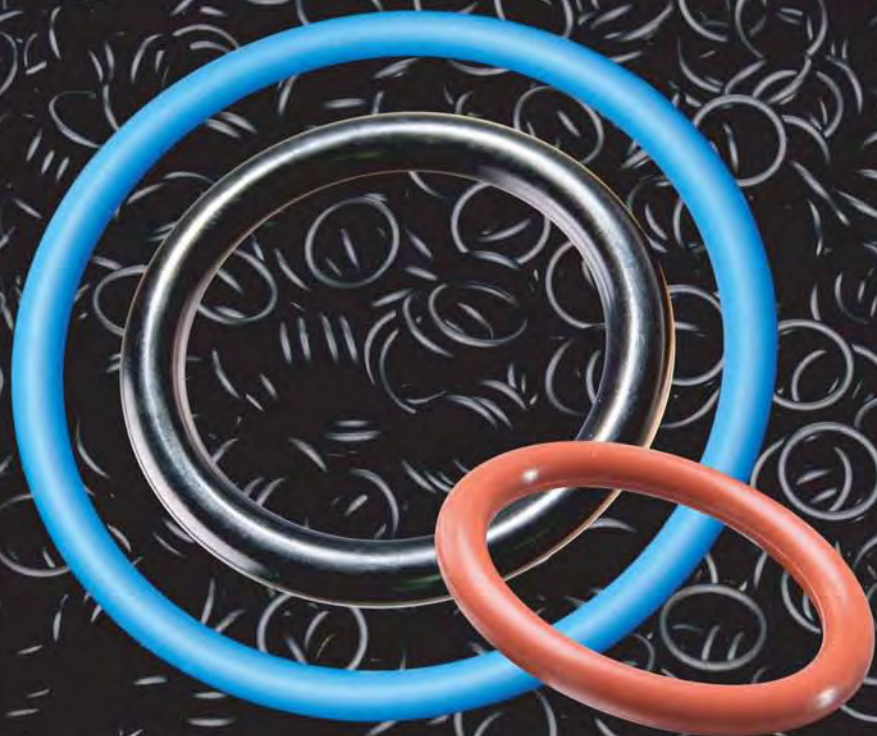




Seals & O-rings Specialist

C09 11 '04



• O-RINGS

X-RINGS • BACK-UP RINGS • BONDED SEALS



Seals & O-rings Specialist

O - R I N G S H A N D B O O K

HEAD OFFICE

268, 270, 272 Krungthonmuangkaew
Sirinthorn Rd., Bangplad
Bangkok 10700 Thailand
TEL. (66) 02-8810555
FAX. (66) 02-8810550
www.specseal.co.th
e-mail : info@specseal.co.th

BANGNA OFFICE

89/64 Moo.15 Enterprize Park,
Bangna-Trad Rd., Bangkaew, Bangplee,
Samutprakarn 10540 Thailand
TEL. (66) 02-1367999
FAX. (66) 02-1369484
e-mail : contact_bangna@specseal.co.th

AMATA NAKORN OFFICE

118/28-29 Moo.6 Donhuaroh,
Muang District, Chonburi 20000 Thailand
TEL. (66) 038-453111
FAX. (66) 038-453122
e-mail : info_amata@specseal.co.th

RANGSIT OFFICE

56/149-150 Moo 6, Rangsit auto parts center,
Phahon Yothin Rd., KM.39, Klong 1,
Klong Luang Pathumtanee, 10120 Thailand
TEL. (66) 02-1533311
FAX. (66) 02-1533300
e-mail : info_rangsit@specseal.co.th

คำนำ

บริษัท สเปคซีล จำกัด มีความยินดีและภูมิใจนำเสนอ **แคตตาล็อกโอริง** ที่มีความสมบูรณ์แบบมากที่สุดในประเทศไทย เราได้รวบรวมและเรียบเรียงข้อมูลเกี่ยวกับโอริง เอ็กซีริง แบคอัพริงและบอนด์ดีดซีลซึ่งสะดวกต่อผู้ใช้งาน โดยสเปคซีลมีความมุ่งมั่นอย่างต่อเนื่องเพื่อให้การบริการที่ดีที่สุดต่อภาคอุตสาหกรรมไทยที่มีการพัฒนาอย่างไม่หยุดยั้ง

ท่านสามารถค้นหาขนาดของโอริงที่ท่านต้องการพร้อมข้อมูลเกี่ยวกับร่องขึ้นงาน และการประกอบอย่างถูกวิธีและข้อมูลอื่นๆ ที่สำคัญเกี่ยวกับโอริง เนื้อหาในเล่มหนา 17 ถึง 21 มีข้อแนะนำเกี่ยวกับวัสดุของโอริงที่ท่านควรเลือกใช้ให้ถูกต้องตรงตามลักษณะการใช้งาน รวมทั้งสารานุกรมที่ท่านต้องการทราบในคอลัมน์ Q&A หนา 127-128

นอกจากสเปคซีลจะให้คำแนะนำทางด้านเทคนิคเกี่ยวกับซีลและโอริงอย่างผู้เชี่ยวชาญชั้นนำแล้ว เรายังสามารถบริการจัดส่งสินค้าที่มีพร้อมในสต็อกของเราที่มีอยู่ตามสาขาต่างๆ ของสเปคซีลที่อยู่ใกล้กับบริษัทของท่านได้รวดเร็วตรงตามความต้องการ

บริษัทฯ หวังเป็นอย่างยิ่งว่าท่านจะพึงพอใจในแคตตาล็อกเล่มนี้เหมือนอย่างที่เรา รู้สึกพึงพอใจที่ได้มีโอกาสบริการท่านมาเป็นเวลากว่า 20 ปี.....ด้วยความปรารถนาดี

สเปคซีลผู้เชี่ยวชาญด้านซีลและโอริง

Introduction

Specseal Company Limited is proud to introduce our latest **O-Ring catalogue**, the most comprehensive and completed o-ring catalogue in Thailand. This valuable and handsome O-Ring handbook presents the most popular topics regarding o-rings that are suitable for engineers as well as purchasing officers. This catalogue is part of Specseal's continuing mission to bring the very best seals service to the growing Thai industries.

You will easily find the sizes of o-rings you require with their groove dimensions and installation instructions. The most widely used compounds are listed on page 17 and their properties are also set out clearly in the table on page 21. This means that you will not go wrong in choosing the right materials for your applications. Look for Q&A column on page 127-128 if you have a question concerning the o-rings you are using.

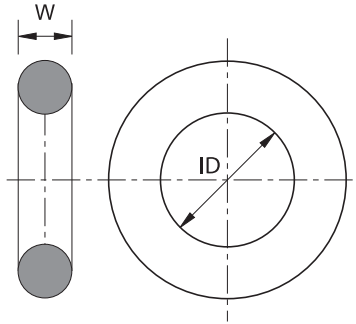
In addition, we bring you all the O-Ring accessories you may use, the X-Rings with Back-up Rings and Bonded Seals detailed dimensions and profiles which reflects the Specseal way of assuring the maximum customers' satisfaction. We do not only offer superior technical support but also prompt deliveries from our warehouses in our sales offices around you.

We hope that you will derive as much pleasure from reading this catalogue, as we do from serving you.

Specseal.....Your seals & o-rings specialist.

O-Rings

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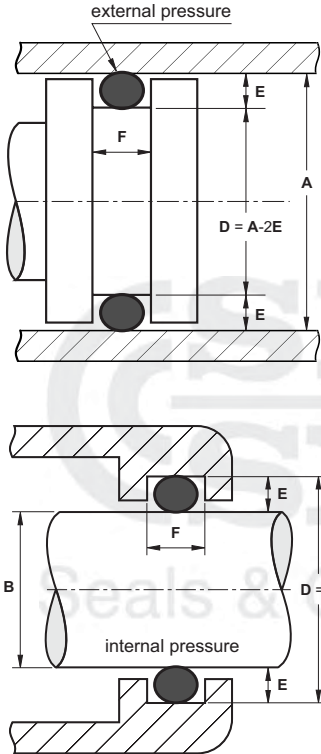
All O-Rings ordered from **SPECSEAL** are available in all standard sizes in accordance with U.S. (AS 568A), (BS 1806, BS 4518) Swedish and DIN standards. We can also supply a wide variety of non-standard sizes not included in this handbook, but available on request.

Thanks to advanced manufacturing and quality control methods all O-Rings from us possess optimum A.Q.L (Average Quality Level). In view of mass production this is of particular importance.

Our quality NBR-70 is most widely used. It represents Buna-N (Perbuna-N or nitrile) rubber compound, 70° Shore, and is suitable for roughly 90% of all cases. Our O-Rings are also available in Kalrez® (perfluorelastomer), fluorocarbon, silicone, fluorosilicone, neoprene®, ethylene propylene and many other special compounds. Our table of resistance properties on pages 17-21 may serve as a guide for the proper choice of material.

O-Rings are used for dynamic and for static applications. In the case of dynamic applications either the outside or the inside or the inside circumference of the O-Rings works as a rubbing seal.

Dynamic Application



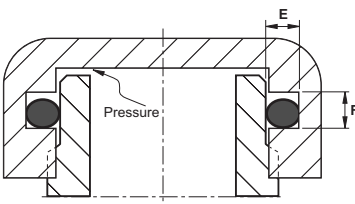
A Sealing the reciprocating piston of, say, a hydraulic cylinder or a valve in a housing. The O-Ring is mounted in a rectangular groove on the outside of the piston or the valve. The depth of the groove should be such that the O-Ring shows a little above the groove. When the piston is installed in the cylinder, the O-Ring will be compressed 10-15%, so that an effective amount of sealing capacity will be obtained. The sealing is based on the elasticity of rubber (elastomer). Constructional data is given on page 14,15

B Sealing rotating shafts and reciprocating rods of, say, the piston rod of a hydraulic cylinder or the spindle of a tap or valve. The O-Ring should be installed in a groove in the body. The depth of the groove should be such that the O-Ring rises a little above the groove. When the shaft or the rod is mounted, the O-Ring will be compressed 10-15%, so that an effective amount of sealing will be obtained.

C The application of O-Rings for sealing rotating parts is not advisable, if it is necessary to use a compact sealing element in such cases, we recommend the application of X-Rings or other suitable sealing elements from our programme.

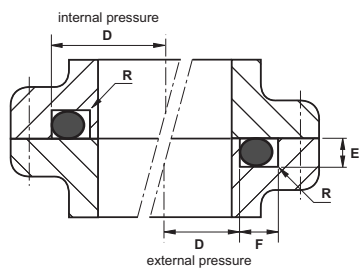
Static Application

(no flanges)



D It is advisable to take rings with the largest cross section that is available, because the rings can then be used for high pressures (up to 2000 atm., for instance) and will also be safe when the pressure load is subject to variations, particularly when the construction is subjected to expanding and shrinking movements. The diametric compression of the small cross sections up to 30%. Constructional data is given on page 14,15

(flanges)



E Flange sealing requires special groove dimensions. This construction provides a 100% perfect seal against fluids and gases under high or low pressure, even when the pipes are subject to vibration. Constructional data is given on page 14,15. The dimensions must be such that when the O-Ring is exposed to internal pressure, its outer circumference is sitting close. In the case of external pressure the O-Ring must sit close along the inner circumference.

CONSTRUCTIONAL DATA

Preceding the tables of O-Rings dimensions, page 14,15 states constructional data needed to ensure a perfect seal.

We also state the following supplementary data herewith

1. directions for the choice of an O-Ring for dynamic parts.
2. directions for the choice of an O-Ring for static parts.
3. choice of running surface material, finish of running surface and groove, fits and lubrication.
4. installation instructions.
5. hardness of O-Rings.
6. application of back-up rings
7. table showing groove dimensions for both dynamic and static parts for O-Rings.

1. GUIDE FOR THE CHOICE OF AN O-RING FOR DYNAMIC PARTS

Cross section $\varnothing$	Rod Cylinder $\varnothing$
≥ 1.6	0 - 13 mm.
≥ 2.4	13 - 25 mm.
≥ 3.5	25 - 40 mm.
≥ 5.3	40 - 115 mm.
≥ 7.0	> 115

The right cross section can be inferred from the table:

Always take the maximum cross section the available room accepts.

Rubber behaves like water and can consequently not be compressed. Its volume will remain unchanged.

When O-Rings tend to rotate with the shaft, the rubber is consequently apt to become "winding"

When applied to a piston, the ring may twist.

It is advisable, therefore, to observe the following rules:

When the outer circumference is exposed to friction:

Outside O-Ring diameter = (0.95 mm to 1.00 mm) x cylinder dia (= A).

The diameter of the groove = cylinder dia (= A) - 2 x groove depth (= E).

The groove depth is shown in the table on page 14,15

When the inside circumference is exposed to friction:

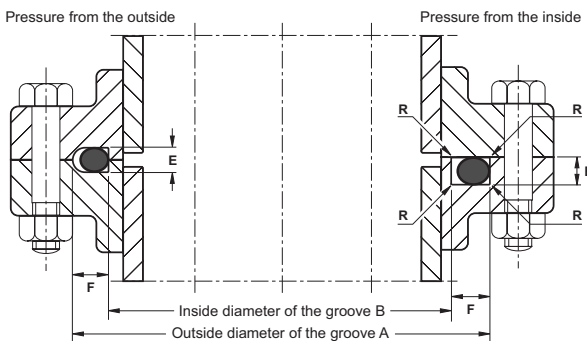
Inside O-Ring dia = (0.95 mm to 1.0 mm) x rod dia (= B)

The diameter of the groove = rod dia (= B) + 2 x groove depth (= E).

The groove depth is shown in the table on page 14,15

2. DIRECTIONS FOR THE CHOICE OF AN O-RING FOR STATIC PARTS

Although in principle any cross section is suitable, it is advisable to take O-Rings with the biggest cross section available. The rings can also be safely used then for high pressures (for instance 2000 atm.) and for varying pressure loads. A distinction must be made between flanges and other static parts.



For flanged seals the following rules are applicable:

Pressure from the inside: A = outside ring diameter (= inside dia + 2 x cross section), so that the O-Ring fits properly on the outside and has some clearance towards the inside.

Pressure from the outside (vacuum): B should be the inside ring dia, so that the ring fits properly on the inside and has some clearance towards the outside.

For groove dimensions see table on page 14,15

Static Parts

As far as static parts are concerned, the same directions as indicated in the case of dynamic parts apply. The O-Ring may be expanded 0-5%, but should be as snug a fit as possible in the groove. The groove dimensions are shown in the table on page 14,15

3. CHOICE OF RUNNING SURFACE MATERIAL, RUNNING SURFACE AND GROOVE FINISHES, FITS AND LUBRICATION

a. The choice of the running surface material.

In order to obtain the maximum service life for O-Rings sealing dynamic parts, it is recommended to use polished hard steel shafts and rods and honed steel or cast iron cylinder walls. Honing makes the best surface. Hardened steel causes the least friction, whereas chrome hardening causes considerable friction. Soft materials like aluminium alloys, copper, brass, monel or soft stainless steel are no advisable because their wear resistance are small. The initial friction of elastomers is high; the rubber tends to adhere to the grooves in the surface of the material. The use of harder compounds can reduce this initial friction, but when a very low initial friction is required, PTFE seals are better suited. Details on PTFE products are available on request.

b. Running surface finish and fits.

A close fit between the dynamic parts and a superior surface finish of the sliding parts are of special importance to the proper sealing and long service life of O-Rings.

The sealing clearance

In regard of the allowable clearance values, the table below specifies the I.S.A. fits to be aimed at, dependent on the nominal diameters.

Nom Ø	Clearance
up to 10 mm.	H 9 / e 8
10 to 60 mm.	H 8 / e 8
> 60 mm.	H 7 / f 7

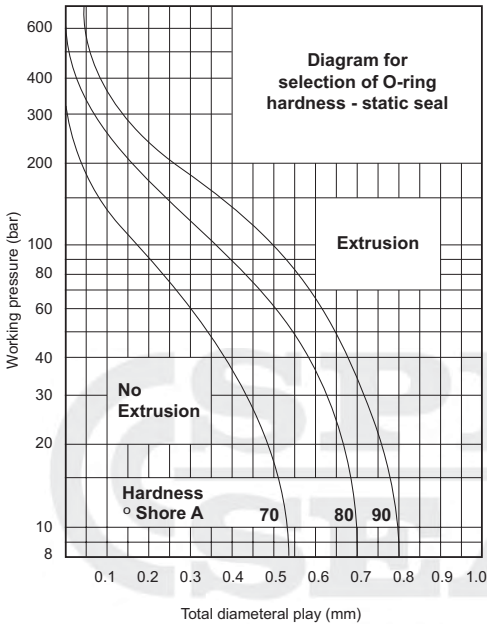
The roughness of the parts sliding against the rubber should be

between 0.2 and 0.8 μ m (Ra) = 8-32 Ru.

A surface finish finer than 0.15 μ m (= 6 Ru) should be avoided, else it would be difficult to maintain a lubricating film.

The allowable sealing clearance depends on the pressure to be sealed and the hardness of the O-Ring compound used. At elevated pressures a part of the O-Ring will be forced into the sealing clearance. Particularly soft rubber types can thus be damaged severely.

In other words: dependent on the pressures to be sealed, the amount of sealing clearance is bound to maximum values.



The diagram opposite represents roughly the connection between hardness, pressure and clearance.

At pressures over 100 kg.cm², however, it is always advisable to support the O-Ring by a PTFE back-up ring

The table below specifies the allowable values at the pressures and O-Ring hardnesses stated for cross sections according to AS 568A.

Dimensions in millimetres.

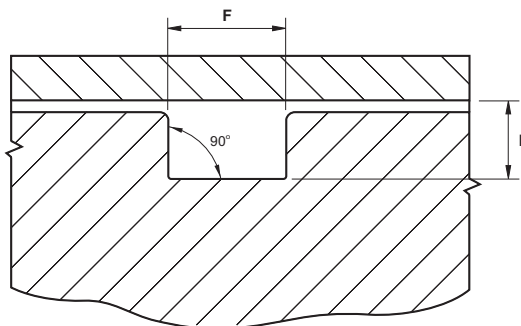
HARDNESS 70-80° SHORE A

O-Ring "W"	Cross section				
	1.78	2.62	3.53	5.33	7.00
Pressure	Clearance				
35 bar	0.20	0.25	0.30	0.36	0.41
70 bar	0.15	0.18	0.23	0.25	0.30
100 bar	0.10	0.13	0.15	0.18	0.20
150 bar	0.05	0.08	0.10	0.10	0.11
175 bar	0.03	0.04	0.05	0.06	0.06

HARDNESS 90° SHORE A

O-Ring "W"	Cross section				
	1.78	2.62	3.53	5.33	7.00
Pressure	Clearance				
35 bar	0.36	0.41	0.46	0.51	0.51
70 bar	0.30	0.36	0.41	0.46	0.46
100 bar	0.25	0.30	0.36	0.38	0.41
150 bar	0.20	0.23	0.25	0.30	0.30
175 bar	0.15	0.18	0.20	0.25	0.25
200 bar	0.13	0.15	0.18	0.20	0.20
350 bar	0.08	0.10	0.13	0.15	0.15

It is also important that by mounting dirt wipers plungers and rods are prevented from wearing quickly. When the running surface is rather rough, a satisfactory service life of the O-Ring can not be expected. Also lubrication and the right choice of running surface material are decisive.



Surfacing of the groove, and clearance O-Rings are generally installed in non-adjustable grooves, the dimensions of which are such that after installation, the O-Rings have a diametrical compression that, depending on its application, is variable, but is normally between 10-20%. The groove width should be such that the oval deformation + a certain amount of swelling can be accepted. The groove may be rectangular, but sometimes the groove can be more easily turned when its sides may be slightly conical. The bevel should not be over 5. Groove surfacing : 1.6-3 $\varnothing$ m (64-125 Ru).

Recommended groove tolerances are:

1. groove bottom up to nom. dia. 60 mm. h 11 and H 11 respectively
 $\geq$ nom. dia. 60 mm. and over h 9 and H 9 respectively
2. groove width: see table of groove dimensions on page 14,15

c. Lubrication

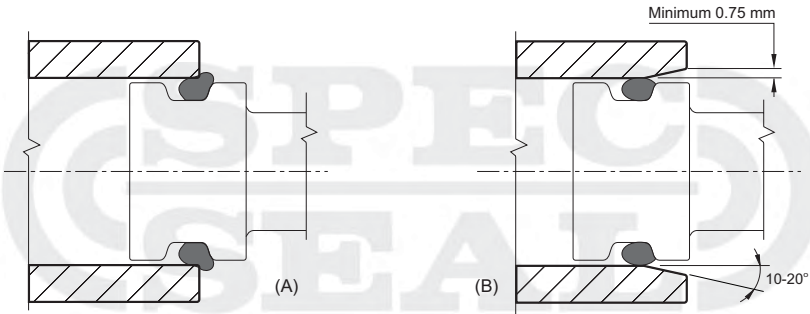
For dynamic application the O-Ring requires thorough lubrication in order to ensure a long service life, wear quickly being occasioned when dry. O-Rings also require lubrication when used for pneumatic equipment, for instance by filling the groove with a grease of high melting point. Our 5 cc tubes of DC 200 silicone oil are excellent for the purpose. **Mineral and vegetable oils and fats must not be used when Ethylene Propylene O-Rings are installed.**

4. INSTALLATION INSTRUCTIONS

Bevelled edges

When designing O-Ring Sealing devices it is of vital importance that bevelled edges are provided for, so that the O-Rings will not be damaged when being mounted. In many cases a mere rounding of sharp edges is insufficient. The following figures show, why:

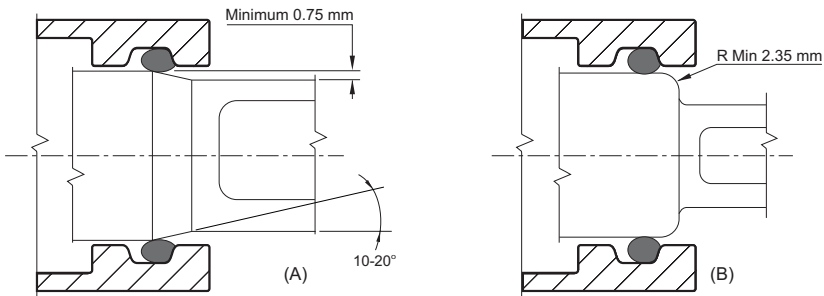
Cylinders



The ring gets jammed and is destroyed because the edges have not been bevelled.

Correctly bevelled edges ensure simple mounting without problems.

Piston Rods and Plungers

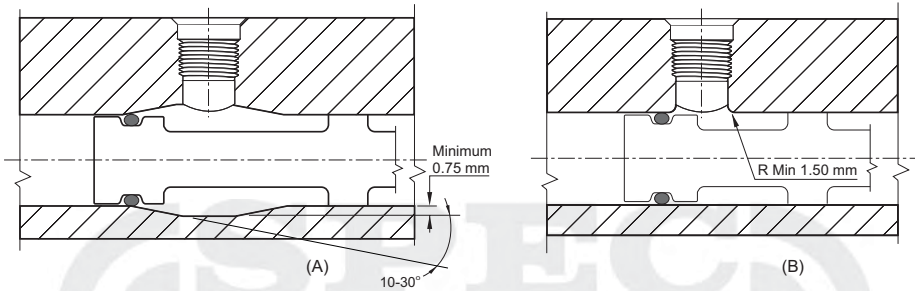


In case of piston rods and plungers this construction is given preference.

This construction may also be used.

Valves, etc.

When O-Rings must pass a hole when being mounted, provision should be made so that the rings cannot be pinched off.



This construction is to be preferred.

This construction is also workable.

When a certain amount of passage is required, we advise constructing several small diameter holes instead of a few large diameter holes.

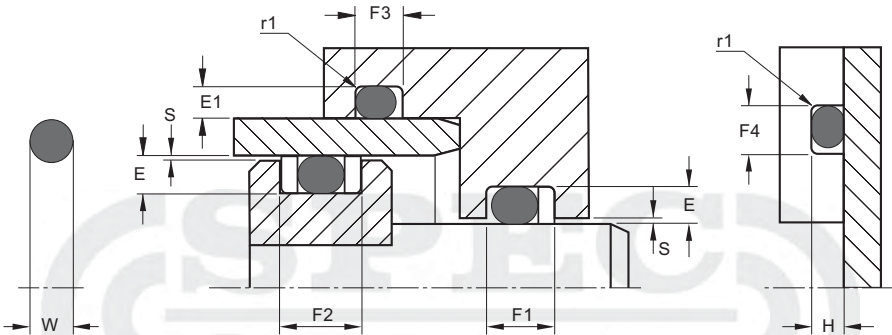
5. HARDNESS OF THE O-RINGS

In the majority of cases a 70° Shore A quality will do. Though not really necessary, softer O-Rings from 40 to 60° Shore A are often installed for sealing at low pressures or vacuum. O-Rings harder than 70° Shore A (90° Shore A) Should be used (preferably together with back-up rings) at high pressures to avoid that the O-Ring is extruded into the clearance.

In regard of hardnesses to be chosen the following facts deserve attention:

- If pressures are low, hard O-Rings seal less perfectly than soft O-Rings.
- To reach the amount of diametrical compression desired, hard O-Rings require more load than soft O-Rings.

6. TABLE OF GROOVE DIMENSIONS



Installation Recommendation

Cross Section W	Dynamic Installation			Static Installation		Axial Installation		Radius
	Groove Depth	Groove Width		Groove Depth	Groove Width	Groove Depth	Groove Width	
	E + 0.05	F1 + 0.2	F2 + 0.2	E1 + 0.05	F3 + 0.2	H + 0.05	F4 + 0.2	
0.50	-	-	-	0.35	0.80	0.35	0.80	0.20
0.74	-	-	-	0.50	1.00	0.50	1.00	0.20
1.00 1.02	-	-	-	0.70	1.40	0.70	1.40	0.20
1.2	-	-	-	0.85	1.70	0.85	1.70	0.20
1.25 1.27	-	-	-	0.90	1.70	0.90	1.80	0.20
1.3	-	-	-	0.95	1.80	0.95	1.80	0.20
1.42	-	-	-	1.05	1.90	1.05	2.00	0.30
1.50 1.52	1.25	3.00	4.00	1.10	2.00	1.10	2.10	0.30
1.60 1.63	1.30	3.10	4.10	1.20	2.10	1.20	2.20	0.30
1.78 1.80	1.45	3.80	5.20	1.30	2.40	1.30	2.60	0.40
1.83	1.50	3.90	5.30	1.35	2.50	1.35	2.60	0.40
1.90	1.55	4.00	5.40	1.40	2.60	1.40	2.70	0.40
1.98 2.00	1.65	4.10	5.50	1.50	2.70	1.50	2.80	0.40
2.08 2.10	1.75	4.20	5.60	1.55	2.80	1.55	2.90	0.40
2.20	1.85	4.40	5.80	1.60	3.00	1.60	3.00	0.40

Cross Section W	Dynamic Installation			Static Installation		Axial Installation		Radius
	Groove Depth	Groove Width		Groove Depth	Groove Width	Groove Depth	Groove Width	
	E + 0.05	F1 + 0.2	F2 + 0.2	E1 + 0.05	F3 + 0.2	H + 0.05	F4 + 0.2	r1
2.26	1.90	4.40	5.80	1.70	3.00	1.70	3.10	0.40
2.30 2.34	1.95	4.50	5.90	1.75	3.10	1.75	3.10	0.40
2.40	2.05	4.60	6.00	1.80	3.20	1.80	3.30	0.50
2.46	2.10	4.70	6.10	1.85	3.30	1.85	3.40	0.50
2.50	2.15	4.70	6.10	1.85	3.30	1.85	3.40	0.50
2.62 2.65	2.25	5.00	6.40	2.00	3.60	2.00	3.80	0.60
2.70	2.30	5.00	6.40	2.05	3.60	2.05	3.80	0.60
2.80	2.40	5.10	6.50	2.10	3.70	2.10	3.90	0.60
2.92 2.95	2.50	5.30	6.70	2.20	3.90	2.20	4.00	0.60
3.00	2.60	5.40	6.80	2.30	4.00	2.30	4.00	0.60
3.50	3.05	6.00	7.40	2.65	4.60	2.65	4.70	0.60
3.53 3.55	3.10	6.20	7.60	2.70	4.80	2.70	5.00	0.80
3.60	3.15	6.20	7.60	2.80	4.80	2.80	5.10	0.80
4.00	3.50	6.90	8.60	3.10	5.20	3.10	5.30	0.80
4.50	4.00	7.50	9.20	3.50	5.80	3.50	5.90	0.80
5.00	4.40	8.30	10.00	4.00	6.60	4.00	6.70	0.80
5.33 5.30	4.70	8.80	10.50	4.30	7.10	4.30	7.30	1.20
5.50	4.80	8.80	10.50	4.50	7.10	4.50	7.30	1.20
5.70	5.00	8.90	10.60	4.60	7.20	4.60	7.40	1.20
6.00	5.30	9.10	10.80	4.90	7.40	4.90	7.60	1.20
6.50	5.70	9.70	11.40	5.40	8.00	5.40	8.20	1.20
6.99 7.00	6.10	12.00	14.50	5.80	9.50	5.80	9.70	1.50
7.50	6.60	12.20	14.70	6.30	9.70	6.30	9.90	1.50
8.00	7.10	12.30	14.80	6.70	9.80	6.70	10.00	1.50
8.40	7.50	12.50	15.00	7.10	10.00	7.10	10.30	1.50
9.00	8.10	13.10	15.60	7.70	10.60	7.70	10.90	2.00
9.50	8.60	13.50	16.00	8.20	11.00	8.20	11.40	2.00
10.00	9.10	14.10	16.60	8.60	11.60	8.60	12.00	2.50
12.00	11.00	16.00	18.50	10.60	13.50	10.60	14.00	2.50

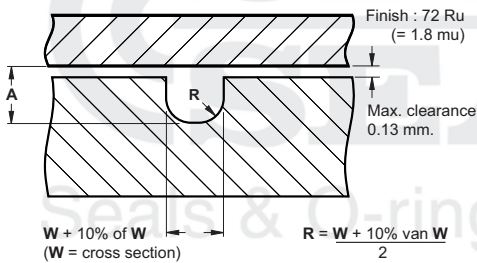
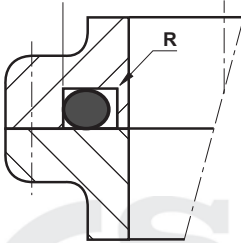
The installation dimensions here apply to O-Rings in NBR.

