oil suitable to the operating conditions should be continually applied to the felt through the oil hole. When used for sealing substances like air and gas in particular, use felt wipers as much as possible in order to prevent deterioration, deformation, and wear of the O-ring. Increases/decreases to friction, which are a cause of O-ring wear, are depicted in Table 27.

Table 27 Relationship between O-rings and frictional resistance

Friction increases	Cause	Friction decreases
Large	Load (squeeze)	Small
Rough	Metal surface finish	Smooth
Large	Hardness	Small
Low	Speed	High
Large	O-ring thickness	Small
Large	Pressure	Small
None	Lubrication	Present
Low	Temperature	High
Small	Groove width	Large
Large	Shaft diameter	Small
Rough	O-ring surface finish	Smooth

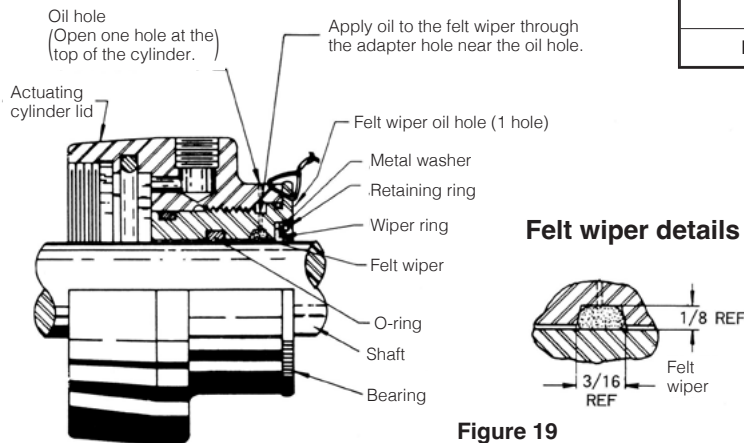


Figure 19

(4) Twisting or damage to O-ring

Twisting of the O-ring, which can shorten the service life of O-rings by causing leaks or damage, is more likely to occur with pressure differentials of 2.94 MPa {30 kgf/cm²} or less, while sliding speeds are low at 5 mm per second or less, or when strokes of 300 mm or greater are applied (unless special consideration taken), so extra caution is required in these circumstances. Note that other causes can include lubrication methods, squeeze, operational temperatures, groove portions, and the finish of the sliding surface.

(5) When the installation mechanism has sharp edges

(A) Removing the edges of the installation mechanism

In order to prevent damage to the O-ring during installation, ensure that all sharp edges, such as the glands and the piston rods, appear as depicted in Figure 21.

JIS B 2406 (2005) stipulates dimensional indications to remove sharp edges of the attachment portion as shown in Table 28.

(B) Using a jig for installation

If the O-ring is to be installed through a threaded portion or some other area with sharp edges, design the mechanism so that the O-ring will not be damaged. Furthermore, attaching a cap to the threaded portion as depicted in Figure 20-3 below will yield effective results during attachment.

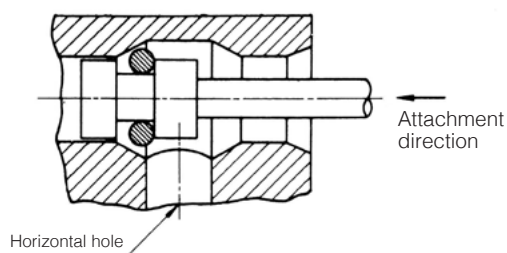


Figure 20-1 Correct attachment method

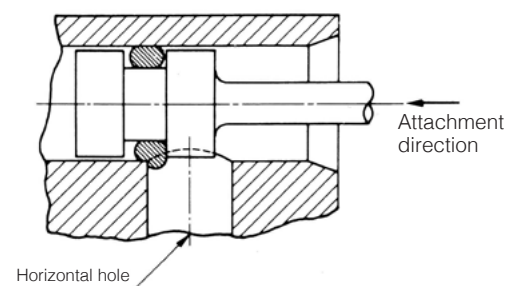


Figure 20-2 Incorrect attachment method

Table 28 Attachment portion dimension table

Unit : mm

O-ring bearing number	O-ring thickness	Z(Minimum)
P3 ~ P10	1.9±0.08	1.2
P10A ~ P22	2.4±0.09	1.4
P22A ~ P50	3.5±0.10	1.8
P48A ~ P150	5.7±0.13	3.0
P150A ~ P400	8.4±0.15	4.3
G25 ~ G145	3.1±0.10	1.7
G150 ~ G300	5.7±0.13	3.0
A0018G ~ A0170G	1.80±0.08	1.1
B0140G ~ B0387G	2.65±0.09	1.5
C0180G ~ C2000G	3.55±0.10	1.8
D0400G ~ D4000G	5.30±0.13	2.7
E1090G ~ E6700G	7.00±0.15	3.6

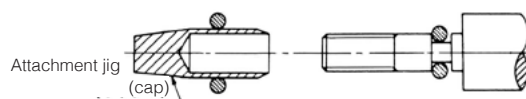


Figure 20-3 Correct attachment method

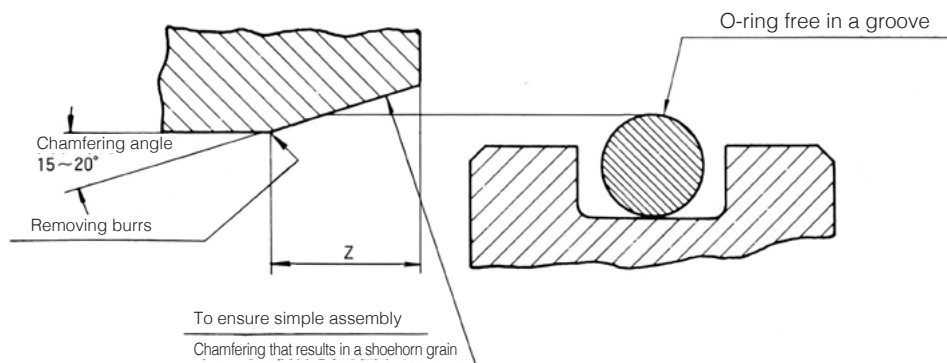
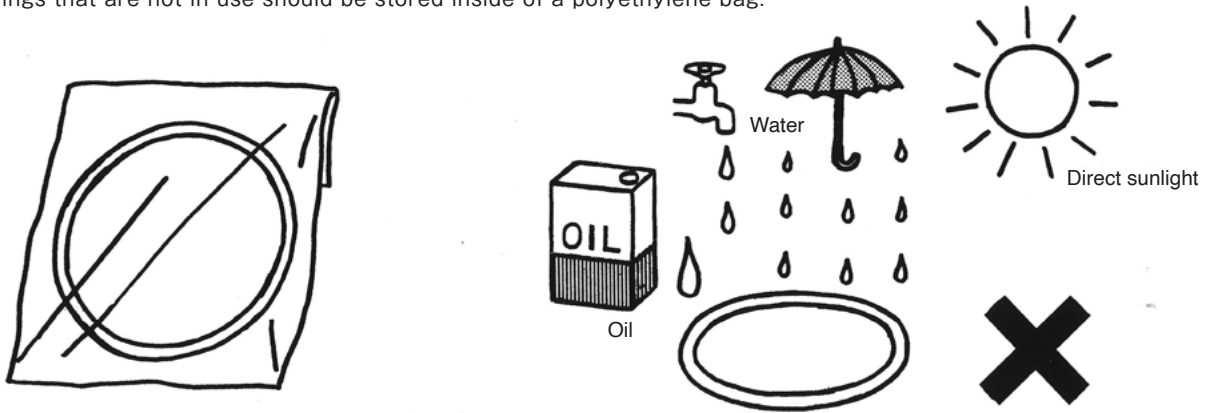


Figure 21 Figure showing removed sharp edges

5.6 Precautions when storing O-rings

- (1) The rubber comprising O-rings can deteriorate when exposed to elements such as direct sunlight, oil, water, or ozone.

O-rings that are not in use should be stored inside of a polyethylene bag.



- (2) Store O-rings in a cool, dark place, and ensure that the ambient temperature is no greater than 38°C.



- (1) Keep O-rings that are not in use in a complete condition.
- (2) When storing O-rings for long periods of time, please examine them for external abnormalities, such as cracks, stickiness, and hardening, before use.
- (3) O-ring storage expiration date
Install O-rings into devices within 3 years of their manufacturing date, and ensure that the devices into which the O-rings have been installed are used within 1 year of installation.

5.7 Precautions when discarding O-rings and backup rings

O-rings and backup rings may produce harmful gases when the rings are incinerated. Treat the rings as industrial waste.

5.8 Other

- (1) Please consult with us separately when intending to use the products for food or medical-related reasons.
- (2) Please use caution when heating our products to high temperatures, as they may produce harmful gases.
- (3) We can accommodate manufacturing of products with special dimensions outside of the standard dimensions, so please feel free to discuss such products with us.



**"VALQUA" is a compounded word coming from VALUE and QUALITY
which is the symbol and motto of the company.**

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