For elastomers with larger mould shrinkage, such as MVQ or FPM,

the groove depth may have to be reduced. In such cases, please contact us!

Groove dimensions for PTFE O-Rings

Owing to the less elastic properties of the material, PTFE O-Rings can be used for static sealing in axial groove constructions only.



When using PTFE O-Rings in axial groove or flange constructions, normal groove depths are suitable.

Considering the occurrence of cold flow of PTFE, the best results are achieved if the groove construction stated below is used.

PTFE O-Rings used in the groove construction outlined below are more effective than when they are installed in the usual O-Ring grooves.

$A = W - 10 \text{ to } 20\% \text{ of } W$
(for cross sections 1.78 to 5.33 mm)

$A = W - 10 \text{ to } 15\% \text{ of } W$
(for cross sections 5.33 to 7 mm inclusive)

Compressing PTFE O-Rings requires higher loads than compressing elastomer O-Rings. Consequently PTFE O-Rings can be used for pressure sealing in axial groove, not in radial grooves.

In radial grooves PTFE O-Rings can serve as a pressureless separating seal, for instance.

Because PTFE O-Rings are difficult to expand and difficult to compress, it is advisable to choose groove dimensions that create a sliding fit.

If PTFE O-Rings are heated to 80 or 100°C, they are easier to install.

Because Kalrez® is much more elastic than PTFE, it is recommendable to consider the application of Kalrez instead of PTFE if chemical and thermal conditions do not permit the use of polymer.

Application of O-Rings against vacuum

When constructing O-Ring grooves for vacuum sealing, it is important that the groove is filled by the O-Ring as much as possible, because when rubber is being exposed to vacuum, it will shrink to a certain extent. Besides it must be prevented that the O-Ring can slide or roll. The surfaces to be sealed must be machined as smooth as possible.

The figures in the next column represent the cross section according to AS 568A for vacuum sealing.

Cross section	Groove depth E	Groove width F
1.78	1.27 - 1.32	2.11 - 2.24
2.62	1.88 - 1.98	3.00 - 3.12
3.53	2.57 - 2.62	3.99 - 4.14
5.33	3.86 - 3.94	5.99 - 6.12
7.00	5.11 - 5.18	7.75 - 7.87

In the case of high-vacuum sealing the gas permeability and degassing properties of the O-Rings play an important part. These properties vary widely among the various elastomers and are also highly dependent on temperature and medium handled.

Dimensions in millimetres.

In the majority of cases butyl and, particularly, Viton are the compounds to be preferred for sealing against vacuum.

If in regard of vacuum and elevated temperatures maximum requirements are made, Kalrez[®] will give the best results.

We will be glad to supply you with additional data on the use of elastomers for vacuum technology.

7. RECOMMENDATIONS FOR USE OF STANDARD COMPOUNDS

Buna N (NBR): compounds of this material are the most common industrial compounds.

Copolymers of butadiene and acrylonitrile are known by several generic names, Buna N, Nitrile Rubber and NBR. The acrylonitrile content of NBR compounds varies considerably (18% to 50%) and influences the physical properties of the finished material.

The higher acrylonitrile content, the better resistance to oil and fuel. At the same time, elasticity, compression set resistance to low temperature is adversely affected. The lower acrylonitrile content obtains, the better low temperature resistance, but sacrifice some resistance to oil and fuel. In view of these opposing realities, a compromise selection is the medium acrylonitrile content rubber. NBR has good mechanical properties when compared with other elastomers and high wear resistance.

NBR is unable to resist the weathering and ozone. Some special compound can improve this defect, such as NBR/PVC blending compound which has excellent weathering and ozone resistance and good resistance to fuel but compression set is not so good.

SERVICE TEMPERATURE

For NBR the service temperature can be designed from -55° C to 100° C or up to 125° C depending on different acrylonitrile content and formula. Generally higher than 100° C, life time will be shortened.

HARDNESS

40 to 90 Shore A are available.

APPLICATION

NBR compounds have excellent resistance to abrasion, non-polar oil and solvent, water and permeation (higher acrylonitrile content will be better). NBR also can be used in conditions of dilute acids, alkalis and salt solution at low temperatures. Applying in aromatic hydrocarbons, chlorinated hydrocarbons and polar solvents are not suitable.

Fluorocarbon (FPM)

Fluorocarbon is a well-known high performance rubber, especially it has excellent resistance to high temperature, ozone, weather, oxygen, mineral oil, fuels, hydraulic fluids, aromatics and many organic solvents and chemicals.

Now we can supply parts made by Viton® system gum like general type (A-TYPE, 66% fluorine) middle fluorine content type (B-, GBL-TYPE, 67~68.5% fluorine), high fluorine content type (F-, GF-TYPE, 70% fluorine), improving low temperature flexibility type (GLT-, GFLT) and excellent resistant to more chemicals and solvents Viton® ETP Extreme. We also can supply excellent acid and alkali resistance parts made by AFLAS®.

SERVICE TEMPERATURE

For general type the service temperature is better limited to approximately from - 26°C (-15°F) to 232°C (450°F) in static application, though the service temperature can arrive to 275°C at short time but up to 232°C the parts life will be shortened.

In dynamic application it is suitable between -15°C and 200°C.

For GLT-type the low temperature can be down below -40°C.

HARDNESS

For general type the hardness from 50 to 90 Shore A are available.

For others type 60 to 90 Shore A are appropriate.

APPLICATION

Because FPM has excellent resistance to high temperature, oil, solvent, flame, chemical and weather, it is usually applied in automotive, chemical processing, aerospace and many industries.

Viton® GLT has more broad usable thermal range of -45°C to +275°C and outstanding aggressive HTS-type oils, applied in aerospace is a good choice.

Viton® EPT usually applies in chemical industrial field.

Some fuels add several methanol, Viton® F- and B-type are more usable than A-type especially F-type. Some lubricant add a few organic amide or amine, choosing peroxide curing system Viton® will be better than bisphenol curing system.

ETHYLENE PROPYLENE RUBBER (EPM, EPDM.)

EPM is a Copolymer of ethylene and propylene, EPDM is terpolymer of ethylene and propylene with a small amount of a third monomer (usually a diolefin) to permit vulcanization with sulfur. Generally Ethylene Propylene Rubber posses excellent resistance to ozone, sunlight and weathering, and have very good flexibility at low temperature, good chemical resistance (many dilute acids and alkalis, polar solvents), and good electrical insulation property.

SERVICE TEMPERATURE

For EPDM the service temperature can be designed from -55°C to 125°C or up to 150°C (for peroxide cured systems).

APPLICATION

In phosphate-ester based hydraulic fluids and glycol based brake fluids systems Ethylene Propylene Rubber is good choice for sealing parts. Applying in domestic water, rubber parts must pass the chloramine and chlorine resistance test. It is not suitable for any types Ethylene Propylene Rubber, higher saturated EPDM or EPM and higher ethylene content will be good for chloramine and chlorine attacking. It also usually be used in hot water or steam up to 150°C.

Ethylene Propylene Rubber is not suitable in petroleum fluid (fuels, mineral oils, greases).

SILICONE

Physically, silicone are based on silicon, an element derived from quartz. To create this class of synthetic elastomers, pendant organic groups such as methyl, phenyl and vinyl are attached to silicon atoms. The different addition of side chains can achieve significant variations in properties. Silicones have excellent heat, ozone and corona resistance, very well dielectric stability, and resistance to many oils, chemicals, and solvents. And for all elastomers, silicones possess the best flexible property at low temperature. But it also have some weakness like low tensile strength, poor tear and wear resistance.

SERVICE TEMPERATURE

For Silicones the service temperature are from -60°C to 225°C. Some special types can be used in extreme temperature up to 300°C and down to -100°C.

HARDNESS

25 to 90 Shore A are available.

APPLICATION

Silicone rubber performs well under environmental and temperature extremes, it usually be applied in automotive and aerospace industries, where flexibility and longevity are important. It also has outstanding electrical insulating properties, applying in strict performance standards are critical. And it is a suitable material for parts that need FDA approval for food handling equipment and appliances.

FLUOROSILICONE (FVMQ)

Fluorosilicone is like silicone rubber, bonding trifluoropropyl, methyl, and vinyl as side chains. The mechanical and physical properties are similar to VMQ. However, FVMQ offers improved fuel and mineral oil resistance.

SERVICE TEMPERATURE

For FVMQ the service temperature are from -60°C to 177°C. In dry heat, the serviceable temperature range can extend to 232°C.

HARDNESS

45 to 80 Shore A are available.

APPLICATION

FVMQ offers excellent low-temperature flexibility and good for fuel and aromatic mineral oil. It is usually applied in contact with jet and automotive fuels, most solvents, or engine oil, especially in aerospace industry.

NEOPRENE (CR)

Neoprene was one of the first successful synthetic elastomers in 1931 by Dupont. It is prepared by emulsion polymerization of Neoprene, or 2-chlorobutadiene. CR is a multi-purpose elastomer which yields a balanced combination of properties. It has good resistance to sun, ozone, weather and perform well in contact with oils and many chemicals. It also display outstanding physical toughness and good resistance to fire.

SERVICE TEMPERATURE

The service temperature of Neoprene can be designed from -40°C to 100°C or up to 125°C depending on different grades. Generally higher than 100°C, life time will be shortened.

HARDNESS

30 to 90 Shore A are available.

APPLICATION

Neoprene has been used thousands of diverse environments, including automotive, wire and cable industries.

GENERAL PROPERTIES OF MOST USED ELASTOMERS

	NITRILE (HIGH NITRILE)	NEOPRENE	ETHYLENE PROPYLENE TERPOLYMER	POLYACRYLATE	SILICONE	FLUORO- SILICONE	FLUORO- CABON
ASTM D1418 DESIGNATION	NBR	CR	EPDM	ACM	MQ. PMQ	FVMQ	FPM
ASTM D2000 /SAE J200 TYPE CLASS	BF.BG BK.CH	BC.BE	AA.BA.CA	DF.DH	VMQ.PVMQ FC.FE.GE	FK	HK
HARDNESS, SHORE A	40-90	30-90	30-90	40-85	30-85	60-80	60-95
TENSILE STRENGTH MAX, REINF (PSI)	4000	4000	3000	2500	1200	1200	2500
ELONGATION MAX, REINF(%)	600	600	600	400	700	400	300
SPECIFIC GRAVITY	1.00	1.24	0.86	1.09	0.98	0.98	1.85
BRITTLE POINT (F)	-40	-80	-90	-40	-90 TO -180	-85	-40
COMPRESSION SET	G-E	G-E	G-E	G	F-E	G	G-E
RESILIENCE AT 73°F	G	G-E	G	F	P-E	F	F
ELECTRICAL PROPERTIES	P-F	E	E	F	G-E	E	G
ADHESION TO METAL	G-E	G-E	F-G	G	G	F	F
RESISTANCE TO							
ABRASION	E	E	G	F	P-F	P	G
TEARING	G	F-G	F	P-F	P-F	P	F-G
FLAME	P	G-E	P	P	F-E	F	E
OZONE	P-F	E	E	E	E	E	E
WEATHER	P	E	E	E	E	E	E
OXIDATION	G	E	E	G	E	E	E
WATER	E	G	E	P	G-E	E	E
STEAM	F-G	F	G-E	VP	F-G	F-G	G
ACID (DILUTED)	G	E	E	P-F	G	E	E
ACID (CONCENTRATED)	G	E	E	P-F	F	G	E
ALKALIES (DILUTED)	G	E	E	P-F	E	E	E
ALKALIES (CONCENTRATED)	G	E	E	P-F	E	G	E
SYNTHETIC LUBRICANTS	G-E	P	VP	P	VP	E	E
LUBRICATING OILS (HIGH ANILINE)	E	E	VP	E	G	E	E
LUBRICATING OILS (LOW ANILINE)	E	G	VP	E	F	E	E
ANIMAL, VEGETABLE OILS	G	G	G-E	G	E	E	E
GAS PERMEABILITY	G-E	G	F	G	P	P	E

E = EXCELLENT, G = GOOD, F = FAIR, P = POOR, VP = VERY POOR

CONDENSED LISTING : STANDARD INCH SIZE O-RING SIZES

British Standard (BS 1806 : 1962) Size in bold, others to American Standard AS568

SECTION					SECTION				
i.d	1/16	3/32	1/8	3/16	i.d	1/16	3/32	1/8	3/16
1/32	001*				1 9/16		129		
3/64	002**				1 5/8	030	130	223	326
1/16	003	102			1 11/16		131		
5/64	004				1 3/4	031	132	224	327
3/32	005	103			1 13/16		133		
1/8	006	104			1 7/8	032	134	225	328
5/32	007	105			1 15/16		135		
3/16	008	106	201		2	033	136	226	329
7/32	009	107			2 1/16		137		
1/4	010	108	202		2 1/8	034	138	227	330
5/16	011	109	203		2 3/16		139		
3/8	012	110	204		2 1/4	035	140	228	331
7/16	013	111	205	309	2 5/16		141		
1/2	014	112	206	310	2 3/8	036	142	229	332
9/16	015	113	207	311	2 7/16		143		
5/8	016	114	208	312	2 1/2	037	144	230	333
11/16	017	115	209	313	2 9/16		145		
3/4	018	116	210	314	2 3/8	038	146	231	334
13/16	019	117	211	315	2 11/16		147		
7/8	020	118	212		2 1/4	039	148	232	335
15/16	021	119	213	317	2 13/16		149		
1	022	120	214	318	2 7/8	040	150	233	336
1 1/16	023	121	215	319	3	041	151	234	337
1 1/8	024	122	216	320	3 1/8			235	338
1 3/16	025	123	217	321	3 1/4	042	152	236	339
1 1/4	026	124	218	322	3 1/8			237	340
1 5/8	027	125	219	323	3 1/2	043	153	238	341
1 3/8	028	126	220	324	3 5/8			239	342
1 7/16		127	221		3 3/4	044	154	240	343
1 1/2	029	128	222	325	3 7/8			241	344

* 1/32 Section ** 3/64 Section

O-Ring

SECTION						SECTION			
i.d	1/16	3/32	1/8	3/16	1/4	i.d	1/8	3/16	1/4
4	045	155	242	345		10	274	377	449
4 1/8			243	346		10 1/4			449A
4 1/4	046	156	244	347		10 1/2	275	378	450
4 3/8			245	348		10 3/4			450A
4 1/2	047	157	246	349	425	11	276	379	451
4 5/8			247	350	426	11 1/4			451A
4 3/4	048	158	248	351	427	11 1/2	277	380	452
4 7/8			249	352	428	11 3/4			452A
5	049	159	250	353	429	12	278	381	453
5 1/8			251	354	430	12 1/2			454
5 1/4	050	160	252	355	431	13	279	382	455
5 3/8			253	356	432	13 1/2			456
5 1/2		161	254	357	433	14	280	383	457
5 5/8			255	358	434	14 1/2			458
5 3/4		162	256	359	435	15	281	384	459
5 7/8			257	360	436	15 1/2			460
6		163	258	361	437	16	282	385	461
6 1/4		164	259	362	438	16 1/2			462
6 1/2		165	260	363	439	17	283	386	463
6 3/4		166	261	364	440	17 1/2			464
7		167	262	365	441	18	284	387	465
7 1/4		168	263	366	442	18 1/2			466
7 1/2		169	264	367	443	19		388	467
7 3/4		170	265	368	444	19 1/2			468
8		171	266	369	445	20		389	469
8 1/4		172	267	370	445A	21		390	470
8 1/2		173	268	371	446	22		391	471
8 3/4		174	269	372	446A	23		392	472
9		175	270	373	447	24		393	473
9 1/4		176	271	374	447A	25		394	474
9 1/2		177	272	375	448	26		395	475
9 3/4		178	273	376	448A				

TABLES OF AMERICAN STANDARDS (AS SERIES)

AS-0XX Size : Cross-section W = 1.78 mm							
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-001*	0.74	-016	15.60	-031	44.17	-046	107.67
-002*	1.07	-017	17.17	-032	47.35	-047	114.02
-003*	1.42	-018	18.77	-033	50.52	-048	120.37
-004	1.78	-019	20.35	-034	53.70	-049	126.72
-005	2.57	-020	21.95	-035	56.87	-050	133.07
-006	2.90	-021	23.52	-036	60.05		
-007	3.68	-022	25.12	-037	63.22		
-008	4.47	-023	26.70	-038	66.40		
-009	5.28	-024	28.30	-039	69.57		
-010	6.07	-025	29.87	-040	72.75		
-011	7.65	-026	31.47	-041	75.92		
-012	9.25	-027	33.05	-042	82.27		
-013	10.82	-028	34.65	-043	88.62		
-014	12.42	-029	37.82	-044	94.97		
-015	14.00	-030	41.00	-045	101.32		

*Please note : for AS-001 cross-section W = 1.02 mm
for AS-002 cross-section W = 1.27 mm
for AS-003 cross-section W = 1.52 mm

AS-1XX Size : Cross-section W = 2.62 mm							
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-102	1.24	-112	12.37	-122	28.24	-132	44.12
-103	2.06	-113	13.94	-123	29.82	-133	45.69
-104	2.84	-114	15.54	-124	31.42	-134	47.29
-105	3.63	-115	17.12	-125	32.99	-135	48.90
-106	4.42	-116	18.72	-126	34.59	-136	50.47
-107	5.23	-117	20.29	-127	36.17	-137	52.07
-108	6.02	-118	21.89	-128	37.77	-138	53.64
-109	7.59	-119	23.47	-129	39.34	-139	55.25
-110	9.19	-120	25.07	-130	40.94	-140	56.82
-111	10.77	-121	26.64	-131	42.52	-141	58.42

AS-1XX Size : Cross-section W = 2.62 mm							
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-142	59.99	-152	82.22	-162	145.72	-172	209.22
-143	61.60	-153	88.57	-163	152.07	-173	215.57
-144	63.17	-154	94.92	-164	158.42	-174	221.92
-145	64.77	-155	101.27	-165	164.77	-175	228.27
-146	66.34	-156	107.62	-166	171.12	-176	234.62
-147	67.95	-157	113.97	-167	177.47	-177	240.97
-148	69.52	-158	120.32	-168	183.82	-178	247.32
-149	71.12	-159	126.67	-169	190.17		
-150	72.69	-160	133.02	-170	196.52		
-151	75.87	-161	139.37	-171	202.87		

AS-2XX Size : Cross-section W = 3.53 mm							
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-201	4.34	-222	37.69	-243	104.37	-264	190.09
-202	5.94	-223	40.87	-244	107.54	-265	196.44
-203	7.52	-224	44.04	-245	110.72	-266	202.79
-204	9.12	-225	47.22	-246	113.89	-267	209.14
-205	10.69	-226	50.39	-247	117.07	-268	215.49
-206	12.29	-227	53.57	-248	120.24	-269	221.84
-207	13.87	-228	56.74	-249	123.42	-270	228.19
-208	15.47	-229	59.92	-250	126.59	-271	234.54
-209	17.04	-230	63.09	-251	129.77	-272	240.89
-210	18.64	-231	66.27	-252	132.94	-273	247.24
-211	20.22	-232	69.44	-253	136.12	-274	253.59
-212	21.82	-233	72.62	-254	139.29	-275	266.29
-213	23.39	-234	75.79	-255	142.47	-276	278.99
-214	24.99	-235	78.97	-256	145.64	-277	291.69
-215	26.57	-236	82.14	-257	148.82	-278	304.39
-216	28.17	-237	85.32	-258	151.99	-279	329.79
-217	29.74	-238	88.49	-259	158.34	-280	355.19
-218	31.34	-239	91.67	-260	164.69	-281	380.59
-219	32.92	-240	94.84	-261	171.04	-282	405.26
-220	34.52	-241	98.02	-262	177.39	-283	430.66
-221	36.09	-242	101.19	-263	183.74	-284	456.06

AS-XXX SERIES

AS-3XX Size : Cross-section W = 5.33 mm							
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-309	10.46	-334	66.04	-359	145.42	-384	380.37
-310	12.07	-335	69.22	-360	148.59	-385	405.26
-311	13.64	-336	72.39	-361	151.77	-386	430.66
-312	15.24	-337	75.57	-362	158.12	-387	456.06
-313	16.81	-338	78.74	-363	164.47	-388	481.41
-314	18.42	-339	81.92	-364	170.82	-389	506.81
-315	19.99	-340	85.09	-365	177.17	-390	532.21
-316	21.59	-341	88.27	-366	183.52	-391	557.61
-317	23.16	-342	91.44	-367	189.87	-392	582.68
-318	24.77	-343	94.62	-368	196.22	-393	608.08
-319	26.34	-344	97.79	-369	202.57	-394	633.48
-320	27.94	-345	100.97	-370	208.92	-395	658.88
-321	29.51	-346	104.14	-371	215.27		
-322	31.12	-347	107.32	-372	221.62		
-323	32.69	-348	110.49	-373	227.97		
-324	34.29	-349	113.67	-374	234.32		
-325	37.47	-350	116.84	-375	240.67		
-326	40.64	-351	120.02	-376	247.02		
-327	43.82	-352	123.19	-377	253.37		
-328	46.99	-353	126.37	-378	266.07		
-329	50.17	-354	129.54	-379	278.77		
-330	53.34	-355	132.72	-380	291.47		
-331	56.52	-356	135.89	-381	304.17		
-332	59.69	-357	139.07	-382	329.57		
-333	62.87	-358	142.24	-383	354.97		

AS-XXX SERIES

AS-4XX Size : Cross-section W = 6.99 mm					
AS Nr.	ID. mm	AS Nr.	ID. mm	AS Nr.	ID. mm
-425	113.67	-447A	234.90	-467	481.46
-426	116.84	-448	240.67	-468	494.16
-427	120.02	-448A	247.65	-469	506.86
-428	123.19	-449	253.37	-470	532.26
-429	126.37	-449A	260.35	-471	557.66
-430	129.54	-450	266.07	-472	582.68
-431	132.72	-450A	273.05	-473	608.08
-432	135.89	-451	278.77	-474	633.48
-433	139.07	-451A	285.75	-475	658.88
-434	142.24	-452	291.47		
-435	145.42	-452A	298.45		
-436	148.59	-453	304.17		
-437	151.77	-454	316.87		
-438	158.12	-455	329.57		
-439	164.47	-456	342.27		
-440	170.82	-457	354.97		
-441	177.17	-458	367.67		
-442	183.52	-459	380.37		
-443	189.87	-460	393.07		
-444	196.22	-461	405.26		
-445	202.57	-462	417.96		
-445A	209.55	-463	430.66		
-446	215.27	-464	443.36		
-446A	222.25	-465	456.06		
-447	227.97	-466	468.76		

O-RING SIZE CROSS REFERENCE TABLE

These O-rings are intended for use with internal straight thread fluid connection bosses and tube fittings.

AS568A Dash No.	Dash No.	Tube O.D. (Ref.)	Metric O-Ring Size per AS568A (Units are in Millimeters)		O-Ring Size - Actual per AS568A (Units are in inches)	
			I.D.	W	I.D.	W
AS-901	-01	$\frac{3}{32}$	4.70	1.42	.185	.056
AS-902	-02	$\frac{1}{8}$	6.07	1.63	.239	.064
AS-903	-03	$\frac{3}{16}$	7.65	1.63	.301	.064
AS-904	-04	$\frac{1}{4}$	8.92	1.83	.351	.072
AS-905	-05	$\frac{5}{16}$	10.52	1.83	.414	.072
AS-906	-06	$\frac{3}{8}$	11.89	1.98	.468	.078
AS-907	-07	$\frac{7}{16}$	13.46	2.08	.530	.082
AS-908	-08	$\frac{1}{2}$	16.36	2.21	.644	.087
AS-909	-09	$\frac{9}{16}$	17.93	2.46	.706	.097
AS-910	-10	$\frac{5}{8}$	19.18	2.46	.755	.097
AS-911	-11	$\frac{11}{16}$	21.92	2.95	.863	.116
AS-912	-12	$\frac{3}{4}$	23.47	2.95	.924	.116
AS-913	-13	$\frac{13}{16}$	25.04	2.95	.986	.116
AS-914	-14	$\frac{7}{8}$	26.59	2.95	1.047	.116
AS-916	-16	1	29.74	2.95	1.171	.116
AS-918	-18	$1\frac{1}{8}$	34.42	2.95	1.355	.116
AS-920	-20	$1\frac{1}{4}$	37.47	3.00	1.475	.118
AS-924	-24	$1\frac{1}{2}$	43.69	3.00	1.720	.118
AS-928	-28	$1\frac{3}{4}$	53.09	3.00	2.090	.118
AS-932	-32	2	59.36	3.00	2.337	.118

TABLES OF JAPANESE STANDARDS (P SERIES)

Table of dimensions of O-rings for dynamic sealing and static sealing of cylindrical surface and flat surface (JIS B2401) (JIS B2406) (JASO 6605) all dimensions in mm.

O-Ring thickness (w) = 1.9 ± 0.07			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 3	1003	2.8	0 ± 0.12
P 4	1004	3.8	
P 5	1005	4.8	
P 6	1006	5.8	
P 7	1007	6.8	
P 8	1008	7.8	
P 9	1009	8.8	
P 10	1010	9.8	
	1011	11.0	
	1012	12.3	
	1013	13.0	0 ± 0.15
	1014	13.8	
	1015	14.8	
	1016	15.8	
	1017	16.8	
	1018	17.8	
	1019	18.8	
	1020	19.8	
	1021	21.0	
	1022	22.1	
	1023	23.3	
	1025	24.7	
	1026	26.2	
	1028	27.7	
	1030	29.7	
	1031	31.2	
	1033	33.2	
	1035	35.2	

O-Ring thickness (w) = 2.4 ± 0.07			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 10A	2010	9.8	± 0.12
P 11	-	10.8	
P 11.2	2011	11.0	
P 12	-	11.8	
P 12.5	2012	12.3	
-	2013	13.0	
P 14	2014	13.8	
P 15	2015	14.8	
P 16	2016	15.8	
-	2017	16.8	
P 18	2018	17.8	± 0.15
-	2019	18.8	
P 20	2020	19.8	
P 21	2021	20.8	
P 22	-	21.8	
-	2022	22.1	
-	2023	23.3	
-	2025	24.7	
-	2026	26.2	
-	2028	27.7	
-	2030	29.7	
-	2031	31.2	
-	2033	33.2	
-	2035	35.2	
-	2037	37.2	
-	2040	39.7	± 0.25
-	2042	42.2	
-	2045	44.7	
-	2047	47.2	
-	2050	49.7	
-	2053	52.6	
-	2056	55.5	
-	2060	59.6	
-	2063	62.6	
-	2067	66.6	
-	2071	70.6	± 0.4

TABLES OF JAPANESE STANDARDS (P SERIES)

O-Ring thickness (w) = 3.5 ± 0.1			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 22A	-	21.7	
P 22.4	3022	22.1	
P 24	3024	23.7	
P 25	3025	24.7	
P 25.5	-	25.2	
P 26	3026	25.7	
P 28	3028	27.7	
P 29	-	28.7	
P 29.5	-	29.2	
P 30	3030	29.7	
P 31	-	30.7	±0.15
P 31.5	3031	31.2	
P 32	-	31.7	
P 34	3034	33.7	
P 35	-	34.7	
P 35.5	3035	35.2	
P 36	-	35.7	
P 38	3038	37.7	
P 39	3039	38.7	
P 40	3040	39.7	
P 41	-	40.7	
P 42	3042	41.7	
P 44	3044	43.7	
P 45	3045	44.7	
P 46	-	45.7	
P 48	3048	47.7	
P 49	-	48.7	
P 50	3050	49.7	
-	3053	52.6	
-	3056	55.6	
-	3060	59.6	±0.25
-	3063	62.6	
-	3067	66.6	
-	3071	70.6	
-	3075	74.6	

O-Ring thickness (w) = 3.5 ± 0.1			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
-	3080	79.6	±0.4
-	3085	84.6	
-	3090	89.6	
-	3095	94.6	
-	3100	99.6	
-	3106	105.6	
-	3112	111.6	

O-Ring thickness (w) = 5.7 ± 0.15			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
-	3118	117.6	±0.4
-	3125	124.6	
-	3132	131.6	±0.6
-	3140	139.6	
-	3150	149.6	
P 48A		47.6	
P 50A		49.6	±0.25
P 52		51.6	
P 53		52.6	
P 55		54.6	
P 56		55.6	
P 58		57.6	
P 60		59.6	
P 62		61.6	
P 63		62.6	
P 65		64.6	
P 67		66.6	±0.4
P 70		69.6	
P 71		70.6	
P 75		74.6	±0.4
P 80		79.6	

TABLES OF JAPANESE STANDARDS (P SERIES)

O-Ring thickness (w) = 5.7 ± 0.15			
Nominal size by JIS B 2401	Nominal size by JIS B 2401	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 85		84.6	±0.4
P 90		89.6	
P 95		94.6	
P 100		99.6	
P 102		101.6	
P 105		104.6	
P 110		109.6	
P 112		111.6	
P 115		114.6	
P 120		119.6	
P 125		124.6	
P 130		129.6	±0.6
P 132		131.6	
P 135		134.6	
P 140		139.6	
P 145		144.6	
P 150		149.6	

O-Ring thickness (w) = 8.4 ± 0.15			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 150A		149.5	±0.6
P 155		154.5	
P 160		159.5	
P 165		164.5	
P 170		169.5	
P 175		174.5	
P 180		179.5	
P 185		184.5	±0.8
P 190		189.5	
P 195		194.5	
P 200		199.5	

O-Ring thickness (w) = 8.4 ± 0.15			
Nominal size by JIS B 2401	Nominal size by JASO 6605 (automobile standards)	Dimensions of O-Rings	
		Inside diameter (ID.)	
P 205		204.5	±0.8
P 209		208.5	
P 210		209.5	
P 215		214.5	
P 220		219.5	
P 225		224.5	
P 230		229.5	
P 235		234.5	
P 240		239.5	
P 245		244.5	
P 250		249.5	
P 255		254.5	
P 260		259.5	
P 265		264.5	
P 270		269.5	
P 275		274.5	
P 280		279.5	
P 285		284.5	
P 290		289.5	
P 295		294.5	
P 300		299.5	
P 315		314.5	±1.0
P 320		319.5	
P 335		334.5	
P 340		339.5	
P 355		354.5	
P 360		359.5	
P 375		374.5	
P 385		384.5	
P 400		399.5	

TABLES OF JAPANESE STANDARDS (G SERIES)

Table of dimensions of O-rings for static sealing of cylindrical surface and flat surface (JIS B2401) (JIS B2406) all dimensions in mm.

O-Ring thickness (w) = 3,1 ± 0.1			O-Ring thickness (w) = 5.7 ± 0.15			
Nominal size by JIS B 2401	Dimensions of O-Rings		Nominal size by JIS B 2401	Dimensions of O-Rings		
	Inside diameter (ID.)			Inside diameter (ID.)		
G 25	24.4	±0.15	G 150	149.3	±0.6	
G 30	29.4		G 155	154.3		
G 35	34.4		G 160	159.3		
G 40	39.4		G 165	164.3		
G 45	44.4	±0.25	G 170	169.3		
G 50	49.4		G 175	174.3		
G 55	54.4		G 180	179.3		
G 60	59.4		G 185	184.3		
G 65	64.4		G 190	189.3		
G 70	69.4		G 195	194.3		
G 75	74.5	±0.4	G 200	199.3	±0.8	
G 80	79.4		G 210	209.3		
G 85	84.4		G 220	219.3		
G 90	89.4		G 230	229.3		
G 95	94.4		G 240	239.3		
G 100	99.4		G 250	249.3		
G 105	104.4		G 260	259.3		
G 110	109.4		G 270	269.3		
G 115	114.4		G 280	279.3		
G 120	119.4		G 290	289.3		
G 125	124.4		G 300	299.3		
G 130	129.4	±0.6				
G 135	134.4					
G 140	139.4					
G 145	144.4					

TABLES OF JAPANESE STANDARDS (S SERIES)

Table of dimensions of O-rings for static sealing (S Standard : rubber materials : nitrile rubber) all dimensions in mm.

O-Ring thickness (w) = 1.5 ± 0.1		
Nominal size	Dimensions of O-Rings	
	Inside diameter (ID.)	
S 3	2.5	
S 4	3.5	
S 5	4.5	
S 6	5.5	
S 7	6.5	
S 8	7.5	
S 9	8.5	
S 10	9.5	
S 11.2	10.7	±0.15
S 12	11.5	
S 12.5	12.0	
S 14	13.5	
S 15	14.5	
S 16	15.5	
S 18	17.5	
S 20	19.5	
S 22	21.5	

O-Ring thickness (w) = 2.0 ± 0.1		
Nominal size	Dimensions of O-Rings	
	Inside diameter (ID.)	
S 22.4	21.9	
S 24	23.5	
S 25	24.5	
S 26	25.5	
S 28	27.5	
S 29	28.5	±0.15
S 30	29.5	
S 31.5	31.0	
S 32	31.5	
S 34	33.5	
S 35	34.5	
S 35.5	35.0	

O-Ring thickness (w) = 2.0 ± 0.1		
Nominal size	Dimensions of O-Rings	
	Inside diameter (ID.)	
S 36	35.5	
S 38	37.5	±0.15
S 39	38.5	
S 40	39.5	
S 42	41.5	
S 44	43.5	
S 45	44.5	
S 46	45.5	
S 48	47.5	
S 50	49.5	
S 53	52.5	±0.25
S 55	54.5	
S 56	55.5	
S 60	59.5	
S 63	62.5	
S 65	64.5	
S 67	66.5	
S 70	69.5	
S 71	70.5	
S 75	74.5	
S 80	79.5	
S 85	84.5	
S 90	89.5	
S 95	94.5	
S 100	99.5	±0.4
S 105	104.5	
S 110	109.5	
S 112	111.5	
S 115	114.5	
S 120	119.5	
S 125	124.5	
S 130	129.5	
S 132	131.5	
S 135	134.5	±0.6
S 140	139.5	
S 145	144.5	
S 150	149.5	

TABLES OF JAPANESE STANDARDS (V SERIES)

Table of dimensions of O-rings for vacuum flange (JIS B2401) (JIS B2290) all dimensions in mm.

O-Ring thickness (w) = 4.0 ± 0.1		
Nominal size by JIS B 2401	Dimensions of O-Rings	
	Inside diameter (ID.)	
V 15	14.5	±0.15
V 24	23.5	
V 34	33.5	
V 40	39.5	
V 55	54.5	±0.25
V 70	69.0	
V 85	84.0	±0.4
V 100	99.0	
V 120	119.0	
V 150	148.5	
V 175	173.0	±0.6

O-Ring thickness (w) = 10.0 ± 0.3		
Nominal size by JIS B 2401	Dimensions of O-Rings	
	Inside diameter (ID.)	
V 480	475.0	±1.2
V 530	524.5	±1.6
V 585	579.0	
V 640	633.5	
V 690	683.0	
V 740	732.5	±2.0
V 790	782.0	
V 845	836.5	
V 950	940.5	±2.5
V 1055	1044.0	±3.0

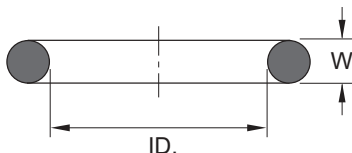
O-Ring thickness (w) = 6.0 ± 0.15*		
Nominal size by JIS B 2401	Dimensions of O-Rings	
	Inside diameter (ID.)	
V 225	222.5	±0.8
V 275	272.0	
V 325	321.5	±1.0
V 380	376.0	
V 430	425.5	±1.2



O-RING SIZE RANGE

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METRIC SIZES AND INTERNATIONAL STANDARDS



The abbreviations in the column "Standard" have the following meaning :

DIN/ISO = DIN 3771/ ISO 3601

AS = American standard AS 568 A,
British standard BS 1806

P/G/V = Japanese standard JIS B 2401

S = Japanese standard

NF = French standard NF T 47-501

R = French standard

TABLES OF STANDARD RANGE O-RING DIMENSIONS

Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.
0.74 x 1.02	$\frac{1}{32} \times \frac{3}{32} \times \frac{1}{32}$	AS-001
1.07 x 1.27	$\frac{3}{64} \times \frac{9}{64} \times \frac{3}{64}$	AS-002
1.15 x 1		
1.24 x 2.62	$\frac{1}{16} \times \frac{1}{4} \times \frac{3}{32}$	AS-102
1.25 x 1		
1.3 x 1.25		
1.4 x 1		
1.42 x 1.52	$\frac{1}{16} \times \frac{3}{16} \times \frac{1}{16}$	AS-003
1.5 x 1		
1.78 x 1.02	$\frac{1}{16} \times \frac{1}{8} \times \frac{1}{32}$	
1.78 x 1.78	$\frac{5}{64} \times \frac{13}{64} \times \frac{1}{16}$	AS-004
1.8 x 1		
1.8 x 1.5		
1.8 x 1.8		DIN/ISO/NF
1.85 x 1.5		
2 x 1		
2 x 1.5		
2 x 1.8		DIN/ISO/NF
2.06 x 2.62	$\frac{3}{32} \times \frac{9}{32} \times \frac{3}{32}$	AS-103
2.2 x 1.6		
2.24 x 1.8		DIN/ISO/NF
2.3 x 0.9		
2.4 x 1.9		R0
2.5 x 1		
2.5 x 1.5		S-3

Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.
2.5 x 1.8		DIN/ISO/NF
2.5 x 2		
2.57 x 1.78	$\frac{3}{32} \times \frac{7}{32} \times \frac{1}{16}$	AS-005
2.6 x 1.9		R1
2.75 x 1.6		R1b
2.8 x 1.5		
2.8 x 1.6		
2.8 x 1.8		DIN/ISO/NF
2.8 x 1.9		P-3
2.84 x 2.62	$\frac{1}{8} \times \frac{5}{16} \times \frac{3}{32}$	AS-104
2.9 x 1.78	$\frac{1}{8} \times \frac{1}{4} \times \frac{1}{16}$	AS-006
3 x 1		
3 x 1.5		
3 x 1.8		
3 x 2		
3 x 3		
3.1 x 1.6		
3.15 x 1.8		DIN/ISO/NF
3.17 x 1.78		
3.2 x 1.6		
3.3 x 2.4		
3.4 x 1.9		R2
3.5 x 1		
3.5 x 1.5		S-4
3.5 x 2		

O-Ring



Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.
3.5 x 3			5 x 1		
3.55 x 1.8		DIN/ISO/NF	5 x 1.2		
3.6 x 2.4			5 x 1.5		
3.63 x 2.62	$5/32 \times 11/32 \times 3/32$	AS-105	5 x 1.6		
3.68 x 1.78	$5/32 \times 9/32 \times 1/16$	AS-007	5 x 1.8		DIN/ISO/NF
3.7 x 1.6			5 x 2		
3.75 x 1.8			5 x 2.5		
3.8 x 1.9		P-4	5 x 3		
4 x 1			5 x 4		
4 x 1.5			5 x 5		
4 x 1.8		DIN/ISO/NF	5.1 x 1		
4 x 2			5.1 x 1.6		
4 x 2.5			5.15 x 1.8		DIN/ISO/NF
4 x 3			5.23 x 2.62	$7/32 \times 13/32 \times 3/32$	AS-107
4 x 4			5.28 x 1.78	$7/32 \times 11/32 \times 1/16$	AS-009
4 x 5			5.3 x 1.8		DIN/ISO/NF
4.1 x 1.6		R3	5.3 x 2.4		
4.2 x 1.9			5.5 x 1		S-6
4.3 x 2.4			5.5 x 1.5		
4.34 x 3.53	$3/16 \times 7/16 \times 1/8$	AS-201	5.5 x 1.8		
4.42 x 2.62	$3/16 \times 3/8 \times 3/32$	AS-106	5.5 x 2		
4.47 x 1.78	$3/16 \times 5/16 \times 1/16$	AS-008	5.5 x 2.4		
4.5 x 1			5.5 x 2.5		
4.5 x 1.5		S-5	5.5 x 3		
4.5 x 1.8			5.6 x 1.8		DIN/ISO/NF
4.5 x 2			5.6 x 2.4		
4.5 x 3			5.7 x 1.9		R5
4.6 x 2.4			5.8 x 1.9		P-6
4.6 x 2.5			5.94 x 3.53	$1/4 \times 1/2 \times 1/8$	AS-202
4.7 x 1.42		AS-901	6 x 1		
4.7 x 1.6			6 x 1.5		
4.76 x 1.78			6 x 1.8		DIN/ISO/NF
4.8 x 1.9		P-5	6 x 2		
4.87 x 1.8		DIN/ISO/NF	6 x 2.2		R6b
4.9 x 1.9		R4	6 x 2.5		

Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension ID. x W Metric	Nominal Dimension U.S.standard	Ref. No.
6 x 3			7.5 x 1		
6 x 4			7.5 x 1.5		S-8
6 x 4.5			7.5 x 1.8		DIN/ISO/NF
6 x 5			7.5 x 2		
6 x 6			7.5 x 2.4		
6.02x 2.62	$\frac{1}{4} \times \frac{1}{16} \times \frac{3}{32}$	AS-108	7.5 x 2.5		
6.07x 1.63		AS-902	7.5 x 3		
6.07x 1.78	$\frac{1}{4} \times \frac{3}{8} \times \frac{1}{16}$	AS-010	7.52 x 3.53	$\frac{5}{16} \times \frac{9}{16} \times \frac{1}{8}$	AS-203
6.1 x 1.6			7.59 x 2.62	$\frac{5}{16} \times \frac{1}{2} \times \frac{3}{32}$	AS-109
6.3 x 1.8		DIN/ISO/NF	7.6 x 2.4		
6.3 x 2.4			7.65 x 1.63		AS-903
6.35x 1.78		R5b	7.65 x 1.78	$\frac{5}{16} \times \frac{7}{16} \times \frac{1}{16}$	AS-011
6.4 x 1.9		R5a	7.8 x 1.9		P-8
6.5 x 1			7.94 x 1.78		
6.5 x 1.5		S-7	8 x 1		
6.5 x 2			8 x 1.5		
6.5 x 2.5			8 x 1.8		DIN/ISO/NF
6.5 x 3			8 x 1.9		R6a
6.6 x 2.4			8 x 2		
6.7 x 1.8		DIN/ISO/NF	8 x 2.5		
6.75x 1.78			8 x 3		
6.8 x 1.9		P-7	8 x 3.5		
6.9 x 1.8		DIN/ISO/NF	8 x 4		
7 x 1			8 x 4.5		
7 x 1.5			8 x 5		
7 x 2			8.1 x 1.6		
7 x 2.5			8.3 x 2.4		
7 x 3			8.35 x 2.7		
7 x 4			8.5 x 1		
7 x 5			8.5 x 1.5		S-9
7 x 6			8.5 x 1.8		
7.1 x 1.6			8.5 x 2		DIN/ISO/NF
7.1 x 1.8			8.5 x 2.5		
7.2 x 1.9		DIN/ISO/NF	8.5 x 3		
7.3 x 2.4		R6	8.6 x 2.4		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
8.73 x 1.78		DIN/ISO/NF P-9 R7 R8
8.75 x 1.8		
8.8 x 1.9		
8.9 x 1.9		
8.9 x 2.7		
8.92 x 1.83		AS-904 DIN/ISO/NF
9 x 1		
9 x 1.5		
9 x 1.8		
9 x 2		
9 x 2.2		
9 x 2.5		
9 x 3		
9 x 3.5		
9 x 4		
9 x 4.5	$\frac{3}{8} \times \frac{5}{8} \times \frac{1}{8}$	AS-204
9 x 5		
9 x 6		
9.1 x 1.6		
9.12 x 3.53		
9.13 x 2.62	$\frac{3}{8} \times \frac{9}{16} \times \frac{3}{32}$ $\frac{3}{8} \times \frac{1}{2} \times \frac{1}{6}$	AS-110 AS-012
9.19 x 2.62		
9.25 x 1.78		
9.3 x 2.4		
9.5 x 1		
9.5 x 1.5		S-10 DIN/ISO/NF
9.5 x 1.8		
9.5 x 2		
9.5 x 2.5		
9.5 x 3		
9.5 x 4.5		R8b P-10 P-10A
9.52 x 1.78		
9.6 x 2.4		
9.8 x 1.9		
9.8 x 2.4		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
9.9 x 2.62		DIN/ISO/NF
10 x 1		
10 x 1.5		
10 x 1.8		
10 x 2		
10 x 2.5		
10 x 3		
10 x 3.5		
10 x 4		
10 x 4.5		
10 x 5	$\frac{7}{16} \times \frac{13}{16} \times \frac{3}{16}$	AS-309
10 x 6		
10.1 x 1.6		
10.3 x 2.4		
10.46 x 5.33		
10.5 x 1		
10.5 x 1.5		
10.5 x 2		
10.5 x 2.4		
10.5 x 2.5		
10.5 x 2.7		R9 AS-905 DIN/ISO/NF
10.5 x 3		
10.5 x 4.5		
10.52 x 1.83		
10.6 x 1.8		
10.6 x 2.4	$\frac{7}{16} \times \frac{11}{16} \times \frac{1}{8}$	AS-205 S-11.2
10.69 x 3.53		
10.7 x 1.5		
10.72 x 1.83		
10.77 x 2.62		
10.8 x 2.4	$\frac{7}{16} \times \frac{5}{8} \times \frac{3}{32}$	AS-111
10.82 x 1.78		
11 x 1		
11 x 1.5		
11 x 1.9		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
11 x 2		P-11.2
11 x 2.4		
11 x 2.5		
11 x 3		
11 x 3.5		
11 x 4		
11 x 4.5		
11 x 5		
11 x 6		
11.1 x 1.6		
11.11 x 1.78		DIN/ISO/NF S-12
11.2 x 1.8		
11.3 x 2.4		
11.5 x 1		
11.5 x 1.5		
11.5 x 2		
11.5 x 2.4		
11.5 x 2.5		
11.5 x 3		
11.6 x 2.4		
11.7 x 5.8		DIN/ISO/NF P-12 AS-906
11.8 x 1.8		
11.8 x 2.4		
11.89 x 1.98		
11.91 x 1.78		
11.91 x 2.62		S-12.5
12 x 1		
12 x 1.5		
12 x 2		
12 x 2.5		
12 x 3		
12 x 3.5		
12 x 4		
12 x 4.5		
12 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
12 x 5.6		AS-310 R10
12 x 6		
12.07 x 5.33	$\frac{1}{2} \times \frac{7}{8} \times \frac{3}{16}$	
12.1 x 1.6		
12.1 x 2.7		
12.29 x 3.53	$\frac{1}{2} \times \frac{3}{4} \times \frac{1}{8}$	AS-206
12.3 x 1.9		P-12.5 AS-112 AS-014
12.3 x 2.4		
12.37 x 2.62	$\frac{1}{2} \times \frac{11}{16} \times \frac{3}{32}$	
12.42 x 1.78	$\frac{1}{2} \times \frac{5}{8} \times \frac{1}{16}$	
12.5 x 1		DIN/ISO/NF
12.5 x 1.5		
12.5 x 1.8		
12.5 x 2		
12.5 x 2.5		
12.5 x 3		
12.5 x 3.5		
12.6 x 2.4		
12.7 x 2.62		
13 x 1		
13 x 1.5		
13 x 1.9		
13 x 2		
13 x 2.4		
13 x 2.5		
13 x 3		
13 x 3.5		
13 x 4		
13 x 4.5		
13 x 5		
13 x 6		DIN/ISO/NF
13.1 x 1.6		
13.1 x 2.62		
13.2 x 1.8		
13.3 x 2.4		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
13.46 x 2.08		AS-907	14.6 x 2.4		P-15
13.5 x 1		S-14	14.8 x 1.9		
13.5 x 1.5			14.8 x 2.4		
13.5 x 2			15 x 1		
13.5 x 2.4			15 x 1.5		
13.5 x 2.5	$\frac{9}{16} \times \frac{15}{16} \times \frac{3}{16}$	R11 AS-311	15 x 1.8		DIN/ISO/NF
13.5 x 3			15 x 2		DIN/ISO/NF
13.6 x 2.4			15 x 2.5		
13.6 x 2.7			15 x 2.65		
13.64 x 5.33			15 x 3		
13.8 x 1.9	$\frac{9}{16} \times \frac{13}{16} \times \frac{1}{8}$	P-14	15 x 3.5		
13.8 x 2.4		AS-207	15 x 4		
13.87 x 3.53			15 x 4.5		
13.94 x 2.62			15 x 5		
14 x 1		AS-113	15 x 6		
14 x 1.5	$\frac{9}{16} \times \frac{11}{16} \times \frac{1}{16}$	AS-015 DIN/ISO/NF	15.08 x 2.62	$\frac{5}{8} \times 1 \times \frac{3}{16}$	R12 AS-312
14 x 1.78			15.1 x 6		
14 x 1.8			15.1 x 2.7		
14 x 2			15.2 x 3.5		
14 x 2.5			15.24 x 5.33		
14 x 2.65		DIN/ISO/NF	15.3 x 2.4	$\frac{5}{8} \times \frac{7}{8} \times \frac{1}{8}$	AS-208 S-16
14 x 3			15.47 x 3.53		
14 x 3.5			15.5 x 1		
14 x 4			15.5 x 1.5		
14 x 5			15.5 x 2		
14 x 6		S-15	15.5 x 2.4	$\frac{5}{8} \times \frac{13}{16} \times \frac{3}{32}$	AS-114 AS-016
14.1 x 1.6			15.5 x 2.5		
14.3 x 2.4			15.5 x 3		
14.5 x 1			15.5 x 4.5		
14.5 x 1.5			15.54 x 2.62		
14.5 x 2		V-15	15.6 x 1.78	$\frac{5}{8} \times \frac{3}{4} \times \frac{1}{16}$	P-16
14.5 x 2.4			15.6 x 2.4		
14.5 x 2.5			15.8 x 1.9		
14.5 x 3			15.8 x 2.4		
14.5 x 4			15.88 x 2.62		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
16 x 1	DIN/ISO/NF		17 x 4	$\frac{1}{16} \times \frac{15}{16} \times \frac{1}{8}$	AS-209
16 x 1.25			17 x 4.5		
16 x 1.5			17 x 5		
16 x 1.8			17 x 6		
16 x 1.9			17.04 x 3.53		
16 x 2	DIN/ISO/NF		17.1 x 1.6	$\frac{11}{16} \times \frac{7}{8} \times \frac{3}{32}$	AS-115 AS-017
16 x 2.5			17.12 x 2.62		
16 x 2.65			17.17 x 1.78		
16 x 3			17.3 x 2.4		
16 x 3.5			17.46 x 2.62		
16 x 4			17.5 x 1	S-18	
16 x 4.5			17.5 x 1.5		
15 x 5			17.5 x 2		
16 x 6			17.5 x 2.4		
16.1 x 1.6			17.5 x 2.5		
16.3 x 2.4	AS-908		17.5 x 3	P-18	
16.36 x 2.21			17.6 x 2.4		
16.5 x 1			17.8 x 1.9		
16.5 x 1.5			17.8 x 2.4		
16.5 x 2			17.86 x 2.62		
16.5 x 2.5			17.93 x 2.46	AS-909	
16.5 x 3			18 x 1		
16.6 x 2.4			18 x 1.5		
16.8 x 1.9			18 x 2		
16.8 x 2.4			18 x 2.5		
16.81 x 5.33	$\frac{11}{16} \times 1 \frac{1}{16} \times \frac{3}{16}$	AS-313 R13	18 x 2.65	DIN/ISO/NF	DIN/ISO/NF
16.9 x 2.7			18 x 3		
17 x 1			18 x 3.5		
17 x 1.5			18 x 3.55		
17 x 1.8			18 x 4		
17 x 2	DIN/ISO/NF		18 x 4.5		
17 x 2.5			18 x 5		
17 x 2.65			18 x 6		
17 x 3			18.1 x 1.6		
17 x 3.5			18.2 x 3		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
18.3 x 2.4	$\frac{3}{4} \times 1\frac{1}{8} \times \frac{3}{16}$	R15 R14 AS-314	19.5 x 2.4		
18.3 x 3.6			19.5 x 2.5		
18.4 x 2.7			19.5 x 3		
18.42 x 5.33			19.5 x 6		
18.5 x 1			19.6 x 2.4		
18.5 x 1.5			19.8 x 1.9	$\frac{13}{16} \times 1\frac{3}{16} \times \frac{3}{16}$	P-20 R16 AS-315
18.5 x 2			19.8 x 2.4		
18.5 x 2.5			19.8 x 3.6		
18.5 x 3			19.99 x 5.33		
18.6 x 2.4			20 x 1		
18.64 x 3.53	$\frac{3}{4} \times 1 \times \frac{1}{8}$	AS-210	20 x 1.3		DIN/ISO/NF
18.72 x 2.62	$\frac{3}{4} \times \frac{15}{16} \times \frac{3}{32}$	AS-116	20 x 1.5		
18.77 x 1.78	$\frac{3}{4} \times \frac{7}{8} \times \frac{1}{16}$	AS-018	20 x 2		
18.8 x 1.9			20 x 2.5		
18.8 x 2.4			20 x 2.65		
19 x 1			20 x 3		DIN/ISO/NF
19 x 1.5			20 x 3.5		
19 x 2			20 x 3.55		
19 x 2.5			20 x 4		
19 x 2.65		DIN/ISO/NF	20 x 4.5		
19 x 3		DIN/ISO/NF	20 x 5	$\frac{13}{16} \times 1\frac{1}{16} \times \frac{1}{8}$	AS-211
19 x 3.5			20 x 6		
19 x 3.55			20.2 x 3		
19 x 4			20.22 x 3.53		
19 x 4.5			20.3 x 1.6		
19 x 5		AS-910	20.3 x 2.4	$\frac{13}{16} \times 1 \times \frac{3}{32}$ $\frac{13}{16} \times \frac{15}{16} \times \frac{1}{16}$	AS-117 AS-019
19 x 6			20.3 x 2.62		
19.05 x 1.78			20.35 x 1.78		
19.1 x 1.6			20.5 x 1		
19.18 x 2.46			20.5 x 1.5		
19.2 x 3		S-20	20.5 x 2		
19.3 x 2.4			20.5 x 2.4		
19.5 x 1			20.5 x 2.5		
19.5 x 1.5			20.5 x 3		
19.5 x 2			20.64 x 2.62		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
20.8 x 2.4		P-21	22 x 3		
21 x 1			22 x 3.5		
21 x 1.5			22 x 4		
21 x 1.9			22 x 4.5		
21 x 2			22 x 5		
21 x 2.5			22 x 5.5		
21 x 3			22 x 6		
21 x 3.5			22.1 x 1.6		
21 x 4			22.1 x 1.9		
21 x 4.5			22.1 x 2.4		
21 x 5		DIN/ISO/NF DIN/ISO/NF R17	22.1 x 3.5		P-22.4
21 x 6			22.2 x 3		
21.2 x 2.65			22.23 x 2.62		
21.2 x 3.55			22.3 x 2.4		
21.3 x 3.6			22.4 x 2.5		
21.5 x 1		S-22	22.4 x 2.62		DIN/ISO/NF DIN/ISO/NF
21.5 x 1.5			22.4 x 3.55		
21.5 x 2			22.5 x 1		
21.5 x 2.4			22.5 x 1.5		
21.5 x 2.5			22.5 x 2		
21.5 x 3		AS-316	22.5 x 2.5		
21.5 x 4.5			22.5 x 3		
21.59 x 5.33	$\frac{7}{8} \times 1 \frac{1}{4} \times \frac{3}{16}$		22.5 x 4.5		
21.6 x 2.4			23 x 1		
21.7 x 3.5			23 x 1.5		
21.8 x 2.4		P-22	23 x 2		R18
21.82 x 3.53	$\frac{7}{8} \times 1 \frac{1}{8} \times \frac{1}{8}$	AS-212	23 x 2.5		
21.89 x 2.62	$\frac{7}{8} \times 1 \frac{1}{16} \times \frac{3}{32}$	AS-118	23 x 3		
21.9 x 2		S-22.4	23 x 3.5		
21.92 x 2.95		AS-911	23 x 3.6		
21.95 x 1.78	$\frac{7}{8} \times 1 \times \frac{1}{16}$	AS-020	23 x 4		
22 x 1			23 x 4.5		
22 x 1.5			23 x 5		
22 x 2			23 x 6		
22 x 2.5			23.16 x 5.33	$\frac{15}{16} \times 1 \frac{5}{16} \times \frac{3}{16}$	AS-317

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
23.3 x 1.9	$1\frac{5}{16} \times 1\frac{3}{16} \times \frac{1}{8}$	AS-213	24.5 x 3		R19
23.3 x 2.4			24.5 x 4.5		
23.39 x 3.53			24.6 x 2.4		
23.47 x 2.62			24.6 x 3		
23.47 x 2.95			24.6 x 3.6		
23.5 x 1		S-24	24.7 x 1.9	$1 \times 1\frac{3}{8} \times \frac{3}{16}$	P-25 AS-318 AS-214
23.5 x 1.5			24.7 x 2.4		
23.5 x 2			24.7 x 3.5		
23.5 x 2.4			24.77 x 5.33		
23.5 x 2.5			24.99 x 3.53		
23.5 x 3	$1\frac{5}{16} \times 1\frac{1}{16} \times \frac{1}{16}$	V-24 AS-021 DIN/ISO/NF	25 x 1		R19b
23.5 x 4			25 x 1.5		
23.5 x 6			25 x 2		
23.52 x 1.78			25 x 2.4		
23.6 x 2.65			25 x 2.5		
23.6 x 3.55		DIN/ISO/NF P-24	25 x 2.65		DIN/ISO/NF DIN/ISO/NF
23.7 x 3.5			25 x 3		
23.81 x 2.62			25 x 3.5		
24 x 1			25 x 3.55		
24 x 1.5			25 x 4		
24 x 2			25 x 4.5		AS-913
24 x 2.5			25 x 5		
24 x 3			25 x 6		
24 x 3.5			25 x 8		
24 x 4			25.04 x 2.95		
24 x 4.5		G-25	25.07 x 2.62	$1 \times 1\frac{3}{16} \times \frac{3}{32}$	AS-120 AS-022 P-25.5
24 x 5			25.1 x 1.6		
24 x 6			25.12 x 1.78		
24.2 x 3			25.2 x 3		
24.4 x 3.1			25.2 x 3.5		
24.5 x 1		S-25	25.3 x 2.4		S-26
24.5 x 1.5			25.4 x 1.6		
24.5 x 2			25.5 x 1.5		
24.5 x 2.4			25.5 x 2		
24.5 x 2.5			25.5 x 2.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
25.5 x 3	P-26 DIN/ISO/NF DIN/ISO/NF	
25.7 x 3.5		
25.8 x 2.65		
25.8 x 3.55		
26 x 1.5		
26 x 2		
26 x 2.5		
26 x 3		
26 x 3.5		
26 x 4		
26 x 4.5		
26 x 5		
26 x 6		
26.2 x 1.9		
26.2 x 2.4		
26.2 x 3	R20 AS-319	
26.2 x 3.6		
26.34x 5.33		
26.5 x 1.5		
26.5 x 2		
26.5 x 2.5	1 1/16 x 1 5/16 x 1/8	AS-215
26.5 x 2.65		
26.5 x 3		
26.5 x 3.55		
26.57x 3.53		
26.59x 2.95	1 1/16 x 1 1/4 x 3/32	AS-914 AS-121 AS-023
26.64x 2.62		
26.7 x 1.78		
27 x 1.5		
27 x 2		
27 x 2.5		
27 x 3		
27 x 3.5		
27 x 4		
27 x 4.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
27 x 5		
27 x 6		
27.1 x 1.6		
27.3 x 2.4		
27.3 x 2.7		R20†
27.5 x 1.5		S-28
27.5 x 2		
27.5 x 2.4		
27.5 x 2.5		
27.5 x 3		
27.5 x 4.5		P-28
27.6 x 2.4		
27.7 x 1.9		
27.7 x 2.4		
27.7 x 3.5		
27.8 x 1.6	1 1/8 x 1 1/2 x 3/16	R21 AS-320
27.8 x 3.6		
27.94 x 5.33		
28 x 1.5		
28 x 2		
28 x 2.5		DIN/ISO/NF
28 x 2.65		
28 x 3		
28 x 3.15		
28 x 3.5		
28 x 3.55		DIN/ISO/NF
28 x 4		
28 x 4.5		
28 x 5		
28 x 6		
28.17 x 3.53	1 1/8 x 1 3/8 x 1/8	AS-216
28.24 x 2.62	1 1/8 x 1 5/16 x 3/32	AS-122
28.3 x 1.78	1 1/8 x 1 1/4 x 1/16	AS-024
28.5 x 1.5		S-29
28.5 x 2		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
28.5 x 2.5 28.5 x 3 28.5 x 4.5 28.7 x 3.5 28.8 x 3.53		P-29	29.9 x 1 30 x 1.5 30 x 2 30 x 2.5 30 x 2.65		DIN/ISO/NF
29 x 1.5 29 x 2 29 x 2.5 29 x 3 29 x 3.5			30 x 3 30 x 3.5 30 x 3.55 30 x 4 30 x 4.5		DIN/ISO/NF
29 x 4 29 x 4.5 29 x 5 29 x 6 29.1 x 1.6			30 x 5 30 x 6 30.2 x 3 30.5 x 1.5 30.5 x 2		
29.1 x 2.55 29.2 x 3 29.2 x 3.5 29.3 x 3.6 29.4 x 1		R20b P-29.5 R22	30.5 x 2.5 30.5 x 3 30.7 x 3.5 30.8 x 3.6 31 x 1.5		P-31 R23
29.4 x 3.1 29.5 x 1.5 29.5 x 2 29.5 x 2.5 29.5 x 3		G-30 S-30	31 x 2 31 x 2.5 31 x 3 31 x 3.5 31 x 4		S-31.5
29.5 x 4.5 29.51 x 5.33 29.6 x 2.4 29.7 x 1.9 29.7 x 2.4	1 ³ / ₁₆ x 1 ⁹ / ₁₆ x ³ / ₁₆	AS-321	31 x 4.5 31 x 5 31 x 6 31.12 x 5.33 31.2 x 1.9	1 ¹ / ₄ x 1 ⁵ / ₈ x ³ / ₁₆	AS-322
29.7 x 3.5 29.74 x 2.95 29.74 x 3.53 29.82 x 2.62 29.87 x 1.78		P-30 AS-916 AS-217 AS-123 AS-025	31.2 x 2.4 31.2 x 3.5 31.34 x 3.53 31.42 x 2.62 31.47 x 1.78		P-31.5 AS-218 AS-124 AS-026

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
31.5 x 1.5		S-31.5	33 x 3		
31.5 x 2			33 x 3.5		
31.5 x 2.5			33 x 4		
31.5 x 2.65			33 x 4.5		
31.5 x 3			33 x 5		
31.5 x 3.55		DIN/ISO/NF	33 x 6	$1 \frac{5}{16} \times 1 \frac{7}{16} \times 1 \frac{1}{16}$	AS-027
31.5 x 4.5			33.05 x 1.78		
31.6 x 2.4			33.2 x 1.9		
31.7 x 3.5			33.2 x 2.4		
32 x 1.5			33.3 x 2.4		
32 x 2		P-32	33.5 x 1.5		S-34
32 x 2.5			33.5 x 2		
33 x 3			33.5 x 2.5		
32 x 3.5			33.5 x 2.65		
32 x 4			33.5 x 3		
32 x 4.5			33.5 x 3.15		DIN/ISO/NF V-34 P-34
32 x 5			33.5 x 3.55		
32 x 6			33.5 x 4		
32 x 8			33.7 x 3.5		
32.1 x 1.6			34 x 1.5		
32.2 x 3			34 x 2		
32.5 x 1.5			34 x 2.5		
32.5 x 2			34 x 3		
32.5 x 2.5			34 x 3.5		
32.5 x 2.65			34 x 4		
32.5 x 3	$1 \frac{5}{16} \times 1 \frac{11}{16} \times \frac{3}{16}$	DIN/ISO/NF R24 AS-323	34 x 4.5		R25
32.5 x 3.55			34 x 5		
32.5 x 3.6			34 x 6		
32.69 x 5.33			34.1 x 3.6		
32.7 x 1.3			34.2 x 3		
32.92 x 3.53	$1 \frac{5}{16} \times 1 \frac{9}{16} \times \frac{1}{8}$ $1 \frac{5}{16} \times 1 \frac{1}{2} \times \frac{3}{32}$	AS-219 AS-125	34.29 x 5.33	$1 \frac{3}{8} \times 1 \frac{3}{4} \times \frac{3}{16}$	AS-324 G-35 AS-918
32.99 x 2.62			34.4 x 3.1		
33 x 1.5			34.42 x 2.95		
33 x 2			34.5 x 1.5		
33 x 2.5			34.5 x 1.6		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
34.5 x 2		S-35	35.7 x 3.5		P-36
34.5 x 2.5		DIN/ISO/NF	35.8 x 4		
34.5 x 2.65			36 x 1.5		
34.5 x 3			36 x 1.78		
34.5 x 3.55		DIN/ISO/NF	36 x 2		
34.5 x 4.5	$1 \frac{3}{8} \times 1 \frac{5}{8} \times \frac{1}{8}$	AS-220	36 x 2.5		
34.52 x 3.53		AS-126	36 x 3		
34.59 x 2.62			36 x 3.5		
34.6 x 2.4			36 x 4		
34.65 x 1.78		AS-028	36 x 4.5		
34.7 x 3.5		P-35	36 x 5	$1 \frac{7}{16} \times 1 \frac{11}{16} \times \frac{1}{8}$	AS-221
35 x 1.5		S-35.5	36 x 6		
35 x 2			36.09 x 3.53		
35 x 2.5			36.17 x 2.62		
35 x 3			36.2 x 3		
35 x 3.5			36.27 x 1.78		DIN/ISO/NF
35 x 4			36.5 x 1.5		
35 x 4.5			36.5 x 2		
35 x 5			36.5 x 2.65		
35 x 6			36.5 x 3		
35 x 10			36.5 x 3.55		DIN/ISO/NF
35.1 x 1.6			37 x 1.5		
35.2 x 1.9			37 x 2		
35.2 x 2.4			37 x 3		
35.2 x 3			37 x 3.5		
35.2 x 3.5		P-35.5	37 x 4		
35.2 x 5.7		S-36	37 x 4.5		
35.5 x 1.5			37 x 5		
35.5 x 2			37 x 6		
35.5 x 2.5			37 x 10		
35.5 x 2.65		DIN/ISO/NF	37.1 x 1.6		R27
35.5 x 3		DIN/ISO/NF	37.2 x 2.4		
35.5 x 3.55			37.2 x 3		
35.5 x 4.5			37.3 x 3.6		
35.6 x 3.6		R26	37.4 x 4.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
37.47 x 3	1 1/2 x 1 7/8 x 3/16	AS-920	39 x 3.5		
37.47 x 5.33		AS-325, R28	39 x 4		
37.5 x 1.5		S-38	39 x 4.5		
37.5 x 2			39 x 5		
37.5 x 2.5			39 x 6		
37.5 x 2.65		DIN/ISO/NF	39.2 x 3		
37.5 x 3		DIN/ISO/NF	39.2 x 5.7		
37.5 x 3.55			39.34 x 2.62		
37.5 x 4.5			39.4 x 3.1		
37.6 x 2.4			39.45 x 1.78		
37.69 x 3.53	1 1/2 x 1 3/4 x 1/8	AS-222	39.5 x 1.5	1 9/16 x 1 3/4 x 3/32	AS-129 G-40
37.7 x 3.5	P-38	S-40	39.5 x 2		
37.77 x 2.62	1 1/2 x 1 11/16 x 3/32		39.5 x 2.5		
37.82 x 1.78	1 1/2 x 1 5/8 x 1/16		39.5 x 3		
38 x 1.5		AS-029	39.5 x 4		V-40
38 x 2			39.5 x 6		
38 x 2.5			39.6 x 2.4		
38 x 3			39.69 x 3.53		
38 x 3.5			39.7 x 2.4		
38 x 4			39.7 x 3.53		P-40
38 x 4.5			40 x 1.5		
38 x 5			40 x 2		
38 x 6			40 x 2.5		
38 x 10			40 x 3		
38.5 x 1.5			40 x 3.5		
38.5 x 2		S-39	40 x 3.55		DIN/ISO/NF
38.5 x 2.5		DIN/ISO/NF	40 x 4		
38.5 x 3			40 x 4.5		
38.7 x 2.65			40 x 5		
38.7 x 3.5		P-39	40 x 5.3		
38.7 x 3.55		DIN/ISO/NF	40 x 6		
39 x 1.5			40.2 x 3		
39 x 2			40.5 x 4.5		
39 x 2.5			40.64 x 5.33		
39 x 3			40.7 x 3.5		
				1 5/8 x 2 x 3/16	AS-326, R29 P-41

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
40.87 x 3.53	1 ⁵ / ₈ x 1 ⁷ / ₈ x ¹ / ₈	AS-223	42.5 x 3		
40.94 x 2.62	1 ⁵ / ₈ x 1 ¹³ / ₁₆ x ³ / ₃₂	AS-130	42.5 x 3.55		DIN/ISO/NF
41 x 1.5			42.5 x 5.3		DIN/ISO/NF
41 x 1.78	1 ⁵ / ₈ x 1 ³ / ₄ x ¹ / ₁₆	AS-030	42.52 x 2.62	1 ¹¹ / ₁₆ x 1 ⁷ / ₈ x ³ / ₃₂	AS-131
41 x 2			42.86 x 3.53		
41 x 2.5			43 x 1.5		
41 x 3			43 x 2		
41 x 3.5			43 x 2.5		
41 x 4			43 x 3		
41 x 4.5			43 x 3.5		
41 x 5			43 x 4		
41 x 6			43 x 4.5		
41.2 x 3.55		DIN/ISO/NF	43 x 5		
41.2 x 5.3		DIN/ISO/NF	43 x 6		
41.2 x 5.7			43.4 x 3.6		R29†
41.28 x 3.53			43.5 x 2		S-44
41.4 x 5.3		R29b	43.69 x 3		AS-924
41.5 x 2		S-42	43.7 x 3.5		P-44
41.5 x 3			43.7 x 3.55		DIN/ISO/NF
41.5 x 6			43.7 x 5.3		DIN/ISO/NF
41.6 x 2.4			43.82 x 5.33	1 ³ / ₄ x 2 ¹ / ₈ x ³ / ₁₆	AS-327, R30
41.7 x 3.5		P-42	44 x 1.5		
42 x 1.5			44 x 2		
42 x 2			44 x 2.5		
42 x 2.5			44 x 3		
42 x 3			44 x 3.5		
42 x 3.5			44 x 4		
42 x 4			44 x 4.5		
42 x 4.5			44 x 5		
42 x 5			44 x 6		
42 x 6			44 x 6.5		
42 x 8			44.04 x 3.53	1 ³ / ₄ x 2 x ¹ / ₈	AS-224
42.1 x 1.15			44.1 x 1.6		
42.2 x 2.4			44.12 x 2.62	1 ³ / ₄ x 1 ¹⁵ / ₁₆ x ³ / ₃₂	AS-132
42.2 x 3			44.17 x 1.78	1 ³ / ₄ x 1 ⁷ / ₈ x ¹ / ₁₆	AS-031

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
44.2 x 3 44.2 x 5.7 44.3 x 5.7 44.4 x 3.1 44.45 x 3.53		G-45	46 x 4 46 x 4.5 46 x 5 46 x 6 46.04 x 3.53		
44.5 x 2 44.5 x 3 44.5 x 6 44.6 x 2.4 44.7 x 2.4		S-45	46.2 x 3 46.2 x 3.55 46.2 x 5.3 46.99 x 5.33 47 x 1.5	1 7/8 x 2 1/4 x 3/16	DIN/ISO/NF DIN/ISO/NF AS-328, R31
44.7 x 3.5 44.95 x 3.53 45 x 1.5 45 x 1.6 45 x 2		P-45	47 x 2 47 x 2.5 47 x 3 47 x 3.5 47 x 3.7		
45 x 2.5 45 x 3 45 x 3.5 45 x 3.55 45 x 3.6		DIN/ISO/NF	47 x 4 47 x 4.5 47 x 5 47 x 6 47.2 x 2.4		
45 x 4 45 x 4.5 45 x 5 45 x 5.3 45 x 6		DIN/ISO/NF	47.2 x 5.7 47.22 x 3.53 47.29 x 2.62 47.35 x 1.78 47.5 x 2	1 7/8 x 2 1/8 x 1/8 1 7/8 x 2 1/16 x 3/32 1 7/8 x 2 x 1/16	AS-225 AS-134 AS-032 S-48
45.2 x 3 45.3 x 5.7 45.5 x 2 45.69 x 2.62 45.7 x 3.5	1 13/16 x 2 x 3/32	S-46 AS-133 P-46	47.5 x 3.55 47.5 x 5.3 47.6 x 2.4 47.6 x 5.7 47.62 x 3.53		DIN/ISO/NF DIN/ISO/NF P-48A
46 x 1.5 46 x 2 46 x 2.5 46 x 3 46 x 3.5			47.65 x 1.57 47.7 x 3.5 48 x 1.5 48 x 2 48 x 2.5		P-48

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
48 x 3			50 x 4		
48 x 3.5			50 x 4.5		
48 x 4			50 x 5		
48 x 4.5			50 x 5.3		DIN/ISO/NF
48 x 5			50 x 6		
48 x 6			50 x 6.5		
48.7 x 3.5		P-49	50.17 x 5.33	$2 \times 2 \frac{3}{8} \times \frac{3}{16}$	AS-329, R32
48.7 x 3.55		DIN/ISO/NF	50.39 x 3.53	$2 \times 2 \frac{1}{4} \times \frac{1}{8}$	AS-226
48.7 x 5.3		DIN/ISO/NF	50.47 x 2.62	$2 \times 2 \frac{3}{16} \times \frac{3}{32}$	AS-136
48.9 x 2.62	$1 \frac{5}{16} \times 2 \frac{1}{8} \times \frac{3}{32}$	AS-135	50.5 x 3		
49 x 1.5			50.52 x 1.78	$2 \times 2 \frac{1}{8} \times \frac{1}{16}$	AS-033
49 x 2			50.8 x 3.53		
49 x 2.5			51 x 1.5		
49 x 3			51 x 2		
49 x 3.5			51 x 2.5		
49 x 4			51 x 3		
49 x 4.5			51 x 3.5		
49 x 5			51 x 4		
49 x 6			51 x 4.5		
49.2 x 3.53			51 x 5		
49.2 x 5.7			51 x 6		
49.3 x 5.7			51.2 x 5.7		
49.4 x 3.1		G-50	51.5 x 3.55		DIN/ISO/NF
49.5 x 2		S-50	51.5 x 5.3		DIN/ISO/NF
49.5 x 3			51.6 x 2.4		
49.6 x 2.4			51.6 x 5.7		P-52
49.6 x 5.7		P-50A	52 x 1.5		
49.7 x 2.4			52 x 2		
49.7 x 3.5		P-50	52 x 2.5		
50 x 1.5			52 x 3		
50 x 2			52 x 3.5		
50 x 2.5			52 x 4		
50 x 3			52 x 5		
50 x 3.5			52 x 6		
50 x 3.55		DIN/ISO/NF	52.07 x 2.62	$2 \frac{1}{16} \times 2 \frac{1}{4} \times \frac{3}{32}$	AS-137

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
52.3 x 5.7 52.4 x 3.53 52.5 x 2 52.5 x 3 52.5 x 5.7		S-53
52.6 x 2.4 52.6 x 3.5 52.6 x 5.7 53 x 1.5 53 x 2		P-53
53 x 2.5 53 x 3 53 x 3.5 53 x 3.55 53 x 4		DIN/ISO/NF
53 x 4.5 53 x 5 53 x 5.3 53 x 6 53.09 x 3		DIN/ISO/NF AS-928
53.34 x 5.33 53.57 x 3.53 53.64 x 2.62 53.7 x 1.78 53.97 x 3.53	2 1/8 x 2 1/2 x 3/16 2 1/8 x 2 3/8 x 1/8 2 1/8 x 2 5/16 x 3/32 2 1/8 x 2 1/4 x 1/16	AS-330, R33 AS-227 AS-138 AS-034
54 x 1.5 54 x 2 54 x 2.5 54 x 3 54 x 3.5		
54 x 4 54 x 5 54 x 6 54.2 x 3 54.2 x 5.7		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
54.3 x 5.7 54.4 x 3.1 54.4 x 5.3 54.5 x 2 54.5 x 3		G-55 R33b S-55
54.5 x 3.55 54.5 x 4 54.5 x 5.3 54.6 x 2.4 54.6 x 5.7		DIN/ISO/NF V-55 DIN/ISO/NF P-55
55 x 1.5 55 x 2 55 x 2.5 55 x 3 55 x 3.5		
55 x 4 55 x 5 55 x 6 55.2 x 5.7 55.25 x 2.62	2 3/16 x 2 3/8 x 3/32	AS-139
55.3 x 5.7 55.5 x 2 55.5 x 2.4 55.56 x 3.53 55.6 x 3.5		S-56
55.6 x 5.7 56 x 1.5 56 x 2 56 x 2.5 56 x 3		P-56
56 x 3.5 56 x 3.55 56 x 4 56 x 4.5 56 x 5		DIN/ISO/NF

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
56 x 5.3	$2 \frac{1}{4} \times 2 \frac{5}{8} \times \frac{3}{16}$	DIN/ISO/NF
56 x 6		
56.52 x 5.33		AS-331, R34
56.74 x 3.53		AS-228
56.82 x 2.62		AS-140
56.87 x 1.78	$2 \frac{1}{4} \times 2 \frac{3}{8} \times \frac{1}{16}$	AS-035
57 x 1.5		
57 x 2		
57 x 2.5		
57 x 3		
57 x 3.5		
57 x 4		
57 x 4.5		
57 x 5		
57 x 6		
57.15 x 3.53		
57.2 x 5.7		
57.6 x 2.4		
57.6 x 5.7		P-58
58 x 1.5		
58 x 2		
58 x 2.5		
58 x 3		
58 x 3.5		
58 x 3.55		DIN/ISO/NF
58 x 4		
58 x 5	$2 \frac{5}{16} \times 2 \frac{1}{2} \times \frac{3}{32}$	DIN/ISO/NF
58 x 5.3		
58 x 6		
58.42 x 2.62		AS-141
58.74 x 3.53		
59 x 1.5		
59 x 2		
59 x 2.5		
59 x 3		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
59 x 3.5		
59 x 4		
59 x 5		
59.2 x 5.7		
59.3 x 5.7		
59.36 x 3		AS-932
59.4 x 3.1		G-60
59.5 x 2		S-60
59.5 x 3		
59.5 x 6		
59.6 x 2.4	$2 \frac{3}{8} \times 2 \frac{3}{4} \times \frac{3}{16}$	
59.6 x 3.5		
59.6 x 5.7		P-60
59.69 x 5.33		AS-332, R35
59.7 x 5.7		
59.92 x 3.53	$2 \frac{3}{8} \times 2 \frac{5}{8} \times \frac{1}{8}$	AS-229
59.99 x 2.62	$2 \frac{3}{8} \times 2 \frac{9}{16} \times \frac{3}{32}$	AS-142
60 x 1.5		
60 x 2		
60 x 2.5		
60 x 3		
60 x 3.5		
60 x 3.55		DIN/ISO/NF
60 x 4		
60 x 4.5		
60 x 5		
60 x 5.3	$2 \frac{3}{8} \times 2 \frac{1}{2} \times \frac{1}{16}$	DIN/ISO/NF
60 x 6		
60 x 8		
60.04 x 1.78		AS-036
60.32 x 3.53		
61 x 1.5		
61 x 2		
61 x 2.5		
61 x 3		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
61 x 3.5			63 x 5		
61 x 4			63 x 5.3		DIN/ISO/NF
61 x 4.5			63 x 6		
61 x 5			63.09 x 3.53	2 1/2 x 2 3/4 x 1/8	AS-230
61 x 6			63.17 x 2.62	2 1/2 x 2 11/16 x 3/32	AS-144
61.5 x 3.55		DIN/ISO/NF	63.22 x 1.78	2 1/2 x 2 5/8 x 1/16	AS-037
61.5 x 5.3		DIN/ISO/NF	63.5 x 3.53		
61.6 x 2.4			64 x 1.5		
61.6 x 2.62	2 7/16 x 2 5/8 x 3/32	AS-143	64 x 2		
61.6 x 5.7		P-62	64 x 2.5		
61.9 x 3.53			64 x 3		
62 x 1.5			64 x 3.5		
62 x 2			64 x 4		
62 x 2.5			64 x 4.5		
62 x 3			64 x 5		
62 x 3.5			64 x 5.7		
62 x 4			64 x 6		
62 x 5			64.2 x 1.6		
62 x 5.7			64.2 x 5.7		
62 x 6			64.3 x 5.7		
62.2 x 3			64.4 x 3.1		G-65
62.3 x 5.7			64.5 x 2		S-65
62.5 x 2		S-63	64.5 x 3		
62.6 x 2.4			64.6 x 2.4		
62.6 x 3.5			64.6 x 5.7		P-65
62.6 x 5.7		P-63	64.77 x 2.62	2 9/16 x 2 3/4 x 3/32	AS-145
62.87 x 5.33	2 1/2 x 2 7/8 x 3/16	AS-333, R36	65 x 1.5		
63 x 1.5			65 x 2		
63 x 2			65 x 2.5		
63 x 2.5			65 x 3		
63 x 3			65 x 3.5		
63 x 3.5			65 x 3.55		DIN/ISO/NF
63 x 3.55		DIN/ISO/NF	65 x 4		
63 x 4			65 x 4.5		
63 x 4.5			65 x 5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
65 x 5.3		DIN/ISO/NF	68 x 2		
65 x 6			68 x 2.5		
65.1 x 3.53			68 x 3		
66 x 1.5			68 x 3.5		
66 x 2			68 x 4		
66 x 2.5			68 x 4.5		
66 x 3			68 x 5		
66 x 3.5			68 x 6		
66 x 4			68.26 x 3.53		
66 x 4.5			69 x 1.5		
66 x 5			69 x 2		
66 x 6			69 x 2.5		
66.04 x 5.33	$2 \frac{5}{8} \times 3 \times \frac{3}{16}$	AS-334, R37	69 x 3		
66.27 x 3.53	$2 \frac{5}{8} \times 2 \frac{7}{8} \times \frac{1}{8}$	AS-231	69 x 3.5		
66.34 x 2.62	$2 \frac{5}{8} \times 2 \frac{13}{16} \times \frac{3}{32}$	AS-146	69 x 3.55		DIN/ISO/NF
66.4 x 1.78	$2 \frac{5}{8} \times 2 \frac{3}{4} \times \frac{1}{16}$	AS-038	69 x 4		V-70
66.5 x 2		S-67	69 x 4.5		
66.6 x 2.4			69 x 5		
66.6 x 3.5			69 x 5.3		DIN/ISO/NF
66.6 x 5.7		P-67	69 x 5.7		
66.67 x 3.53			69 x 6		
67 x 1.5			69.2 x 5.7		
67 x 2			69.22 x 5.33	$2 \frac{3}{4} \times 3 \frac{1}{8} \times \frac{3}{16}$	AS-335, R38
67 x 2.5			69.3 x 5.7		
67 x 3			69.4 x 3.1		G-70
67 x 3.5			69.44 x 3.53	$2 \frac{3}{4} \times 3 \times \frac{1}{8}$	AS-232
67 x 3.55		DIN/ISO/NF	69.5 x 2		S-70
67 x 4			69.5 x 3		
67 x 5			69.52 x 2.62	$2 \frac{3}{4} \times 2 \frac{15}{16} \times \frac{3}{32}$	AS-148
67 x 5.3		DIN/ISO/NF	69.57 x 1.78	$2 \frac{3}{4} \times 2 \frac{7}{8} \times \frac{1}{16}$	AS-039
67 x 6			69.6 x 2.4		
67.2 x 5.7			69.6 x 5.7		
67.6 x 2.4			69.85 x 3.53		
67.95 x 2.62	$2 \frac{11}{16} \times \frac{7}{8} \times \frac{3}{32}$	AS-147	70 x 1.5		
68 x 1.5			70 x 2		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
70 x 2.5			72.69 x 2.62	2 7/8 x 3 1/16 x 3/32	AS-150
70 x 3			72.75 x 1.78	2 7/8 x 3 x 1/16	AS-040
70 x 3.5			73 x 1.5		
70 x 4			73 x 2		
70 x 4.5			73 x 2.5		
70 x 5			73 x 3		
70 x 6			73 x 3.5		
70 x 7			73 x 3.55		DIN/ISO/NF
70.5 x 2		S-71	73 x 4		
70.6 x 2.4			73 x 4.5		
70.6 x 3.5			73 x 5		
70.6 x 5.7		P-71	73 x 5.3		DIN/ISO/NF
71 x 1.5			73 x 6		
71 x 2			73.02 x 3.53		
71 x 2.5			74 x 1.5		
71 x 3			74 x 2		
71 x 3.5			74 x 2.5		
71 x 3.55		DIN/ISO/NF	74 x 3		
71 x 4			74 x 3.5		
71 x 4.5			74 x 4		
71 x 5			74 x 4.5		
71 x 5.3			74 x 5		
71.12 x 2.62	2 13/16 x 3 x 3/32	DIN/ISO/NF AS-149	74 x 5.7		
71.44 x 3.53			74 x 6		
71.7 x 5.7			74.2 x 5.7		
72 x 1.5			74.3 x 2.62		
72 x 2			74.3 x 5.7		
72 x 2.5			74.5 x 2		S-75
72 x 3			74.5 x 3		
72 x 3.5			74.5 x 3.1		G-75
72 x 4			74.6 x 3.53		
72 x 5			74.6 x 5.7		P-75
72 x 6			74.63 x 5.33		
72.39 x 5.33	2 7/8 x 3 1/4 x 3/16	AS-336, R39	75 x 1.5		
72.62 x 3.53	2 7/8 x 3 1/8 x 1/8	AS-233	75 x 2		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
75 x 2.5			78 x 2.5		
75 x 3			78 x 3		
75 x 3.5			78 x 3.5		
75 x 3.55		DIN/ISO/NF	78 x 4		
75 x 4			78 x 5		
75 x 4.5			78 x 6		
75 x 5			78.5 x 6		
75 x 5.3		DIN/ISO/NF	78.74 x 5.33	3 1/8 x 3 1/2 x 13/16	AS-338, R41
75 x 6			78.97 x 3.53	3 1/8 x 3 3/8 x 1/8	AS-235
75 x 7.5			79 x 1.5		
75.57 x 5.33	3 x 3 3/8 x 3/16	AS-337, R40	79 x 1.78		
75.79 x 3.53	3 x 3 1/4 x 1/8	AS-234	79 x 2		
75.87 x 2.62	3 x 3 3/16 x 3/32	AS-151	79 x 2.5		
75.92 x 1.78	3 x 3 1/8 x 1/16	AS-041	79 x 3		
76 x 1.5			79 x 3.5		
76 x 2			79 x 4		
76 x 2.5			79 x 5		
76 x 3			79 x 5.7		
76 x 3.5			79 x 6		
76 x 4			79.2 x 5.7		
76 x 4.5			79.3 x 5.7		
76 x 5			79.4 x 3.1		G-80
76 x 6			79.5 x 2		S-80
77 x 1.5			79.5 x 3		
77 x 2			79.6 x 3.5		
77 x 2.5			79.6 x 5.7		P-80
77 x 3			79.73 x 5.33		
77 x 3.5			79.77 x 5.33		
77 x 4			80 x 1.5		
77 x 5			80 x 2		
77.5 x 2.62			80 x 2.5		
77.5 x 3.55		DIN/ISO/NF	80 x 3		
77.5 x 5.3		DIN/ISO/NF	80 x 3.5		
78 x 1.5			80 x 3.55		DIN/ISO/NF
78 x 2			80 x 4		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
80 x 4.5	DIN/ISO/NF		83 x 4.5		
80 x 5			83 x 5		
80 x 5.3			83.8 x 2.62		
80 x 6			84 x 1.5		
80.6 x 2.62			84 x 2		
81 x 1.5			84 x 2.5		V-85
81 x 2			84 x 3		
81 x 2.5			84 x 3.5		
81 x 3			84 x 4		
81 x 3.5			84 x 5		
81 x 4			84 x 5.7		
81 x 4.5			84 x 6		
81 x 5			84.1 x 5.7		
81 x 6			84.2 x 5.7		
81.2 x 5.7			84.3 x 5.7		
81.5 x 6	3 1/4 x 3 5/8 x 3/16	AS-339, R42	84.4 x 3.1		G-85 S-85
81.92 x 5.33			84.5 x 2		
82 x 1.5			84.5 x 3		
82 x 2			84.6 x 3.5		
82 x 2.5			84.6 x 5.7		
82 x 3	3 1/4 x 3 1/2 x 1/8	AS-236	85 x 1.5		
82 x 3.5			85 x 2		
82 x 4			85 x 2.5		
82 x 5			85 x 3		
82.14 x 3.53			85 x 3.5		
82.22 x 2.62	3 1/4 x 3 7/16 x 3/32	AS-152	85 x 3.55		DIN/ISO/NF
82.27 x 1.78			85 x 4		
82.5 x 3.55			85 x 4.5		
82.5 x 5.3			85 x 5		
83 x 1.5			85 x 5.3		
83 x 2			85 x 6	3 3/8 x 3 3/4 x 3/16	AS-340, R43 AS-237
83 x 2.5			85.09 x 5.33		
83 x 3			85.32 x 3.53		
83 x 3.5			85.34 x 1.78		
83 x 4			86 x 1.5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
86 x 2		
86 x 2.5		
86 x 3		
86 x 3.5		
86 x 4		
86 x 4.5		
86 x 5		
86 x 6		
87 x 1.5		
87 x 2		
87 x 2.5		
87 x 3		
87 x 3.5		
87 x 4		
87 x 5		
87.2 x 5.7		
87.5 x 3.55		
87.5 x 5.3		
88 x 1.5		
88 x 2		
88 x 2.5		
88 x 3		
88 x 3.5		
88 x 4		
88 x 5		
88 x 6		
88.27 x 5.33	3 1/2 x 3 7/8 x 3/16	AS-341, R44
88.49 x 3.53	3 1/2 x 3 3/4 x 1/8	AS-238
88.57 x 2.62	3 1/2 x 3 11/16 x 3/32	AS-153
88.62 x 1.78	3 1/2 x 3 5/8 x 1/16	AS-043
89 x 1.5		
89 x 2		
89 x 2.5		
89 x 3		
89 x 3.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
89 x 4		
89 x 4.5		
89 x 5		
89 x 5.7		
89.1 x 5.7		
89.2 x 5.7		
89.3 x 5.7		
89.4 x 3.1		
89.5 x 2		
89.5 x 3		
89.6 x 3.5		
89.6 x 5.7		
89.69 x 5.33		
90 x 1.5		
90 x 2		
90 x 2.5		
90 x 3		
90 x 3.5		
90 x 3.55		
90 x 4		
90 x 4.5		
90 x 5		
90 x 5.3		
90 x 6		
91 x 1.5		
91 x 2		
91 x 2.5		
91 x 3		
91 x 3.5		
91 x 4		
91 x 5		
91.44 x 5.33	3 5/8 x 4 x 3/16	
91.67 x 3.53	3 5/8 x 3 7/8 x 1/8	
91.7 x 1.78		
92 x 1.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
92 x 2			94.62 x 5.33	3 ³ / ₄ x 4 ¹ / ₈ x ³ / ₁₆	AS-343, R46
92 x 2.5			94.84 x 3.53	3 ³ / ₄ x 4 x ¹ / ₈	AS-240
92 x 3			94.92 x 2.62	3 ³ / ₄ x 3 ¹⁵ / ₁₆ x ³ / ₃₂	AS-154
92 x 3.5			94.97 x 1.78	3 ³ / ₄ x 3 ⁷ / ₈ x ¹ / ₁₆	AS-044
92 x 4			95 x 1.5		
92 x 4.5			95 x 2		
92 x 5			95 x 2.5		
92 x 6			95 x 3		
92.2 x 5.7			95 x 3.5		
92.5 x 3.55		DIN/ISO/NF	95 x 3.55		DIN/ISO/NF
92.5 x 5.3		DIN/ISO/NF	95 x 4		
93 x 1.5			95 x 4.5		
93 x 2			95 x 5		
93 x 2.5			95 x 5.3		DIN/ISO/NF
93 x 3			95 x 6		
93 x 3.5			96 x 1.5		
93 x 4			96 x 2		
93 x 5			96 x 2.5		
93 x 6			96 x 3		
93.5 x 4.5			96 x 3.5		
94 x 1.5			96 x 4		
94 x 2			96 x 5		
94 x 2.5			96 x 6		
94 x 3			97 x 1.5		
94 x 3.5			97 x 2		
94 x 4			97 x 2.5		
94 x 5			97 x 3		
94 x 5.7			97 x 3.5		
94.1 x 5.7			97 x 4		
94.3 x 5.7			97 x 5		
94.4 x 3.1		G-95	97.2 x 5.7		
94.5 x 2		S-95	97.5 x 3.55		DIN/ISO/NF
94.5 x 3			97.5 x 4.5		
94.6 x 3.5			97.5 x 5.3		DIN/ISO/NF
94.6 x 5.7		P-95	97.79 x 5.33	3 ⁷ / ₈ x 4 ¹ / ₄ x ³ / ₁₆	AS-344, R47

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
98 x 1.5			100 x 4.5		
98 x 2			100 x 5		
98 x 2.5			100 x 5.3		DIN/ISO/NF
98 x 3			100 x 5.33		
98 x 3.5			100 x 6		
98 x 4			100.5 x 4.5		
98 x 4.5			100.97 x 5.33	4 x 4 ³ / ₈ x ³ / ₁₆	AS-345, R48
98 x 5			101 x 2.5		
98 x 6			101 x 3		
98.02 x 3.53	3 ⁷ / ₈ x 4 ¹ / ₈ x ¹ / ₈	AS-241	101 x 3.5		
98.05 x 1.78			101 x 4		
99 x 1.5			101 x 4.5		
99 x 2			101 x 5		
99 x 2.5			101 x 6		
99 x 3			101.19 x 3.53	4 x 4 ¹ / ₄ x ¹ / ₈	AS-242
99 x 3.5			101.27 x 2.62	4 x 4 ³ / ₁₆ x ³ / ₃₂	AS-155
99 x 4	V-100		101.32 x 1.78	4 x 4 ¹ / ₈ x ¹ / ₁₆	AS-045
99 x 5			101.6 x 5.7		P-102
99 x 5.7			102 x 2.5		
99 x 6			102 x 3		
99.1 x 5.7			102 x 3.5		
99.3 x 5.7			102 x 4		
99.4 x 3.1		G-100	102 x 5		
99.5 x 2		S-100	103 x 2.5		
99.5 x 3			103 x 3		
99.5 x 4.5			103 x 3.5		
99.6 x 3.5			103 x 3.55		DIN/ISO/NF
99.6 x 5.7		P-100	103 x 4		
100 x 1.5			103 x 5		
100 x 2			103 x 5.3		DIN/ISO/NF
100 x 2.5			103 x 6		
100 x 3			103.5 x 4.5		
100 x 3.5			104 x 2.5		
100 x 3.55		DIN/ISO/NF	104 x 3		
100 x 4			104 x 3.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
104 x 4			107 x 2.5		
104 x 5			107 x 3		
104 x 5.7			107 x 3.5		
104 x 6			107 x 4		
104.1 x 5.7			107 x 5		
104.14 x 5.33	4 1/8 x 4 1/2 x 3/16	AS-346, R49	107.32 x 5.33	4 1/4 x 4 5/8 x 3/16	AS-347, R50
104.3 x 5.7			107.54 x 3.53	4 1/4 x 4 1/2 x 1/8	AS-244
104.37 x 3.53	4 1/8 x 4 3/8 x 1/8	AS-243	107.62 x 2.62	4 1/4 x 4 7/16 x 3/32	AS-156
104.4 x 1.78			107.67 x 1.78	4 1/4 x 4 3/8 x 1/16	AS-046
104.4 x 3.1		G-105	108 x 2.5		
104.5 x 2		S-105	108 x 3		
104.5 x 3			108 x 3.5		
104.5 x 6			108 x 4		
104.6 x 5.7		P-105	108 x 5		
105 x 2			108 x 6		
105 x 2.5			108 x 8		
105 x 3			109 x 2.5		
105 x 3.5			109 x 3		
105 x 4			109 x 3.5		
105 x 4.5			109 x 3.55		DIN / ISO
105 x 5			109 x 4		
105 x 6			109 x 5		
105 x 7			109 x 5.3		DIN / ISO
105 x 9			109 x 5.7		
105 x 10			109.1 x 5.7		
105.6 x 3.5			109.3 x 5.7		
106 x 2.5			109.4 x 3.1		G-110
106 x 3			109.5 x 2		S-110
106 x 3.5			109.5 x 3		
106 x 3.55		DIN/ISO/NF	109.54 x 5.33		
106 x 4			109.6 x 5.7		P-110
106 x 4.5			110 x 2.5		
106 x 5			110 x 3		
106 x 5.3		DIN/ISO/NF	110 x 3.5		
106 x 6			110 x 4		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
110 x 4.5		
110 x 5		
110 x 6		
110 x 7		
110 x 11		
110.49 x 5.33	4 ³ / ₈ x 4 ³ / ₄ x ³ / ₁₆	AS-348, R51
110.72 x 3.53	4 ³ / ₈ x 4 ⁵ / ₈ x ¹ / ₈	AS-245
110.74 x 1.78		
111 x 2.5		
111 x 3		
111 x 3.5		
111 x 4		
111 x 5		
111 x 6		
111.5 x 2		S-112
111.6 x 3.5		
111.6 x 5.7		P-112
112 x 2.5		
112 x 3		
112 x 3.5		
112 x 3.55		DIN/ISO/NF
112 x 4		
112 x 5		
112 x 5.3		DIN/ISO/NF
112 x 6		
113 x 2.5		
113 x 3		
113 x 3.5		
113 x 4		
113 x 5		
113.67 x 5.33	4 ¹ / ₂ x 4 ⁷ / ₈ x ³ / ₁₆	AS-349, R52
113.67 x 6.99	4 ¹ / ₂ x 5 x ¹ / ₄	AS-425, R53
113.89 x 3.53	4 ¹ / ₂ x 4 ³ / ₄ x ¹ / ₈	AS-246
113.97 x 2.62	4 ¹ / ₂ x 4 ¹¹ / ₁₆ x ³ / ₃₂	AS-157
114 x 2.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
114 x 3		
114 x 3.5		
114 x 4		
114 x 5		
114 x 5.7		
114 x 6		
114 x 8		
114.02 x 1.78	4 ¹ / ₂ x 4 ⁵ / ₈ x ¹ / ₁₆	AS-047
114.3 x 5.7		
114.4 x 3.1		G-115
114.5 x 2		S-115
114.5 x 3		
114.6 x 5.7		P-115
114.7 x 6.99		
115 x 2.5		
115 x 3		
115 x 3.5		
115 x 3.55		DIN/ISO/NF
115 x 4		
115 x 4.5		
115 x 5		
115 x 5.3		DIN/ISO/NF
115 x 6		
115 x 7		DIN/ISO/NF
116 x 2.5		
116 x 3		
116 x 3.5		
116 x 4		
116 x 5		
116.84 x 5.33	4 ⁵ / ₈ x 5 x ³ / ₁₆	AS-350
116.84 x 6.99	4 ⁵ / ₈ x 5 ¹ / ₈ x ¹ / ₄	AS-426, R54
117 x 2.5		
117 x 3		
117 x 3.5		
117 x 4		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
117 x 5	4 ⁵ / ₈ x 4 ⁷ / ₈ x ¹ / ₈	AS-247	120.02 x 6.99	4 ³ / ₄ x 5 ¹ / ₄ x ¹ / ₄	AS-427, R55
117.07 x 3.53			120.02 x 4.8	4 ³ / ₄ x 5 x ¹ / ₈	AS-248
117.1 x 1.78			120.24 x 3.53		
117.48 x 5.33			120.32 x 2.62		
117.6 x 5.7			120.37 x 1.78		
118 x 2.5		DIN/ISO/NF	120.65 x 5.33		
118 x 3			120.70 x 5.33		
118 x 3.5			121 x 2.5		
118 x 3.55			121 x 3		
118 x 4			121 x 3.5		
118 x 4.5		DIN/ISO/NF	121 x 4		
118 x 5			121 x 5		
118 x 5.3			122 x 2.5		
118 x 6			122 x 3		
119 x 2.5			122 x 3.5		
119 x 3		V-120	122 x 3.55		DIN/ISO/NF
119 x 3.5			122 x 4		
119 x 4			122 x 4.5		
119 x 5			122 x 5		
119 x 5.7			122 x 5.3		
119.2 x 5.7		G-120 S-120	122 x 6		
119.3 x 5.7			123 x 2.5		
119.4 x 3.1			123 x 3		
119.5 x 2			123 x 3.5		
119.5 x 3			123 x 4		
119.6 x 5.7		P-120	123 x 5		
120 x 2.5			123 x 6		
120 x 3			123 x 8		
120 x 3.5			123.19 x 5.33	4 ⁷ / ₈ x 5 ¹ / ₄ x ³ / ₁₆	AS-352
120 x 4			123.19 x 6.99	4 ⁷ / ₈ x 5 ³ / ₈ x ¹ / ₄	AS-428, R56
120 x 4.5	4 ³ / ₄ x 5 ¹ / ₈ x ³ / ₁₆	AS-351	123.42 x 3.53	4 ⁷ / ₈ x 5 ¹ / ₈ x ¹ / ₈	AS-249
120 x 5			123.44 x 1.78		
120 x 6			123.83 x 5.33		
120 x 10			124 x 2.5		
120.02 x 5.33			124 x 3		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
124 x 3.5			127 x 3.5		
124 x 4			127 x 4		
124 x 4.5			127 x 5		
124 x 5			127 x 5.33		
124 x 5.7			128 x 2.5		
124 x 6			128 x 3		
124.3 x 5.7			128 x 3.5		
124.4 x 3.1		G-125	128 x 3.55		DIN/ISO/NF
124.5 x 2		S-125	128 x 4		
124.5 x 3			128 x 4.5		
124.6 x 5.7		P-125	128 x 5		
124.6 x 6.99			128 x 5.3		DIN/ISO/NF
125 x 2.4			128 x 6		
125 x 2.5			129 x 2.5		
125 x 3			129 x 3		
125 x 3.5			129 x 3.5		
125 x 3.55	DIN/ISO/NF		129 x 4		
125 x 4			129 x 5		
125 x 5			129.1 x 5.7		
125 x 5.3	DIN/ISO/NF		129.2 x 5.7		
125 x 6			129.3 x 5.7		
125.6 x 2			129.4 x 1.78		
126 x 2.5			129.4 x 3.1		G-130
126 x 3			129.5 x 2		S-130
126 x 3.5			129.5 x 3		
126 x 4			129.54 x 5.33	5 1/8 x 5 1/2 x 3/16	AS-354
126 x 4.5			129.54 x 6.99	5 1/8 x 5 5/8 x 1/4	AS-430, R58
126 x 5			129.6 x 5.7		P-130
126.37 x 5.33	5 x 5 3/8 x 3/16	AS-353	129.77 x 3.53	5 1/8 x 5 3/8 x 1/8	AS-251
126.37 x 6.99	5 x 5 1/2 x 1/4	AS-429, R57	130 x 2.5		
126.59 x 3.53	5 x 5 1/4 x 1/8	AS-250	130 x 3		
126.67 x 2.62	5 x 5 3/16 x 3/32	AS-159	130 x 3.5		
126.72 x 1.78	5 x 5 1/8 x 1/16	AS-049	130 x 4		
127 x 2.5			130 x 4.5		
127 x 3			130 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
130 x 6			134.3 x 5.7		
130.18 x 5.33			134.4 x 3.1		G-135
131 x 2.5			134.5 x 2		S-135
131 x 3			134.5 x 3		
131 x 3.5			134.5 x 4.5		
131 x 4			134.5 x 6.99		
131 x 5			134.6 x 5.7		P-135
131.5 x 2		S-132	135 x 2.5		
131.5 x 4.5		P-132	135 x 3		
131.6 x 5.7			135 x 3.5		
132 x 2.5			135 x 4		
132 x 3			135 x 5		
132 x 3.5			135 x 6		
132 x 3.55		DIN/ISO/NF	135.76 x 1.78		
132 x 4			135.89 x 5.33	5 ³ / ₈ x 5 ³ / ₄ x ³ / ₁₆	AS-356
132 x 5			135.89 x 6.99	5 ³ / ₈ x 5 ⁷ / ₈ x ¹ / ₄	AS-432, R60
132 x 5.3		DIN/ISO/NF	136 x 2.5		
132 x 6			136 x 3		
132.72 x 5.33	5 ¹ / ₄ x 5 ⁵ / ₈ x ³ / ₁₆	AS-355	136 x 3.5		
132.72 x 6.99	5 ¹ / ₄ x 5 ³ / ₄ x ¹ / ₄	AS-431, R59	136 x 3.55		DIN/ISO/NF
132.95 x 3.53	5 ¹ / ₄ x 5 ¹ / ₂ x ¹ / ₈	AS-252	136 x 4		
133 x 2.5			136 x 5		
133 x 3			136 x 5.3		DIN/ISO/NF
133 x 3.5			136 x 6		
133 x 4			136.12 x 3.53	5 ³ / ₈ x 5 ⁵ / ₈ x ¹ / ₈	AS-253
133 x 5			136.53 x 5.33		
133.02 x 2.62	5 ¹ / ₄ x 5 ⁷ / ₁₆ x ³ / ₃₂	AS-160	137 x 2.5		
133.07 x 1.78	5 ¹ / ₄ x 5 ³ / ₈ x ¹ / ₁₆	AS-050	137 x 3		
133.35 x 5.33			137 x 3.5		
134 x 2.5			137 x 4		
134 x 3			137 x 4.5		
134 x 3.5			137 x 5		
134 x 4			138 x 2.5		
134 x 5			138 x 3		
134 x 6			138 x 3.5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
138 x 4			141 x 5		
138 x 5			142 x 2.5		
138 x 6			142 x 3		
138.94 x 1.78			142 x 3.5		
139 x 2.5			142 x 4		
139 x 3			142 x 5		
139 x 3.5			142 x 6		
139 x 4			142.11 x 1.78		
139 x 5			142.24 x 5.33	5 ⁵ / ₈ x 6 x ³ / ₁₆	AS-358
139.07 x 5.33	5 ¹ / ₂ x 5 ⁷ / ₈ x ³ / ₁₆	AS-357	142.24 x 6.99	5 ⁵ / ₈ x 6 ¹ / ₈ x ¹ / ₄	AS-434, R62
139.07 x 6.99	5 ¹ / ₂ x 6 x ¹ / ₄	AS-433, R61	142.47 x 3.53	5 ⁵ / ₈ x 5 ⁷ / ₈ x ¹ / ₈	AS-255
139.2 x 6			142.88 x 5.33		
139.29 x 3.53	5 ¹ / ₂ x 5 ³ / ₄ x ¹ / ₈	AS-254	143 x 2.5		
139.3 x 5.7			143 x 3		
139.37 x 2.62	5 ¹ / ₂ x 5 ¹¹ / ₁₆ x ³ / ₃₂	AS-161	143 x 3.5		
139.4 x 3.1		G-140	143 x 4		
139.5 x 2		S-140	143 x 5		
139.5 x 3			143 x 6		
139.6 x 5.7		P-140	144 x 2.5		
139.7 x 5.33			144 x 3		
140 x 2			144 x 3.5		
140 x 2.5			144 x 4		
140 x 3			144 x 5		
140 x 3.5			144.1 x 8.4		
140 x 3.55		DIN/ISO/NF	144.3 x 5.7		
140 x 4			144.4 x 3.1		G-145
140 x 4.5			144.5 x 2		S-145
140 x 5			144.5 x 3		
140 x 5.3		DIN/ISO/NF	144.6 x 5.7		P-145
140 x 6			145 x 2.5		
140.5 x 4.5			145 x 3		
141 x 2.5			145 x 3.5		
141 x 3			145 x 3.55		DIN/ISO/NF
141 x 3.5			145 x 4		
141 x 4			145 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
145 x 5.3		DIN/ISO/NF	149.1 x 8.4		
145 x 6			149.2 x 5.7		
145.29 x 1.78			149.23 x 5.33		
145.42 x 5.33	5 ³ / ₄ x 6 ¹ / ₈ x ³ / ₁₆	AS-359	149.3 x 5.7		G-150
145.42 x 6.99	5 ³ / ₄ x 6 ¹ / ₄ x ¹ / ₄	AS-435, R63	149.5 x 2		S-150
145.64 x 3.53	5 ³ / ₄ x 6 x ¹ / ₈	AS-256	149.5 x 3		
145.72 x 2.62	5 ³ / ₄ x 5 ¹⁵ / ₁₆ x ³ / ₃₂	AS-162	149.5 x 8.4		P-150A
146 x 2.5			149.6 x 5.7		P-150
146 x 3			150 x 2.5		
146 x 3.5			150 x 3		
146 x 4			150 x 3.5		
146 x 5			150 x 3.55		DIN/ISO/NF
146 x 6			150 x 4		
146.05 x 5.33			150 x 4.5		
147 x 2.5			150 x 5		
147 x 3			150 x 5.3		DIN/ISO/NF
147 x 3.5			150 x 6		
147 x 4			150 x 8		
147 x 5			151 x 3		
148 x 2.5			151 x 3.5		
148 x 3			151 x 4		
148 x 3.5			151 x 5		
148 x 4		V-150	151.64 x 1.78		
148 x 5			151.77 x 5.33	6 x 6 ³ / ₈ x ³ / ₁₆	AS-361
148 x 6			151.77 x 6.99	6 x 6 ¹ / ₂ x ¹ / ₄	AS-437, R65
148 x 10			151.99 x 3.53	6 x 6 ¹ / ₄ x ¹ / ₈	AS-258
148.46 x 1.78			152 x 3		
148.59 x 5.33	5 ⁷ / ₈ x 6 ¹ / ₄ x ³ / ₁₆	AS-360	152 x 3.5		
148.59 x 6.99	5 ⁷ / ₈ x 6 ³ / ₈ x ¹ / ₄	AS-436, R64	152 x 4		
148.82 x 3.53	5 ⁷ / ₈ x 6 ¹ / ₈ x ¹ / ₈	AS-257	152 x 5		
149 x 2.5			152.07 x 2.62	6 x 6 ³ / ₁₆ x ³ / ₃₂	AS-163
149 x 3			153 x 3		
149 x 3.5			153 x 3.5		
149 x 4			153 x 4		
149 x 5			153 x 4.5		

O-Ring

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
153 x 5			158 x 3		
153 x 6			158 x 3.5		
154 x 3			158 x 4		
154 x 3.5			158 x 5		
154 x 4			158 x 6		
154 x 5			158.12 x 5.33	6 1/4 x 6 5/8 x 3/16	AS-362
154 x 6			158.12 x 6.99	6 1/4 x 6 3/4 x 1/4	AS-438, R66
154.1 x 8.4			158.34 x 3.53	6 1/4 x 6 1/2 x 1/8	AS-259
154.3 x 5.7		G-155	158.42 x 2.62	6 1/4 x 6 7/16 x 3/32	AS-164
154.5 x 3			159 x 2		
154.5 x 8.4		P-155	159 x 3		
154.81 x 1.78			159 x 3.5		
155 x 3			159 x 4		
155 x 3.5			159 x 5		
155 x 3.55		DIN/ISO/NF	159 x 6		
155 x 4			159.1 x 8.4		G-160
155 x 4.5			159.3 x 5.7		
155 x 5			159.5 x 3		
155 x 5.3		DIN/ISO/NF	159.5 x 6.99		
155 x 5.33			159.5 x 8.4		P-160
155 x 6			160 x 3		
155.5 x 6			160 x 3.5		
155.6 x 6.99			160 x 3.55		DIN/ISO/NF
156 x 3			160 x 4		
156 x 3.5			160 x 4.5		
156 x 4			160 x 5		
156 x 5			160 x 5.3		DIN/ISO/NF
156 x 6			160 x 6		
157 x 3			160 x 8		
157 x 3.5			160 x 10		
157 x 4			161 x 3		
157 x 4.5			161 x 3.50		
157 x 5			161 x 4		
157 x 6			161 x 5		
158 x 1.78			161.16 x 1.78		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
161.3 x 5.33			166 x 4		
161.9 x 6.99			166 x 5		
162 x 3			166 x 6		
162 x 3.5			166.7 x 6.99		
162 x 4			167 x 3		
162 x 5			167 x 3.5		
162 x 6			167 x 4		
163 x 3			167 x 5		
163 x 3.5			167.51 x 1.78		
163 x 4			167.7 x 5.33		
163 x 5			168 x 3		
164 x 3			168 x 3.5		
164 x 3.5			168 x 4		
164 x 4			168 x 5		
164 x 5			168.3 x 6.99		
164.1 x 8.4			169 x 3		
164.2 x 5.7			169 x 3.5		
164.3 x 5.7		G-165	169 x 4		
164.34 x 1.78			169 x 5		
164.47 x 5.33	6 1/2 x 6 7/8 x 3/16	AS-363	169 x 6		
164.47 x 6.99	6 1/2 x 7 x 1/4	AS-439, R67	169.1 x 8.4		
164.5 x 3			169.3 x 5.7		G-170
164.5 x 8.4		P-165	169.5 x 3		
164.69 x 3.53	6 1/2 x 6 3/4 x 1/8	AS-260	169.5 x 8.4		P-170
164.77 x 2.62	6 1/2 x 6 11/16 x 3/32	AS-165	170 x 2.4		
165 x 3			170 x 3		
165 x 3.5			170 x 3.5		
165 x 3.55		DIN/ISO/NF	170 x 3.55		DIN/ISO/NF
165 x 4			170 x 4		
165 x 4.5			170 x 5		
165 x 5			170 x 5.3		
165 x 5.3		DIN/ISO/NF	170 x 6		
165 x 6			170.69 x 1.78		
166 x 3			170.82 x 5.33	6 3/4 x 7 1/8 x 3/16	AS-364
166 x 3.5			170.82 x 6.99	6 3/4 x 7 1/4 x 1/4	AS-440, R68

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
171 x 3			175 x 6		
171 x 3.5			176 x 3		
171 x 4			176 x 3.5		
171 x 5			176 x 4		
171.04 x 3.53	6 ³ / ₄ x 7 x ¹ / ₈	AS-261	176 x 5		
171.12 x 2.62	6 ³ / ₄ x 6 ¹⁵ / ₁₆ x ³ / ₁₆	AS-166	176 x 6		
172 x 3			177 x 3		
172 x 3.5			177 x 3.5		
172 x 4			177 x 4		
172 x 4.5			177 x 5		
172 x 5			177.17 x 5.33	7 x 7 ³ / ₈ x ³ / ₁₆	AS-365
172 x 6			177.17 x 6.99	7 x 7 ¹ / ₂ x ¹ / ₄	AS-441, R69
173 x 3			177.39 x 3.53	7 x 7 ¹ / ₄ x ¹ / ₈	AS-262
173 x 3.5			177.47 x 2.62	7 x 7 ³ / ₁₆ x ³ / ₃₂	AS-167
173 x 4		V-175	178 x 3		
173 x 5			178 x 3.5		
173.87 x 1.78			178 x 4		
174 x 3			178 x 4.5		
174 x 3.5			178 x 5		
174 x 4			179 x 3		
174 x 5			179 x 3.5		
174 x 5.33			179 x 4		
174 x 6			179 x 5		
174.1 x 8.4			179.1 x 8.4		
174.2 x 5.7			179.3 x 5.7		G-180
174.3 x 5.7		G-175	179.5 x 3		
174.5 x 3			179.5 x 8.4		P-180
174.5 x 8.4		P-175	180 x 3		
174.6 x 6.99			180 x 3.5		
175 x 3			180 x 3.55		DIN/ISO/NF
175 x 3.5			180 x 4		
175 x 3.55		DIN/ISO/NF	180 x 4.5		
175 x 4			180 x 5		
175 x 5			180 x 5.3		DIN/ISO/NF
175 x 5.3		DIN/ISO/NF	180 x 6		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
180 x 8			185 x 5.3		DIN/ISO/NF
181 x 3			185 x 6		
181 x 3.5			186 x 3		
181 x 4			186 x 3.5		
181 x 5			186 x 4		
181 x 6.99			186 x 4.5		
182 x 3			186 x 5		
182 x 3.5			186 x 7		
182 x 4			187 x 3		
182 x 5			187 x 3.5		
182 x 6			187 x 4		
183 x 3			187 x 5		
183 x 3.5			187.3 x 6.99		
183 x 4			188 x 3		
183 x 5			188 x 3.5		
183.5 x 3			188 x 4		
183.52 x 5.33	7 ¹ / ₄ x 7 ⁵ / ₈ x ³ / ₁₆	AS-366	188 x 5		
183.52 x 6.99	7 ¹ / ₄ x 7 ³ / ₄ x ¹ / ₄	AS-442, R70	188 x 6		
183.74 x 3.53	7 ¹ / ₄ x 7 ¹ / ₂ x ¹ / ₈	AS-263	189 x 3		
183.82 x 2.62	7 ¹ / ₄ x 7 ⁷ / ₁₆ x ³ / ₃₂	AS-168	189 x 3.5		
184 x 3			189 x 4		G-190
184 x 3.5			189 x 5		
184 x 4			189.1 x 8.4		
184 x 5			189.2 x 5.7		
184 x 6			189.3 x 5.7		
184.1 x 8.4		G-185	189.5 x 3		P-190 AS-367 AS-443, R71
184.3 x 5.7			189.5 x 4.5		
184.5 x 3		P-185	189.5 x 8.4		
184.5 x 8.4			189.87 x 5.33	7 ¹ / ₂ x 7 ⁷ / ₈ x ³ / ₁₆	
185 x 3			189.87 x 6.99	7 ¹ / ₂ x 8 x ¹ / ₄	
185 x 3.5		DIN/ISO/NF	190 x 3		DIN/ISO/NF
185 x 3.55			190 x 3.5		
185 x 4			190 x 3.55		
185 x 4.5			190 x 4		
185 x 5			190 x 5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
190 x 5.3	$7 \frac{1}{2} \times 7 \frac{3}{4} \times 1 \frac{1}{8}$	DIN/ISO/NF
190 x 6		
190 x 3.53		AS-264
190.17 x 2.62		AS-169
191 x 3		
191 x 3.5		
191 x 4		
191 x 5		
191.2 x 6		
192 x 3.5		
192 x 4		
192 x 4.5		
192 x 5		
192 x 7		
193 x 3		
193 x 3.5		
193 x 4		
193 x 5		
193 x 6		
193.3 x 4		
193.7 x 6.99		
194 x 2		
194 x 3		
194 x 3.5		
194 x 4		
194 x 5		G-195
194.1 x 8.4		
194.3 x 5.7		
194.5 x 3		
194.5 x 8.4		P-195
195 x 3		
195 x 3.5		
195 x 3.55		DIN/ISO/NF
195 x 4		
195 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
195 x 5.3		DIN/ISO/NF
195 x 6		
195 x 10		
196 x 3		
196 x 3.5		
196 x 4		
196 x 5		
196 x 6		
196.22 x 5.33		$7 \frac{3}{4} \times 8 \frac{1}{8} \times \frac{3}{16}$ AS-368
196.22 x 6.99		$7 \frac{3}{4} \times 8 \frac{1}{4} \times \frac{1}{4}$ AS-444, R72
196.44 x 3.53	$7 \frac{3}{4} \times 8 \times \frac{1}{8}$	AS-265
196.52 x 2.62	$7 \frac{3}{4} \times 7 \frac{15}{16} \times \frac{3}{32}$	AS-170
197 x 3		
197 x 3.5		
197 x 4		
197 x 5		
198 x 3		
198 x 3.5		
198 x 4		
198 x 5		
198 x 6		
199 x 3		
199 x 3.5		
199 x 4		
199 x 5		
199.1 x 8.4		
199.2 x 5.7		
199.3 x 5.7		G-200
199.5 x 3		
199.5 x 8.4		P-200
200 x 3		
200 x 3.5		
200 x 3.55		DIN/ISO/NF
200 x 4		
200 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	
200 x 5.3		DIN/ISO/NF	205 x 5			
200 x 6			205 x 6			
200 x 6.99			205 x 10			
201 x 3			206 x 3			
201 x 3.5			206 x 3.5			
201 x 4			206 x 4		DIN/ISO/NF DIN/ISO/NF	
201 x 5			206 x 5			
201 x 6			206 x 5.3			
202 x 3			206 x 7			
202 x 3.5			207 x 3			
202 x 4			207 x 3.5			
202 x 5			207 x 4			
202 x 6			207 x 5			
202.57 x 5.33			208 x 3			
202.57 x 6.99			208 x 3.5			
202.79 x 3.53	8 x 8 ³ / ₈ x ³ / ₁₆	AS-369	208 x 4		P-209	
202.87 x 2.62	8 x 8 ¹ / ₂ x ¹ / ₄	AS-445, R73	208 x 4.5			
203 x 3	8 x 8 ³ / ₁₆ x ³ / ₃₂	AS-266	208 x 5			
203 x 3.5		AS-171	208 x 6			
203 x 4			208.5 x 8.4			
203 x 5			208.9 x 7	8 ¹ / ₄ x 8 ⁵ / ₈ x ³ / ₁₆	AS-370	
203 x 6			208.92 x 5.33			
203.5 x 6			208.92 x 6.99			
204 x 3			209 x 3			
204 x 3.5			209 x 3.5			
204 x 4			209 x 4		AS-267 AS-172	
204 x 5			209 x 5			
204 x 6			209.1 x 8.4			
204.1 x 8.4			209.14 x 3.53			8 ¹ / ₄ x 8 ¹ / ₂ x ¹ / ₈
204.5 x 3			209.22 x 2.62			8 ¹ / ₄ x 8 ⁷ / ₁₆ x ³ / ₃₂
204.5 x 8.4		P-205	209.3 x 5.7		G-210	
205 x 3			209.5 x 3			
205 x 3.5			209.5 x 8.4			
205 x 4			209.55 x 6.99			8 ¹ / ₄ x 8 ³ / ₄ x ¹ / ₄
205 x 4.7			210 x 3			

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
210 x 3.5		
210 x 4		
210 x 5		
210 x 6		
211 x 3		
211 x 3.5		
211 x 4		
211 x 5		
212 x 3		
212 x 3.5		
212 x 4		
212 x 5		
212 x 5.3		DIN/ISO/NF
212 x 6		
212 x 7		DIN/ISO/NF
213 x 3		
213 x 3.5		
213 x 4		
213 x 5		
214 x 3		
214 x 3.5		
214 x 4		
214 x 5		
214.5 x 8.4		P-215
215 x 3		
215 x 3.5		
215 x 4		
215 x 4.5		
215 x 5		
215 x 6		
215.27 x 5.33	8 1/2 x 8 7/8 x 3/16	AS-371
215.27 x 6.99	8 1/2 x 9 x 1/4	AS-446, R74
215.49 x 3.53	8 1/2 x 8 3/4 x 1/8	AS-268
215.57 x 2.62	8 1/2 x 8 11/16 x 3/32	AS-173
216 x 3		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
216 x 3.5		
216 x 4		
216 x 5		
216 x 6		
216 x 8		
217 x 3		
217 x 3.5		
217 x 4		
217 x 5		
217 x 6		
218 x 3		
218 x 3.5		
218 x 4		
218 x 5		
218 x 5.3		DIN/ISO/NF
218 x 5.8		
218 x 6		
218 x 7		DIN/ISO/NF
218.5 x 4.5		
219 x 3		
219 x 3.5		
219 x 4		
219 x 5		
219.1 x 8.4		
219.3 x 5.7		G-220
219.5 x 3		
219.5 x 8.4		
220 x 3		P-220
220 x 3.5		
220 x 4		
220 x 5		
220 x 6		
220 x 6.99		
221 x 3		
221 x 3.5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
221 x 4	$8\frac{3}{4} \times 9\frac{1}{8} \times \frac{3}{16}$	AS-372	226 x 6		
221 x 5			226 x 8		
221 x 6			227 x 3		
221.62 x 5.33			227 x 3.5		
221.62 x 6.99			227 x 4		
221.84 x 3.53	$8\frac{3}{4} \times 9 \times \frac{1}{8}$	AS-269	227 x 4.5	$8\frac{3}{4} \times 9\frac{3}{8} \times \frac{3}{16}$	AS-373
221.92 x 2.62	$8\frac{3}{4} \times 8\frac{15}{16} \times \frac{3}{32}$	AS-174	227 x 5		
222 x 3			227.97 x 5.33		
222 x 3.5			227.97 x 6.99		
222 x 4			228 x 3		
222 x 5			228 x 3.5	$9 \times 9\frac{1}{2} \times \frac{1}{4}$	AS-447, R75
222.25 x 6.99	$8\frac{3}{4} \times 9\frac{1}{4} \times \frac{1}{4}$	AS-446A	228 x 4		
222.5 x 6		V-225	228 x 5		
223 x 3			228 x 10		
223 x 3.5			228.19 x 3.53		
223 x 4			228.27 x 2.62	$9 \times 9\frac{1}{4} \times \frac{1}{8}$	AS-270
223 x 5			229 x 3	$9 \times 9\frac{3}{16} \times \frac{3}{32}$	AS-175
224 x 3			229 x 3.5		
224 x 3.5			229 x 4		
224 x 4			229 x 5		
224 x 5		DIN/ISO/NF	229 x 6		G-230
224 x 5.3			229.1 x 8.4		
224 x 6			229.3 x 5.7		
224 x 7			229.5 x 3		
224.5 x 8.4			229.5 x 8.4		P-230
225 x 3			230 x 3		DIN/ISO/NF
225 x 3.5			230 x 3.5		
225 x 4			230 x 4		
225 x 4.5			230 x 5		
225 x 5			230 x 5.3		
225 x 6			230 x 6		DIN/ISO/NF
226 x 3			230 x 7		
226 x 3.5			230 x 8		
226 x 4			231 x 3		
226 x 5			231 x 3.5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
231 x 4			237 x 3.5		
231 x 5			237 x 4		
232 x 3			237 x 5		
232 x 3.5			237 x 6		
232 x 4			237.5 x 6		
232 x 5			238 x 3		
233 x 3			238 x 3.5		
233 x 3.5			238 x 4		
233 x 4			238 x 5		
233 x 5			238 x 6		
234 x 3			239 x 3		
234 x 3.5			239 x 3.5		
234 x 4			239 x 4		
234 x 5			239 x 5		
234.1 x 8.4			239.1 x 8.4		
234.3 x 5.7	$9 \frac{1}{4} \times 9 \frac{5}{8} \times \frac{3}{16}$	AS-374	239.3 x 5.7		G-240
234.32 x 5.33			239.5 x 3		P-240
234.32 x 6.99			239.5 x 8.4		
234.5 x 8.4		P-235	240 x 3		
234.54 x 3.53		AS-271	240 x 3.5		
234.62 x 2.62	$9 \frac{1}{4} \times 9 \frac{7}{8} \times \frac{3}{32}$	AS-176	240 x 4		
234.90 x 6.99	$9 \frac{1}{4} \times 9 \frac{3}{4} \times \frac{1}{4}$	AS-447A	240 x 5		
235 x 3			240 x 6		
235 x 3.5			240.67 x 5.33	$9 \frac{1}{2} \times 9 \frac{7}{8} \times \frac{3}{16}$	AS-375
235 x 4			240.67 x 6.99	$9 \frac{1}{2} \times 10 \times \frac{1}{4}$	AS-448, R76
235 x 5			240.89 x 3.53	$9 \frac{1}{2} \times 9 \frac{3}{4} \times \frac{1}{8}$	AS-272
235 x 6			240.97 x 2.62	$9 \frac{1}{2} \times 9 \frac{11}{16} \times \frac{3}{32}$	AS-177
236 x 3			241 x 3		
236 x 3.5			241 x 3.5		
236 x 4			241 x 4		
236 x 5			241 x 5		
236 x 5.3		DIN/ISO/NF	242 x 3		
236 x 6			242 x 3.5		
236 x 7		DIN/ISO/NF	242 x 4		
237 x 3			242 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
242 x 6			248 x 3.5		
242 x 8			248 x 4		
243 x 3			248 x 5		
243 x 3.5			249 x 3		
243 x 4			249 x 3.5		
243 x 5			249 x 4		
243 x 5.3		DIN/ISO/NF	249 x 5		
243 x 7		DIN/ISO/NF	249 x 6		
244 x 3			249.1 x 8.4		
244 x 3.5			249.3 x 5.7		G-250
244 x 4			249.5 x 3		
244 x 5			249.5 x 8.4		P-250
244 x 6			250 x 3		
244 x 7			250 x 3.5		
244.5 x 8.4		P-245	250 x 4		
245 x 3			250 x 4.5		
245 x 3.5			250 x 5		
245 x 4			250 x 6		
245 x 5			250 x 7		DIN/ISO/NF
245 x 8			251 x 3.5		
246 x 3			251 x 4		
246 x 3.5			251 x 5		
246 x 4			252 x 3.5		
246 x 5			252 x 4		
247 x 3			252 x 5		
247 x 3.5			253 x 3.5		
247 x 4			253 x 4		
247 x 5			253 x 5		
247 x 6			253.37 x 5.33	10 x 10 $\frac{3}{8}$ x $\frac{3}{16}$	AS-377
247 x 6.99			253.37 x 6.99	10 x 10 $\frac{1}{2}$ x $\frac{1}{4}$	AS-449, R77
247.02 x 5.33	9 $\frac{3}{4}$ x 10 $\frac{1}{8}$ x $\frac{3}{16}$	AS-376	253.59 x 3.53	10 x 10 $\frac{1}{4}$ x $\frac{1}{8}$	AS-274
247.24 x 3.53	9 $\frac{3}{4}$ x 10 x $\frac{1}{8}$	AS-273	254 x 3.5		
247.32 x 2.6	9 $\frac{3}{4}$ x 9 $\frac{15}{16}$ x $\frac{3}{32}$	AS-178	254 x 4		
247.65 x 6.99	9 $\frac{3}{4}$ x 10 $\frac{1}{4}$ x $\frac{1}{4}$	AS-448A	254 x 5		
248 x 3			254.5 x 8.4		P-255

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
255 x 3		
255 x 3.5		
255 x 4		
255 x 5		
256 x 3.5		
256 x 4		
256 x 5		
257 x 3.5		
257 x 4		
257 x 5		
258 x 3.5		
258 x 4		
258 x 5		
258 x 5.3		DIN/ISO/NF
258 x 6		
258 x 7		DIN/ISO/NFF
259 x 3.5		
259 x 4		
259 x 5		
259 x 6		
259.3 x 5.7		G-260
259.5 x 8.4		P-260
259.7 x 6.99		
260 x 3.5		
260 x 4		
260 x 5		
260 x 6		
260.35 x 6.99	10 1/4 x 10 3/4 x 1/4	AS-449A
261 x 3.5		
261 x 4		
261 x 5		
261.5 x 6.4		
262 x 3.5		
262 x 4		
262 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
262 x 6		
263 x 3.5		
263 x 4		
263 x 5		
264 x 3		
264 x 3.5		
264 x 4		
264 x 5		
264 x 10		
264.5 x 8.4		P-265
265 x 3.5		
265 x 4		
265 x 5		
265 x 5.3		DIN/ISO/NF
265 x 6		
265 x 7		DIN/ISO/NF
266 x 3.5		
266 x 4		
266 x 5		
266 x 6		
266.07 x 5.33	10 1/2 x 10 7/8 x 3/16	AS-378
266.07 x 6.99	10 1/2 x 11 x 1/4	AS-450, R78
266.29 x 3.53	10 1/2 x 10 3/4 x 1/8	AS-275
267 x 3.5		
267 x 4		
267 x 4.5		
267 x 5		
268 x 3.5		
268 x 4		
268 x 5		
269 x 3.5		
269 x 4		
269 x 5		
269.3 x 5.7		G-270
269.5 x 8.4		P-270

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
270 x 3.5			278 x 6		
270 x 4			278.77 x 5.33	11 x 11 $\frac{3}{8}$ x $\frac{3}{16}$	AS-379
270 x 5			278.77 x 6.99	11 x 11 $\frac{1}{2}$ x $\frac{1}{4}$	AS-451, R79
270 x 6			278.99 x 3.53	11 x 11 $\frac{1}{4}$ x $\frac{1}{8}$	AS-276
270 x 10			279 x 3.5		
271 x 3.5			279 x 4		
271 x 4			279 x 5		
271 x 5			279.3 x 5.7		G-280
272 x 3.5			279.5 x 8.4		P-280
272 x 4			280 x 3.5		
272 x 5			280 x 4		
272 x 5.3		DIN/ISO/NF	280 x 4.5		
272 x 6		V-275	280 x 5		
272 x 7		DIN/ISO/NF	280 x 5.3		DIN/ISO/NF
272.4 x 6.99			280 x 6		
273 x 3.5			280 x 7		DIN/ISO/NF
273 x 4			280 x 8		
273 x 5			280 x 10		
273.05 x 6.99	10 $\frac{3}{4}$ x 11 $\frac{1}{4}$ x $\frac{1}{4}$	AS-450A	281 x 3.5		
274 x 3.5			281 x 4		
274 x 4			281 x 5		
274 x 5			282 x 3.5		
274.5 x 8.4		P-275	282 x 4		
275 x 3.5			282 x 5		
275 x 4			283 x 3.5		
275 x 5			283 x 4		
276 x 3.5			283 x 5		
276 x 4			284 x 3.5		
276 x 5			284 x 4		
277 x 3.5			284 x 5		
277 x 4			284 x 6		
277 x 5			284.5 x 8.4		P-285
278 x 3.5			285 x 3.5		
278 x 4			285 x 4		
278 x 5			285 x 5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
285 x 6	11 1/4 x 11 3/4 x 1/4	AS-451A
285.1 x 6.99		
285.75 x 6.99		
286 x 3.5		
286 x 4		
286 x 5		
287 x 3.5		
287 x 4		
287 x 5		
288 x 3.5		
288 x 4		
288 x 5		
288 x 6		
288 x 10		
289 x 3.5		
289 x 4		G-290 P-290
289 x 5		
289.2 x 5.7		
289.3 x 5.7		
289.5 x 8.4		
290 x 3.5		DIN/ISO/NF
290 x 4		
290 x 5		
290 x 5.3		
290 x 6		
290 x 7	11 1/2 x 11 7/8 x 3/16	DIN/ISO/NF AS-380
291 x 3.5		
291 x 4		
291 x 5		
291.47 x 5.33		
291.47 x 6.99	11 1/2 x 12 x 1/4	AS-452, R80
291.69 x 3.53	11 1/2 x 11 3/4 x 1/8	AS-277
292 x 3.5		DIN/ISO/NF
292 x 4		
292 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
293 x 3.5		
293 x 4		
293 x 5		
294 x 3.5		
294 x 4		
294 x 5		P-295
294 x 6		
294.5 x 8.4		
295 x 3.5		
295 x 4		
295 x 5		
295 x 6		
296 x 3.5		
296 x 4		
296 x 5		
297 x 3.5		
297 x 4		
297 x 5		
297.8 x 6.99		
298 x 3.5		
298 x 4	11 3/4 x 12 1/4 x 1/4	AS-452A
298 x 5		
298.45 x 6.99		
299 x 3.5		
299 x 4		
299 x 5		G-300 P-300
299.3 x 5.7		
299.5 x 8.4		
300 x 3		
300 x 3.5		
300 x 4		DIN/ISO/NF
300 x 5		
300 x 5.3		
300 x 6		
300 x 7		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
300 x 10			310 x 3.5		
301 x 3.5			310 x 4		
301 x 4			310 x 5		
301 x 5			310 x 6		
301 x 6			310.5 x 6.99		
302 x 3.5			311 x 3.5		
302 x 4			311 x 4		
302 x 5			311 x 5		
303 x 3.5			311 x 6		
303 x 4			312 x 3.5		
303 x 5			312 x 4		
304 x 3.5			312 x 5		
304 x 4			313 x 3.5		
304 x 5			313 x 4		
304.17 x 5.33	12 x 12 ³ / ₈ x ³ / ₁₆	AS-381	313 x 5		
304.17 x 6.99	12 x 12 ¹ / ₂ x ¹ / ₄	AS-453, R81	314 x 3.5		
304.39 x 3.53	12 x 12 ¹ / ₄ x ¹ / ₈	AS-278	314 x 4		
305 x 3.5			314 x 5		
305 x 4			314.5 x 8.4		P-315
305 x 5			315 x 3		
306 x 6			315 x 3.5		
306 x 3.5			315 x 4		
306 x 4			315 x 4.5		
306 x 5			315 x 5		
307 x 3.5			315 x 5.3		DIN/ISO/NF
307 x 4			315 x 6		
307 x 5			315 x 7		DIN/ISO/NF
307 x 5.3		DIN/ISO/NF	315 x 10		
307 x 7		DIN/ISO/NF	316 x 3.5		
308 x 3.5			316 x 4		
308 x 4			316 x 5		
308 x 5			316.87 x 6.99	12 ¹ / ₂ x 13 x ¹ / ₄	AS-454, R82
309 x 3.5			317 x 3.5		
309 x 4			317 x 4		
309 x 5			317 x 5		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
318 x 3.5			326 x 4		
318 x 4			326 x 5		
318 x 5			326 x 8		
319 x 3.5			327 x 3.5		
319 x 4			327 x 4		
319 x 5			327 x 5		
319.3 x 5.7			328 x 3.5		
319.5 x 8.4	P-320		328 x 4		
320 x 3.5			328 x 5		
320 x 4			329 x 3.5		
320 x 5			329 x 4		
320 x 6			329 x 5		
321 x 3.5			329.3 x 5.7		
321 x 4			329.57 x 5.33	13 x 13 $\frac{3}{8}$ x $\frac{3}{16}$	AS-382
321 x 5			329.57 x 6.99	13 x 13 $\frac{1}{2}$ x $\frac{1}{4}$	AS-455, R83
321.5 x 6	V-325		329.79 x 3.53	13 x 13 $\frac{1}{4}$ x $\frac{1}{8}$	AS-279
322 x 3.5			330 x 3.5		
322 x 4			330 x 4		
322 x 5			330 x 5		
323 x 3.5			330 x 6		
323 x 4			330 x 8		
323 x 5			330 x 10		
323.2 x 6.99			331 x 3.5		
324 x 3.5			331 x 4		
324 x 4			331 x 5		
324 x 5			332 x 3.5		
324 x 6			332 x 4		
325 x 3.5			332 x 5		
325 x 4			333 x 3.5		
325 x 5			333 x 4		
325 x 5.3		DIN/ISO/NF	333 x 5		
325 x 6			333 x 6		
325 x 7		DIN/ISO/NF	334 x 3.5		
325 x 10			334 x 4		
326 x 3.5			334 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
334.5 x 8.4		P-335	343 x 3.5		
335 x 3.5			343 x 4		
335 x 4			343 x 5		
335 x 5			344 x 3.5		
335 x 5.3		DIN/ISO/NF	344 x 4		
335 x 6			344 x 5		
335 x 7		DIN/ISO/NF	345 x 3.5		
335.9 x 6.99			345 x 4		
336 x 3.5			345 x 5		
336 x 4			345 x 5.3		DIN/ISO/NF
336 x 5			345 x 6		
337 x 3.5			345 x 7		DIN/ISO/NF
337 x 4			346 x 3.5		
337 x 5			346 x 4		
338 x 3.5			346 x 5		
338 x 4			347 x 3.5		
338 x 5			347 x 4		
338 x 6			347 x 5		
339 x 3.5			348 x 3.5		
339 x 4			348 x 4		
339 x 5			348 x 5		
339.3 x 5.7			348 x 6		
339.5 x 8.4		P-340	349 x 3.5		
340 x 3.5			349 x 4		
340 x 4			349 x 5		
340 x 5			350 x 3.5		
340 x 6			350 x 4		
340 x 10			350 x 5		
341 x 3.5			350 x 6		
341 x 4			350 x 12		
341 x 5			351 x 3.5		
342 x 3.5			351 x 4		
342 x 4			351 x 5		
342 x 5			352 x 3.5		
342.27 x 6.99	13 1/2 x 14 x 1/4	AS-456, R84	352 x 4		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
352 x 5			360 x 5		
353 x 3.5			360 x 6		
353 x 4			360 x 10		
353 x 5			361 x 3.5		
354 x 3.5			361 x 4		
354 x 4			361 x 5		
354 x 5			362 x 3.5		
354 x 8			362 x 4		
354.5 x 8.4		P-355	362 x 5		
354.97 x 5.33	14 x 14 $\frac{3}{8}$ x $\frac{3}{16}$	AS-383	363 x 3.5		
354.97 x 6.99	14 x 14 $\frac{1}{2}$ x $\frac{1}{4}$	AS-457, R85	363 x 4		
355 x 3.5			363 x 5		
355 x 4			364 x 3.5		
355 x 5			364 x 4		
355 x 5.3		DIN/ISO/NF	364 x 5		
355 x 6			365 x 3.5		
355 x 7			365 x 4		
355.19 x 3.53	14 x 14 $\frac{1}{4}$ x $\frac{1}{8}$	DIN/ISO/NF AS-280	365 x 5		
356 x 3.5			365 x 5.3		DIN/ISO/NF
356 x 4			365 x 6		
356 x 5			365 x 7		DIN/ISO/NF
357 x 3.5			366 x 3.5		
357 x 4			366 x 4		
357 x 5			366 x 5		
358 x 3.5			367 x 3.5		
358 x 4			367 x 4		
358 x 5			367 x 5		
358 x 6			367.67 x 6.99	14 $\frac{1}{2}$ x 15 x $\frac{1}{4}$	AS-458, R86
359 x 3.5			368 x 3.5		
359 x 4			368 x 4		
359 x 5			368 x 5		
359.3 x 5.7			368 x 6		
359.5 x 8.4		P-360	369 x 3.5		
360 x 3.5			369 x 4		
360 x 4			369 x 5		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
370 x 2.5			379 x 3.5		
370 x 3.5			379 x 4		
370 x 4			379 x 5		
370 x 5			379.3 x 5.7		
370 x 6			380 x 3.5		
371 x 3.5			380 x 4		
371 x 4			380 x 5		
371 x 5			380 x 6		
372 x 3.5			380 x 10		
372 x 4			380.37 x 5.33	15 x 15 $\frac{3}{8}$ x $\frac{3}{16}$	AS-384
372 x 5			380.37 x 6.99	15 x 15 $\frac{1}{2}$ x $\frac{1}{4}$	AS-459, R87
373 x 3.5			380.59 x 3.53	15 x 15 $\frac{1}{4}$ x $\frac{1}{8}$	AS-281
373 x 4			381 x 3.5		
373 x 5			381 x 4		
374 x 3.5			381 x 5		
374 x 4			382 x 3.5		
374 x 5			382 x 4		
374.5 x 8.4		P-375	382 x 5		
375 x 3.5			383 x 3.5		
375 x 4			383 x 4		
375 x 5			383 x 5		
375 x 5.3		DIN/ISO/NF	384 x 3.5		
375 x 6			384 x 4		
375 x 7		DIN/ISO/NF	384 x 5		
376 x 3.5			384.5 x 8.4		P-385
376 x 4			385 x 3.5		
376 x 5			385 x 4		
376 x 6		V-380	385 x 5		
376 x 8			385 x 6		
377 x 3.5			386 x 3.5		
377 x 4			386 x 4		
377 x 5			386 x 5		
378 x 3.5			386 x 6		
378 x 4			387 x 3.5		
378 x 5			387 x 4		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
387 x 5		DIN/ISO/NF DIN/ISO/NF	396 x 3.5		
387 x 5.3			396 x 4		
387 x 7			396 x 5		
388 x 3.5			397 x 3.5		
388 x 4			397 x 4		
388 x 5			397 x 5		
388 x 6			398 x 3.5		
389 x 3.5			398 x 4		
389 x 4			398 x 5		
389 x 5			398 x 6		
389 x 6			399 x 3.5		
390 x 3.5			399 x 4		
390 x 4			399 x 5		
390 x 5			399.3 x 5.7		
390 x 6			399.5 x 8.4		P-400
391 x 3.5			400 x 3.5		DIN/ISO/NF
391 x 4			400 x 4		
391 x 5			400 x 5		
392 x 3.5			400 x 5.3		
392 x 4			400 x 6		
392 x 5			400 x 7		DIN/ISO/NF
392 x 6			400 x 8		
392 x 10			401 x 3.5		
393 x 3.5			401 x 4		
393 x 4			402 x 3.5		
393 x 5		15 1/2 x 16 x 1/4 AS-460, R88	402 x 4		
393.07 x 6.99			403 x 3.5		
394 x 3.5			403 x 4		
394 x 4			404 x 3.5		
394 x 5			404 x 4		
394 x 6			405 x 3.5		
395 x 3.5			405 x 4		
395 x 4			405.26 x 3.53	16 x 16 1/4 x 1/8	AS-282
395 x 5			405.26 x 5.33	16 x 16 3/8 x 3/16	AS-385
395 x 6			405.26 x 6.99	16 x 16 1/2 x 1/4	AS-461

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
406 x 3.5			420 x 4		
406 x 4			421 x 3.5		
407 x 3.5			421 x 4		
407 x 4			422 x 3.5		
408 x 3.5			422 x 4		
408 x 4			422 x 6		
408 x 12			422.2 x 6.99		
409 x 3.5			423 x 3.5		
409 x 4			423 x 4		
410 x 3.5			424 x 3.5		
410 x 4			424 x 4		
411 x 3.5			425 x 3.5		
411 x 4			425 x 4		
412 x 3.5			425 x 7		DIN/ISO/NF
412 x 4			425 x 8		
412 x 7		DIN/ISO/NF	425.5 x 6		V-340
413 x 3.5			426 x 3.5		
413 x 4			426 x 4		
414 x 3.5			427 x 3.5		
414 x 4			427 x 4		
415 x 3.5			428 x 3.5		
415 x 4			428 x 4		
415 x 5			429 x 3.5		
415 x 6			429 x 4		
416 x 3.5			429 x 6		
416 x 4			430 x 3.5		
417 x 3.5			430 x 4		
417 x 4			430.66 x 3.53	17 x 17 1/4 x 1/8	AS-283
417.96 x 6.99	16 1/2 x 17 x 1/4	AS-462	430.66 x 5.33	17 x 17 3/8 x 3/16	AS-386
418 x 3.5			430.66 x 6.99	17 x 17 1/2 x 1/4	AS-463
418 x 4			431 x 3.5		
419 x 3.5			431 x 4		
419 x 4			432 x 3.5		
419.3 x 5.7			432 x 4		
420 x 3.5			432 x 12		

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Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
432 x 13			450 x 8		
433 x 3.5			450 x 10		
433 x 4			451 x 4		
434 x 3.5			452 x 4		
434 x 4			453 x 4		
435 x 3.5			453 x 6		
435 x 4			454 x 4		
436 x 3.5			455 x 4		
436 x 4			456 x 4		
437 x 3.5			456.06 x 3.53	18 x 18 1/4 x 1/8	AS-284
437 x 4			456.06 x 5.33	18 x 18 3/8 x 3/16	AS-387
437 x 7	DIN/ISO/NF		456.06 x 6.99	18 x 18 1/2 x 1/4	AS-465
438 x 3.5			457 x 4		
438 x 4			457.2 x 7		
439 x 3.5			458 x 4		
439 x 4			459 x 4		
439.3 x 5.7			459.3 x 5.7		
440 x 3.5			460 x 4		
440 x 4			460 x 5		
441 x 4			461 x 4		
442 x 4			462 x 4		
442 x 12			462 x 7		DIN/ISO/NF
443 x 4			463 x 4		
443.36 x 6.99	17 1/2 x 18 x 1/4	AS-464	464 x 4		
444 x 4			465 x 4		
445 x 4			466 x 4		
446 x 4			467 x 4		
446 x 6			468 x 4		
447 x 4			468.76 x 6.99	18 1/2 x 19 x 1/4	AS-466
448 x 4			469 x 4		
448 x 6			470 x 4		
449 x 4			470 x 6		
450 x 4			471 x 4		
450 x 6			472 x 4		
450 x 7		DIN/ISO/NF	473 x 4		

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
474 x 4		DIN/ISO/NF V-480	494.67 x 7		
475 x 4			495 x 4		
475 x 7			496 x 4		
475 x 10			497 x 4		
476 x 4			498 x 4		
477 x 4			499 x 4		DIN/ISO/NF
478 x 4			499.3 x 5.7		
478 x 6			500 x 4		
479 x 4			500 x 6		
479.3 x 5.7			500 x 7		
480 x 4		AS-388	500 x 8		AS-389
480 x 6			504 x 6		
481 x 4			505 x 6		
481.41 x 5.33	19 x 19 $\frac{3}{8}$ x $\frac{3}{16}$		506.81 x 5.33	20 x 20 $\frac{3}{8}$ x $\frac{3}{16}$	
481.46 x 6.99	19 x 19 $\frac{1}{2}$ x $\frac{1}{4}$	AS-467	506.86 x 6.99	20 x 20 $\frac{1}{2}$ x $\frac{1}{4}$	AS-469
482 x 4			508 x 6		DIN/ISO/NF V-530
483 x 4			510 x 6		
483 x 6			515 x 7		
484 x 4			516 x 6		
485 x 4			524.5 x 10		
486 x 4		DIN/ISO/NF	530 x 6		DIN/ISO/NF AS-390 AS-470
486 x 6			530 x 7		
487 x 4			532.21 x 5.33	21 x 21 $\frac{3}{8}$ x $\frac{3}{16}$	
487 x 7			532.26 x 6.99	21 x 21 $\frac{1}{2}$ x $\frac{1}{4}$	
488 x 4			540 x 6		
489 x 4			540 x 12		DIN/ISO/NF
489 x 6			544 x 6		
490 x 4			545 x 7		
490 x 8			545.47 x 7		
490 x 14			548 x 16		
491 x 4		AS-468	549 x 6		AS-391 AS-471
492 x 4			552 x 6		
493 x 4			555 x 6		
494 x 4			557.61 x 5.33	22 x 22 $\frac{3}{8}$ x $\frac{3}{16}$	
494.16 x 6.99	19 $\frac{1}{2}$ x 20 x $\frac{1}{4}$		557.66 x 6.99	22 x 22 $\frac{1}{2}$ x $\frac{1}{4}$	

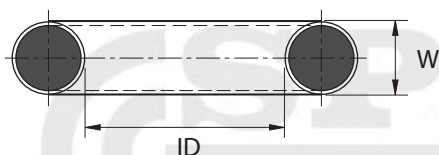
O-Ring

Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.	Dimension I/D x W Metric	Nominal Dimension U.S.standard	Ref. No.
560 x 6			878 x 20		
560 x 7		DIN/ISO/NF	880 x 7		
569 x 6			900 x 7		
571 x 5			925 x 20		
575 x 6			932.5 x 7		
579 x 6			940.5 x 10		V-950
579 x 10		V-585	1,044 x 10		V-1055
580 x 7		DIN/ISO/NF	1,080 x 7		
582.68 x 5.33	23 x 23 ³ / ₈ x ³ / ₁₆	AS-392	1,560 x 7		
582.68 x 6.99	23 x 23 ¹ / ₂ x ¹ / ₄	AS-472			
596.27 x 7					
600 x 7		DIN/ISO/NF			
600 x 16					
608.08 x 5.33	24 x 24 ³ / ₈ x ³ / ₁₆	AS-393			
608.08 x 6.99	24 x 24 ¹ / ₂ x ¹ / ₄	AS-473			
615 x 7		DIN/ISO/NF			
629.3 x 5.7					
630 x 7		DIN/ISO/NF			
633.48 x 5.33	25 x 25 ³ / ₈ x ³ / ₁₆	AS-394			
633.48 x 6.99	25 x 25 ¹ / ₂ x ¹ / ₄	AS-474			
633.5 x 10		V-640			
647.07 x 7					
650 x 7		DIN/ISO/NF			
654 x 18					
658.88 x 5.33	26 x 26 ³ / ₈ x ³ / ₁₆	AS-395			
658.88 x 6.99	26 x 26 ¹ / ₂ x ¹ / ₄	AS-475			
670 x 7		DIN/ISO/NF			
683 x 10		V-690			
718 x 18					
732.5 x 10		V-740			
760 x 7					
782 x 10		V-790			
800 x 7					
836.50 x 10		V-845			
870 x 7					

FEP-Encapsulated O-Ring

Description

The FEP-Encapsulated O-Rings are made of fluorocarbon rubber o-rings or silicone rubber o-rings with FEP-encapsulation, which covers the o-rings completely without seams. They are available in many standards and the dimensions are specified as inside diameter (ID) and the cross section (W). They can be fitted comfortably in existing o-ring grooves.



Cross section W*	Thickness of the FEP-encapsulation
1.78 mm	0.20 mm
2.62 mm	0.30 mm
3.53 mm	0.38 mm
5.33 mm	0.50 mm
7.00 mm	0.50 mm

* Cross section W in accordance AS 568 and DIN 3771

O-Rings with FEP-encapsulation are available in accordance with various standards.

cross sections

American standard	AS 568 A (DIN 3771)	1.78 - 2.62 - 3.53 - 5.33 - 7.00 mm
British standard	BS 1806	1.78 - 2.62 - 3.53 - 5.33 - 7.00 mm
Metric dimensions		2.0 - 2.5 - 3.0 - 3.5 - 4.0 - 5.0 - 6.0 - 7.0 - 8.0 mm
Swedish standard	SMS 1586	2.4 - 3.0 - 5.7 - 8.4 mm

Mode of action

FEP-Encapsulated O-Rings are double-acting sealing elements. As the pressure rises, the compression of the seal is increased.

Advantages over conventional O-Rings

- No stick slip and low friction
- Compatible with most chemicals and fluids, very good chemical resistance
- Cause no contamination when used with foodstuffs, pharmaceutical and medical products
- Can be sterilized with physiologically harmless
- Temperature range between -60°C to +200°C, depending on the O-Ring compound
- Allow only low steam to spread through

Operating ranges

Primarily used as static seals, e.g. for lids, covers, flanges and discs, etc. However, the FEP-encapsulated O-Rings can also be used for dynamic seals, e.g. for pistons, rods, spindles, etc. In case of insignificant strains and stresses.

Fields of application

Mainly used in the chemical industry, petrochemicals, medical, the foodstuffs industry, water and wastewater technology and similar industries. Typically used in the valve spindles and in mechanical seals.

Materials

Fluoride ethylene propylene (FEP) has very good chemical resistance properties, similar to those of PTFE (polytetrafluoroethylene). The elastomer, fluorocarbon rubber (fluorocautchouc - FPM) also has very good chemical and thermal strength properties. Silicone caoutchouc (VMQ) has outstanding resistance to aging and a wide operating temperature range.

Operating Temperature ranges

FEP : appr. -60°C to +204°C

FPM : appr. -25°C to +200°C

VMQ : appr. -60°C to +200°C

Advices on installation and construction

The FEP-encapsulated O-Rings cannot be squeezed into place as easily as the conventional o-rings. A split groove is recommended for radial static and dynamic installation to avoid unnecessary distortion of the rings. When the rings are used in external application, e.g. pistons, they must be stretched out and then put back in shape. The stretching should be carried out on top of a tapered tool, and a calibration collar is used for reshaping. The rings should be first heated in oil water to approximately 100°C before the installation to speed up the process.

The rings should be installed in rectangular grooves. For operating pressures higher than appr. 50 bar, it is recommended to fit concave back-up rings to prevent the o-rings from being extruded through the sealing gap.

Important Note: never force the ring into the groove, e.g. by buckling it.

Surface roughness

The function of the seal and its service life depends on the quality and character of the surface.

Radial-dynamic and static Bore/Rod

Groove surface static

$$R_a = 0.05 - 0.6 \mu\text{m} (R_{\text{max.}} = 0.2 - 2.5 \mu\text{m})$$

Groove surface dynamic

$$R_a \leq 2.5 \mu\text{m} (R_{\text{max.}} \leq 10 \mu\text{m})$$

with pulsating pressures

$$R_a \leq 1.5 \mu\text{m} (R_{\text{max.}} \leq 6 \mu\text{m})$$

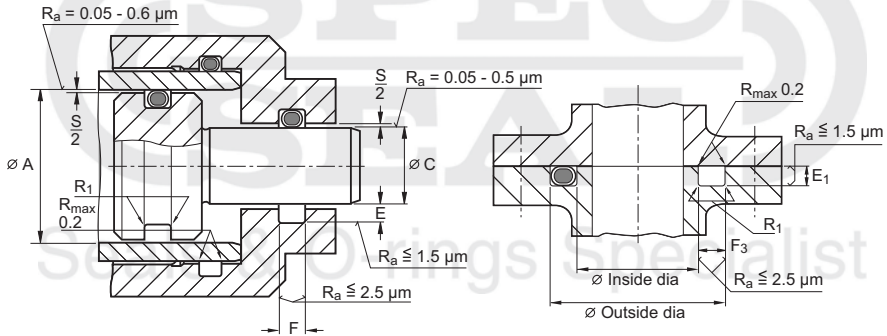
Axial-static

Seal and Groove surfaces

$$R_a \leq 2.5 \mu\text{m} (R_{\text{max.}} \leq 10 \mu\text{m})$$

with pulsating pressures

$$R_a \leq 1.5 \mu\text{m} (R_{\text{max.}} \leq 6 \mu\text{m})$$



Part-No.**	Cross Section W	Radial - dynamic/static		Axial - static		Radius R1	Diametrical clearance Smax.
		Groove dept E + 0.05	Groove width F + 0.2	Groove dept E1 + 0.05	Groove width F3 + 0.2		
014-050	1.78	1.45	2.2	1.2	2.2	0.4	0.15
112-178	2.62	2.25	3.1	1.9	3.1	0.6	0.20
214-284	3.53	3.10	4.2	2.7	4.2	1.0	0.20
329-395	5.33	4.70	6.2	4.3	6.2	1.2	0.25
429-475	7.00	6.10	8.2	5.8	8.2	1.5	0.35

* The groove width can be greater than 20%, if a greater swelling (more than 10%) is to be expected.

O-Ring compound : Fluorocarbon rubber (FPM) = V
Silicone rubber (VMQ) = S

O-RING CORDS

Nitrile rubber precision cord

Ø	Tol.	Ø	Tol.
1.60	± 0.2	8.40	± 0.3
1.78		9.00	
2.00		10.00	
2.40		12.00	
2.62		13.00	
3.00		14.00	
3.53		16.00	± 0.4
4.00		18.00	
5.00		20.00	
5.33		22.00	
6.00	± 0.3	25.00	
6.35		30.00	
7.00		32.00	
8.00		40.00	



Viton mm.	Silicone mm.	Neoprene mm.	Viton mm.	Silicone mm.	Neoprene mm.
Ø 1.60	Ø 1.78	Ø 2.00	Ø 7.00	Ø 10.00	Ø 15.00
1.78	2.00	2.62	7.50	12.00	16.00
2.00	2.40	3.00	8.00	15.00	18.00
2.50	2.62	3.53	8.40	16.00	20.00
2.62	3.00	4.00	9.00	18.00	25.00
3.00	3.53	5.00	9.50		30.00
3.53	4.00	5.33	10.00		
4.00	5.00	6.00	11.00		
4.50	5.33	7.00	12.00		
5.00	5.70	8.00	13.00		
5.33	6.00	9.00	14.00		
5.70	7.00	10.00	15.00		
6.00	8.00	12.00			
6.35	8.40	13.00			
6.40	9.00	14.00			

Other dimensions can be supplied as well

O-RING KITS



O-ring Kit 1

382 O-rings in 30 different imperial sizes.			
Nr.	Ref. Size	Dimensions	Quantity
006	AS-006	2.90 x 1.78	20
007	AS-007	3.68 x 1.78	20
008	AS-008	4.47 x 1.78	20
009	AS-009	5.28 x 1.78	20
010	AS-010	6.07 x 1.78	20
011	AS-011	7.65 x 1.78	20
012	AS-012	9.25 x 1.78	20
110	AS-110	9.19 x 2.62	13
111	AS-111	10.77 x 2.62	13
112	AS-112	12.37 x 2.62	13
113	AS-113	13.94 x 2.62	13
114	AS-114	15.54 x 2.62	13
115	AS-115	17.12 x 2.62	13
116	AS-116	18.76 x 2.62	13
210	AS-210	18.64 x 3.53	10
211	AS-211	20.22 x 3.53	10
212	AS-212	21.82 x 3.53	10
213	AS-213	23.39 x 3.53	10
214	AS-214	24.99 x 3.53	10
215	AS-215	26.57 x 3.53	10
216	AS-216	28.17 x 3.53	10
217	AS-217	29.74 x 3.53	10
218	AS-218	31.34 x 3.53	10
219	AS-219	32.92 x 3.53	10
220	AS-220	34.52 x 3.53	10
221	AS-221	36.09 x 3.53	10
222	AS-222	37.69 x 3.53	10
325	AS-325	37.47 x 5.33	7
326	AS-326	40.64 x 5.33	7
327	AS-327	43.82 x 5.33	7

30 items = 382 O-rings

All O-rings in proven quality NBR 70, 90, FPM-75

O-ring Kit 2

396 O-rings in 30 different imperial sizes.			
Nr.	Ref. Size	Dimensions	Quantity
006	P3	2.80 x 1.90	18
007	P4	3.80 x 1.90	18
008	P5	4.80 x 1.90	18
009	P6	5.80 x 1.90	18
010	P7	6.80 x 1.90	18
011	P8	7.80 x 1.90	18
012	P9	8.80 x 1.90	18
110	P10A	9.80 x 2.40	14
111	P11	10.80 x 2.40	14
112	P12	11.80 x 2.40	14
113	P14	13.80 x 2.40	14
114	P16	15.80 x 2.40	14
115	P18	17.80 x 2.40	14
116	P20	19.80 x 2.40	14
210	G20	20.00 x 3.00	11
211	G22	22.00 x 3.00	11
212	P22.4	22.10 x 3.50	10
213	G25	24.40 x 3.10	11
214	P25	24.70 x 3.50	10
215	P26	25.70 x 3.50	10
216	G30	29.40 x 3.10	11
217	P30	29.70 x 3.50	10
218	P32	31.70 x 3.50	10
219	P34	33.70 x 3.50	10
220	G35	34.70 x 3.10	11
221	P36	35.70 x 3.50	10
222	G40	39.40 x 3.10	11
325	P40	39.70 x 3.50	10
326	G45	44.70 x 3.10	11
327	P48	47.70 x 3.50	10

30 items = 396 O-rings

All O-rings in proven quality NBR 70, 90, FPM-75

Assortment boxes

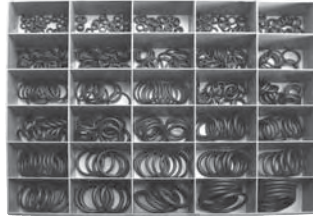
Your own O-Ring warehouse
in accordance with AS 568

TYPE A

Containing **435** O-Rings in 30 sizes.

Available :

- Nitrile 70° Shore A
- Nitrile 90° Shore A
- Fluorocarbon 75° Shore A



30 x 006 (2.90 x 1.78)	30 x 007 (3.69 x 1.78)	30 x 008 (4.47 x 1.78)	30 x 009 (5.28 x 1.78)	30 x 010 (6.07 x 1.78)
30 x 011 (7.65 x 1.78)	30 x 012 (9.25 x 1.78)	20 x 013 (10.82 x 1.78)	20 x 014 (12.42 x 1.78)	10 x 015 (14.00 x 1.78)
10 x 016 (15.60 x 1.78)	10 x 017 (17.17 x 1.78)	10 x 018 (18.77 x 1.78)	15 x 110 (9.20 x 2.62)	15 x 111 (10.78 x 2.62)
15 x 112 (12.37 x 2.62)	15 x 113 (13.95 x 2.62)	10 x 114 (15.54 x 2.62)	10 x 115 (17.12 x 2.62)	10 x 116 (18.72 x 2.62)
10 x 117 (20.30 x 2.62)	5 x 118 (21.90 x 2.62)	5 x 119 (23.47 x 2.62)	5 x 210 (18.64 x 3.53)	5 x 211 (20.22 x 3.53)
5 x 212 (21.82 x 3.53)	5 x 213 (23.39 x 3.53)	5 x 214 (24.99 x 3.53)	5 x 215 (26.57 x 3.53)	5 x 216 (28.17 x 3.53)

TYPE B

Containing **295** O-Rings in 24 sizes.

Available :

- Nitrile 70° Shore A
- Nitrile 90° Shore A
- Fluorocarbon 75° Shore A



15 x 019 (20.35 x 1.78)	15 x 020 (21.95 x 1.78)	15 x 120 (25.07 x 2.62)	15 x 121 (26.65 x 2.62)	15 x 122 (28.25 x 2.62)	15 x 123 (29.82 x 2.62)
15 x 124 (31.42 x 2.62)	15 x 125 (33.00 x 2.62)	15 x 126 (34.60 x 2.62)	15 x 217 (28.25 x 3.53)	15 x 218 (31.34 x 3.53)	15 x 219 (32.92 x 3.53)
15 x 220 (34.52 x 3.53)	10 x 221 (36.09 x 3.53)	10 x 222 (37.69 x 3.53)	10 x 223 (40.87 x 3.53)	10 x 224 (44.04 x 3.53)	10 x 225 (47.22 x 3.53)
10 x 226 (50.39 x 3.53)	10 x 325 (37.47 x 5.34)	10 x 326 (40.64 x 5.34)	10 x 327 (43.82 x 5.34)	5 x 328 (46.99 x 5.34)	5 x 329 (50.19 x 5.34)

Metric sizes

TYPE C

Containing **425** O-Rings in 30 sizes.

Available :

- Nitrile 70° Shore A



20 x 4 x 2	20 x 6 x 2	20 x 8 x 2	20 x 10 x 2	20 x 12 x 2
20 x 3.3 x 2.4	20 x 4.3 x 2.4	20 x 5.3 x 2.4	20 x 6.3 x 2.4	20 x 7.3 x 2.4
20 x 8.3 x 2.4	20 x 9.3 x 2.4	15 x 10.3 x 2.4	15 x 11.3 x 2.4	15 x 12.3 x 2.4
15 x 13.3 x 2.4	15 x 14.3 x 2.4	10 x 15.3 x 2.4	10 x 16.3 x 2.4	10 x 17.3 x 2.4
10 x 10 x 3	10 x 12 x 3	10 x 14 x 3	10 x 16 x 3	10 x 18 x 3
10 x 19.2 x 3	5 x 20 x 3	5 x 22 x 3	5 x 24 x 3	5 x 26.2 x 3

TYPE D

Containing **295** O-Rings in 24 sizes.

Available :

- Nitrile 70° Shore A



15 x 18 x 2	15 x 20 x 2	15 x 25 x 3	15 x 26.2 x 3	15 x 28 x 3	15 x 29.2 x 3
15 x 32.2 x 3	15 x 34.2 x 3	15 x 36.2 x 3	15 x 30 x 4	15 x 32 x 4	15 x 34 x 4
15 x 35 x 4	10 x 38 x 4	10 x 40 x 4	10 x 42 x 4	10 x 45 x 4	10 x 46 x 4
10 x 48 x 4	10 x 35 x 5	10 x 40 x 5	10 x 45 x 5	5 x 48 x 5	5 x 50 x 5

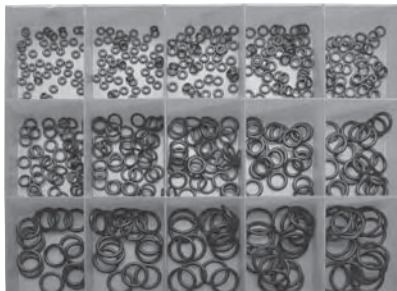
O-Rings in accordance with French standard

TYPE R I

Containing **485** O-Rings in 15 sizes.

Available :

- Nitrile 70° Shore A



RO 2.4 x 1.9	R1 2.6 x 1.9	R2 3.4 x 1.9	R3 4.2 x 1.9	R4 4.9 x 1.9
R5 5.7 x 1.9	R6 7.2 x 1.9	R7 8.9 x 1.9	R8 8.9 x 2.7	R9 10.5 x 2.7
R10 12.1 x 2.7	R11 13.6 x 2.7	R12 15.1 x 2.7	R13 16.9 x 2.7	R14 18.4 x 2.7

TYPE R II

Containing **295** O-Rings in 24 sizes.

Available :

- Nitrile 70° Shore A



R10 12.1 x 2.7	R11 3.6 x 2.7	R12 15.1 x 2.7	R13 16.9 x 2.7	R14 18.4 x 2.7	R15 18.3 x 3.6
R16 19.8 x 3.6	R17 21.3 x 3.6	R18 23 x 3.6	R19 24.6 x 3.6	R20 26.2 x 3.6	R21 27.8 x 3.6
R22 29.3 x 3.6	R23 30.8 x 3.6	R24 32.5 x 3.6	R25 34.1 x 3.6	R26 35.6 x 3.6	R27 37.3 x 3.6
R28 37.47 x 5.33	R29 40.64 x 5.33	R30 43.82 x 5.33	R31 46.99 x 5.33	R32 50.17 x 5.33	R33 53.34 x 5.33

Sicomet 8300

Sicomet 8300 (GLUE)
in 20 g. bottles
Suitable for splicing Nitrile, Fluorocarbon,
EPDM and Neoprene.



O-Ring Tool Kit

Tool for proper installation and
disassembling of O-rings.
Packaged in a black vinyl case
with 5 pcs. of tools.

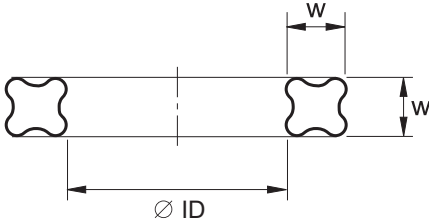


Circrometer

With this metal measuring tape it is
easy to determine the diameter
of O-rings.
There are two types : For diameters
between 1-12 inches (20-300 mm.),
and for diameters 12-27 inches
(300-700 mm.)



X-RING

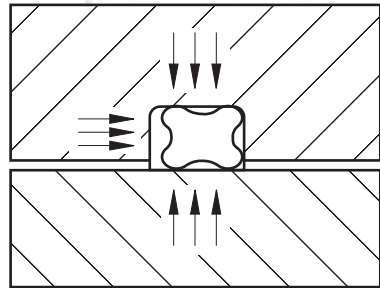
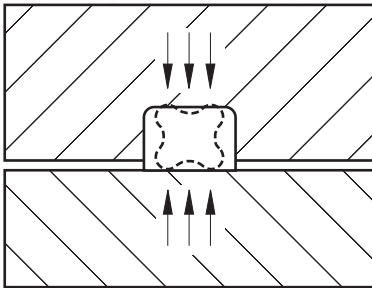


Description

The X-Ring has a shape looks like the "X" with four-lip seal and is used and handled similar to the o-rings. The X-Ring has equivalent sizes to the o-rings that conform to American Standard (AS series) with many types of synthetic rubber, e.g. nitrile rubbers (NBR), ethylene-propylene (EPDM), neoprene (CR), fluorocarbon elastomers (FPM), silicone elastomers (VMQ), fluorosilicone rubber (FVMQ), etc. The dimensions are specified as inside diameter (ID) and the cross section (W).

Mode of action

The X-Rings are pressured energized with double-acting sealing elements. The system pressure will give result in the increase in the compression of the seal as the pressure rises.



Advantages over the conventional O-Ring

- With its special profile of the X-Ring, it will not twist in its groove in the reciprocating motion
- Low friction and wear, the X-Ring has a longer life
- Less leakage losses
- No interfering flash affecting the sealing function

Fields of application

- can be used as dynamic and static seals

Operating ranges

Pressure : Up to appr. 400 bar (with PTFE back-up rings)

Speed : Up to appr. 0.5 m/s (reciprocating motion)

Temperature : appr. -100°C to +260°C (depending on the X-Ring compound)

Groove design and surface roughness

X-Rings are fitted in rectangular grooves. The groove must be larger than the X-Ring, allowing the elastomer to expand in various media. The slope for the groove sides is 5 (maximum). The groove diameter and the outer edges must be rounded off.

Cylinder/Bore

$$R_a = 0.2 - 0.6 \text{ } \mu\text{m} \text{ (} R_{\text{max.}} = 0.8 - 3.2 \text{ } \mu\text{m)}$$

Rod/Shaft

$$R_a = 0.2 - 0.6 \text{ } \mu\text{m} \text{ (} R_{\text{max.}} = 0.8 - 3.2 \text{ } \mu\text{m)}$$

Groove dia./Groove walls

dynamic or pulsating pressure

$$R_a \leq 1 - 2.5 \text{ } \mu\text{m} \text{ (} R_{\text{max.}} \leq 6 - 10 \text{ } \mu\text{m)}$$

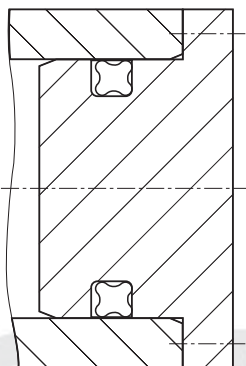
static

$$R_a \leq 1 - 4 \text{ } \mu\text{m} \text{ (} R_{\text{max.}} \leq 6 - 16 \text{ } \mu\text{m)}$$

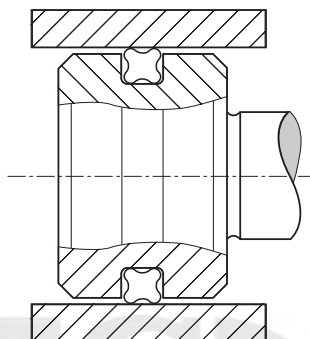
Advices on construction

A distinction is made among the following types of seals:

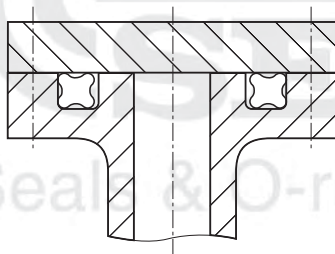
- Static radial seal (external and internal seals) for bushings, covers with spigots, etc.
- Static axial seal for flanges, washers, panels, etc.
- Dynamic reciprocating (external seals) for pistons, slidevalve stems, etc.
- Dynamic reciprocating (internal seals) for rods, plungers, push rods, etc.
- Dynamic rotating (internal seals) for shafts



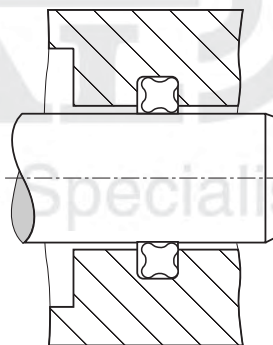
static radial



dynamic external seal



static axial



dynamic internal seal

Selection of X-Ring size

- **External seals installation** : The inside diameter of the X-Ring should be the same as the groove or appr. up to 2% less.
- **Internal seals installation** : The inside diameter of the X-Ring should be equal to or appr. 0.2 to 0.3 mm. smaller than the rod or about 1% larger than the shaft diameter.

Selection of X-Ring compound

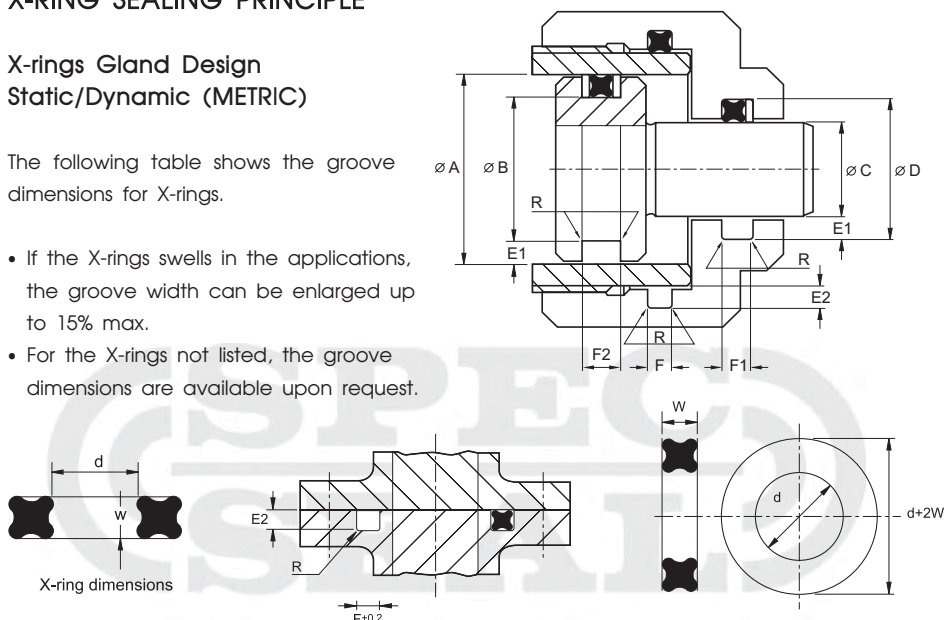
The correct compound depends on the medium, pressure, temperature, speed, surface finish and size of gap. Back-up rings are recommended to be used with X-Ring for large size of gap and a compound of average hardness (70 Shore) is preferable if used for greater pressure.

X-RING SEALING PRINCIPLE

X-rings Gland Design Static/Dynamic (METRIC)

The following table shows the groove dimensions for X-rings.

- If the X-rings swells in the applications, the groove width can be enlarged up to 15% max.
- For the X-rings not listed, the groove dimensions are available upon request.



TABLES AS.8A GLAND DIMENSIONS (millimeters)

X-ring size	Cross section *** W	Depth		Width**			Radius R	Max.µ Clearance S max.
		Dynamic E1	Static E2	No backup ring F+0.2	With backup ring F1+0.2	With backup ring F2+0.2		
X-001	1.02+0.08	0.8 +0.025	0.75+0.025	1.2	-	-	0.1	0.05
X-002	1.27+0.08	1.0 +0.025	0.9 +0.025	1.4	-	-	0.15	0.05
X-003	1.52+0.08	1.3 +0.025	1.2 +0.025	1.7	-	-	0.25	0.08
X-003 1/2	1.02+0.08	0.8 +0.025	0.75+0.025	1.2	-	-	0.1	0.05
X-004 - X-050	1.78+0.08	1.55+0.025	1.4 +0.025	2.0	3.5	5.0	0.25	0.10
X-102 - X-178	2.62+0.08	2.35+0.025	2.25+0.025	3.0	4.4	5.8	0.4	0.15
X-201 - X-284	3.53+0.1	3.25+0.025	3.0 +0.025	4.0	5.4	6.8	0.4	0.15
X-309 - X-395	5.33+0.13	4.95+0.05	4.75+0.05	6.0	7.8	9.5	0.6	0.20
X-425 - X-475	7.00+0.15	6.50+0.05	6.2 +0.05	8.0	10.5	13.0	0.6	0.20

Other dimensions and elastomers are available upon request.

Note :

- (**) In case of exceptional bending of the rod or shaft, the diameter of the bottom of the groove can be adjusted both in case of vacuum and high pressure.
- (***) Similar to O-rings, the X-rings need a squeeze of 10 to 15%.
For critical applications in combination with small cross sections it is recommended to compare squeeze with the actual dimensions and tolerances.

PRECISION X-RING STANDARD SIZES

Nominal and Actual Dimensions

The following tables include nominal and actual dimensions, reflecting a slight built-in size reduction for effective sealing.

Tolerances

The standard seal tooling is dimensioned to the shrink characteristics of the standard NBR 70 hardness. Because every rubber compound has its own shrink characteristics, slight deviations in dimensional tolerances will occur when standard seal tooling is used with materials other than the NBR-70 compound. The majority of the cases encountered involve rubber compounds with a higher shrink factor like a fluoroelastomer, resulting in an undersized seal. A slight adjustment in groove dimension may be required. Please contact SPECSEAL Application Engineers for tolerances when specifying materials other than the NBR-70 compound.

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-001	.031	.093	1/32	1/32	.029	.004	0.74	0.10	.040	.003	1.02	0.08
X-002	.046	.125	3/64	3/64	.042		1.07		.050		1.27	
X-003	.062	.156	1/16	1/16	.056		1.42		.060		1.52	
X-003 1/2	.078	.141	1/16	1/32	.070		1.78		.040		1.02	
X-004	.078	.203	5/64	1/16	.070	.005	1.78	0.13	.070		1.78	
X-005	.109	.234	3/32		.101		2.57					
X-006	.125	.250	1/8		.114		2.90					
X-007	.156	.281	5/32		.145		3.68					
X-008	.187	.312	3/16		.176		4.47					
X-009	.218	.343	7/32		.208		5.28					
X-010	.250	.375	1/4		.239		6.07					
X-011	.312	.437	5/16		.301		7.65					
X-012	.375	.500	3/8		.364		9.25					
X-013	.437	.562	7/16		.426		10.82					
X-014	.500	.625	1/2		.489		12.42					
X-015	.562	.687	9/16		.551	.007	14.00	0.18				

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-016	.625	.750	5/8	1/16	.614	.009	15.60	0.23	.070	.003	1.78	0.08
X-017	.687	.812	11/16		.676		17.17					
X-018	.750	.875	3/4		.739		18.77					
X-019	.812	.937	13/16		.801		20.35					
X-020	.875	1.000	7/8		.864		21.95					
X-021	0.937	1.062	15/16		.926		23.52					
X-022	1.000	1.125	1		.989	.010	25.12	0.25				
X-023	1.062	1.187	1 1/16		1.051		26.70					
X-024	1.125	1.250	1 1/8		1.114		28.23					
X-025	1.187	1.312	1 3/16		1.176	.011	29.87	0.28				
X-026	1.250	1.375	1 1/4		1.239		31.47					
X-027	1.312	1.437	1 5/16		1.301		33.05					
X-028	1.375	1.500	1 3/8		1.364	.013	34.65	0.33				
X-029	1.500	1.625	1 1/2		1.489		37.82					
X-030	1.625	1.750	1 5/8		1.614		41.00					
X-031	1.750	1.875	1 3/4		1.739	.015	44.17	0.38				
X-032	1.875	2.000	1 7/8		1.864		47.35					
X-033	2.000	2.125	2		1.989	.018	50.52	0.46				
X-034	2.125	2.250	2 1/8		2.114		53.70					
X-035	2.250	2.375	2 1/4		2.239		56.87					
X-036	2.375	2.500	2 3/8		2.364		60.05					
X-037	2.500	2.625	2 1/2		2.489		63.22					
X-038	2.625	2.750	2 5/8		2.614	.020	66.40	0.51				
X-039	2.750	2.875	2 3/4		2.739		69.57					
X-040	2.875	3.000	2 7/8		2.864		72.75					
X-041	3.000	3.125	3		2.989	.024	75.92	0.61				
X-042	3.250	3.375	3 1/4		3.239		82.27					
X-043	3.500	3.625	3 1/2		3.489		88.62					
X-044	3.750	3.875	3 3/4		3.739	.027	94.97	0.69				
X-045	4.000	4.125	4		3.989		101.32					
X-046	4.250	4.375	4 1/4		4.239	.030	107.67	0.76				
X-047	4.500	4.625	4 3/4		4.489		114.02					
X-048	4.750	4.875	4 3/4		4.739		120.37					
X-049	5.000	5.125	5		4.989	.037	126.72	0.94				
X-050	5.250	5.375	5 1/4		5.239		133.07					
X-102	0.062	0.250	1/16	3/32	.049	.005	1.24	0.13	.103	0.003	2.62	0.08
X-103	0.094	0.281	3/32		.081		2.06					

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-104	.125	.312	1/8	3/32	.112	.005	2.85	0.13	.103	.003	2.62	0.08
X-105	.156	.343	5/32		.143		3.63					
X-106	.187	.375	3/16		.174		4.42					
X-107	.219	.406	7/32		.206		5.23					
X-108	.250	.437	1/4		.237		6.02					
X-109	.312	.500	5/16		.299		7.60					
X-110	.375	.562	3/8		.362		9.20					
X-111	.437	.625	7/16		.424		10.77					
X-112	.500	.687	1/2		.487		12.37					
X-113	.562	.750	9/16		.549	.007	13.95	0.18				
X-114	.625	.812	5/8		.612	.009	15.55	0.23				
X-115	.687	.875	11/16		.674		17.12					
X-116	.750	.937	3/4		.737		18.72	0.25				
X-117	.812	1.000	13/16		.799	.010	20.30					
X-118	.875	1.062	7/8		.862		21.90					
X-119	.937	1.125	15/16		.924		23.47					
X-120	1.000	1.187	1		.987		25.07					
X-121	1.062	1.250	1 1/16		1.049		26.65					
X-122	1.125	1.312	1 1/8		1.112		28.25					
X-123	1.187	1.375	1 3/16		1.174	.012	29.82	0.31				
X-124	1.250	1.437	1 1/4		1.237		31.42					
X-125	1.312	1.500	1 5/16		1.299		33.00					
X-126	1.375	1.562	1 3/8		1.362		34.60					
X-127	1.437	1.625	1 7/16		1.424		36.17					
X-128	1.500	1.687	1 1/2		1.487		37.77					
X-129	1.562	1.750	1 9/16		1.549	.015	39.35	0.38				
X-130	1.625	1.812	1 5/8		1.612		41.00					
X-131	1.687	1.875	1 11/16		1.674		42.52					
X-132	1.750	1.937	1 3/4		1.737		44.12					
X-133	1.812	2.000	1 13/16		1.799		45.70					
X-134	1.875	2.062	1 7/8		1.862		47.30					
X-135	1.938	2.125	1 15/16		1.925	.017	48.90	0.43				
X-136	2.000	2.187	2		1.987		50.47					
X-137	2.063	2.250	2 1/16		2.050		52.07					
X-138	2.125	2.312	2 1/8		2.112		53.65					
X-139	2.188	2.375	2 3/16		2.175		55.25					
X-140	2.250	2.437	2 1/4		2.237		56.82					
X-141	2.313	2.500	2 5/16		2.300	.020	58.42	0.51				
X-142	2.375	2.562	2 3/8		2.362		60.00					
X-143	2.438	2.625	2 7/16		2.425		61.60					

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-144	2.500	2.687	2 1/2	3/32	2.487	.020	63.17	0.51	.103	.003	2.62	0.08
X-145	2.563	2.750	2 9/16		2.550		64.77					
X-146	2.625	2.812	2 5/8		2.612		66.34					
X-147	2.688	2.875	2 11/16		2.675	.022	67.95	0.56				
X-148	2.750	2.937	2 3/4		2.737		69.52					
X-149	2.813	3.000	2 13/16		2.800		71.12					
X-150	2.875	3.062	2 7/8		2.862		72.70					
X-151	3.000	3.187	3		2.987	.024	75.87	0.61				
X-152	3.250	3.437	3 1/4		3.237		82.22					
X-153	3.500	3.687	3 1/2		3.487		88.57					
X-154	3.750	3.937	3 3/4		3.737	.028	94.92	0.71				
X-155	4.000	4.187	4		3.987		101.27					
X-156	4.250	4.437	4 1/4		4.237	.030	107.62	0.76				
X-157	4.500	4.687	4 1/2		4.487		113.97					
X-158	4.750	4.937	4 3/4		4.737		120.32					
X-159	5.000	5.187	5		4.987	.035	126.67	0.89				
X-160	5.250	5.437	5 1/4		5.237		133.02					
X-161	5.500	5.687	5 1/2		5.487		139.37					
X-162	5.750	5.937	5 3/4		5.737		145.72					
X-163	6.000	6.187	6		5.987		152.07					
X-164	6.250	6.437	6 1/4		6.237	.040	158.42	1.02				
X-165	6.500	6.687	6 1/2		6.487		164.77					
X-166	6.750	6.937	6 3/4		6.737		171.12					
X-167	7.000	7.187	7		6.987		177.47					
X-168	7.250	7.437	7 1/4		7.237	.045	183.82	1.14				
X-169	7.500	7.687	7 1/2		7.487		190.17					
X-170	7.750	7.937	7 3/4		7.737		196.52					
X-171	8.000	8.187	8		7.987		202.87					
X-172	8.250	8.437	8 1/4		8.237	.050	209.20	1.27				
X-173	8.500	8.687	8 1/2		8.487		215.57					
X-174	8.750	8.937	8 3/4		8.737		221.92					
X-175	9.000	9.187	9		8.987		228.27					
X-176	9.250	9.437	9 1/4		9.237	.055	234.62	1.40				
X-177	9.500	9.687	9 1/2		9.487		240.97					
X-178	9.750	9.937	9 3/4		9.737		247.32					
X-201	0.187	.437	3/16	1/8	.171	.005	4.34	0.13	.139	.004	3.53	0.10
X-202	0.250	.500	1/4		.234		5.94					
X-203	0.312	.562	5/16		.296		7.52					
X-204	0.375	.625	3/8		.359		9.12					
X-205	0.437	.687	7/16		.421		10.69					

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-206	0.500	0.750	1/2	1/8	.484	.005	12.29	0.13	.139	.004	3.53	0.10
X-207	0.562	0.812	9/16		.546	.007	13.87	0.18				
X-208	0.625	0.875	5/8		.609	.009	15.47	0.23				
X-209	0.687	0.937	11/16		.671		17.04					
X-210	0.750	1.000	3/4		.734	.010	18.64	0.25				
X-211	0.812	1.062	13/16		.796		20.22					
X-212	0.875	1.125	7/8		.859		21.82					
X-213	0.937	1.187	15/16		.921		23.39					
X-214	1.000	1.250	1		.984		24.99					
X-215	1.062	1.312	1 1/16		1.046		26.57					
X-216	1.125	1.375	1 1/8		1.109	.012	28.17	0.31				
X-217	1.187	1.437	1 3/16		1.171		29.74					
X-218	1.250	1.500	1 1/4		1.234		31.34					
X-219	1.312	1.562	1 5/16		1.296		32.92					
X-220	1.375	1.625	1 3/8		1.359		34.52					
X-221	1.437	1.687	1 7/16		1.421		36.09					
X-222	1.500	1.750	1 1/2		1.484	.015	37.69	0.38				
X-223	1.625	1.875	1 5/8		1.609		40.87					
X-224	1.750	2.000	1 3/4		1.734		44.04					
X-225	1.875	2.125	1 7/8		1.859	.018	47.22	0.46				
X-226	2.000	2.250	2		1.984		50.39					
X-227	2.125	2.675	2 1/8		2.109		53.57					
X-228	2.250	2.500	2 1/4		2.234	.020	56.74	0.51				
X-229	2.375	2.625	2 3/8		2.359		59.92					
X-230	2.500	2.750	2 1/2		2.484		63.09					
X-231	2.625	2.875	2 5/8		2.609		66.27					
X-232	2.750	3.000	2 3/4		2.734	.024	69.44	0.61				
X-233	2.875	3.125	2 7/8		2.859		72.62					
X-234	3.000	3.250	3		2.984		75.79					
X-235	3.125	3.375	3 1/8		3.109		78.97					
X-236	3.250	3.500	3 1/4		3.234		82.14					
X-237	3.375	3.625	3 3/8		3.359		85.32					
X-238	3.500	2.750	3 1/2		3.484		88.49					
X-239	3.625	3.875	3 5/8		3.609	.028	91.67	0.71				
X-240	3.750	4.000	3 3/4		3.734		94.84					
X-241	3.875	4.125	3 7/8		3.859		98.02					
X-242	4.000	4.250	4		3.984		101.19					
X-243	4.125	4.375	4 1/8		4.109		104.37					
X-244	4.250	4.500	4 1/4		4.234	.030	107.54	0.76				
X-245	4.375	4.625	4 3/8		4.359		110.72					

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-246	4.500	4.750	4 1/2	1/8	4.484	.030	113.89	0.76	.139	.004	3.53	0.10
X-247	4.625	4.875	4 5/8		4.609		117.07					
X-248	4.750	5.000	4 3/4		4.734		120.24					
X-249	4.875	5.125	4 7/8		4.859	.035	123.42	0.89				
X-250	5.000	5.250	5		4.984		126.59					
X-251	5.125	5.375	5 1/8		5.109		129.77					
X-252	5.250	5.500	5 1/4		5.234		132.95					
X-253	5.375	5.625	5 3/8		5.359		136.12					
X-254	5.500	5.750	5 1/2		5.484		139.29					
X-255	5.625	5.875	5 5/8		5.609		142.47					
X-256	5.750	6.000	5 3/4		5.734		145.64					
X-257	5.875	6.125	5 7/8		5.859		148.82					
X-258	6.000	6.250	6		5.984		151.99					
X-259	6.250	6.500	6 1/4		6.234	.040	158.34	1.02				
X-260	6.500	6.750	6 1/2		6.484		164.69					
X-261	6.750	7.000	6 3/4		6.734		171.04					
X-262	7.000	7.250	7		6.984		177.39					
X-263	7.250	7.500	7 1/4		7.234	.045	183.74	1.14				
X-264	7.500	7.750	7 1/2		7.484		190.10					
X-265	7.750	8.000	7 3/4		7.737		196.44					
X-266	8.000	8.250	8		7.984		202.79					
X-267	8.250	8.500	8 1/4		8.234	.050	209.14	1.27				
X-268	8.500	8.750	8 1/2		8.484		215.49					
X-269	8.750	9.000	8 3/4		8.734		221.84					
X-270	9.000	9.250	9		8.984		228.19					
X-271	9.250	9.500	9 1/4		9.234	.055	234.54	1.40				
X-272	9.500	9.750	9 1/2		9.484		240.89					
X-273	9.750	10.000	9 3/4		9.734		247.24					
X-274	10.000	10.250	10		9.984		253.59					
X-275	10.500	10.750	10 1/2		10.484		266.29					
X-276	11.000	11.250	11		10.984	.065	278.99	1.65				
X-277	11.500	11.750	11 1/2		11.484		291.69					
X-278	12.000	12.250	12		11.984		304.39					
X-279	13.000	13.250	13		12.984		329.79					
X-280	14.000	14.250	14		13.984		355.19					
X-281	15.000	15.250	15		14.984		380.59					
X-282	16.000	16.250	16		15.955	.075	405.26	1.91				
X-283	17.000	17.250	17		16.955	.080	430.66	2.03				
X-284	18.000	18.250	18		17.955	.085	456.06	2.16				

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-309	.437	.812	7/16	3/16	.412	.005	10.47	0.13	.210	.005	5.33	0.13
X-310	.500	.875	1/2		.475		12.07					
X-311	.562	.937	9/16		.537	.007	13.64	0.18				
X-312	.625	1.000	5/8		.600	.009	15.24	0.23				
X-313	.687	1.062	11/16		.662		16.82					
X-314	.750	1.125	3/4		.725	.010	18.42	0.25				
X-315	.812	1.187	13/16		.787		19.99					
X-316	.875	1.250	7/8		.850		21.59					
X-317	.937	1.312	15/16		.912		23.17					
X-318	1.000	1.375	1		.975		24.77					
X-319	1.062	1.437	1 1/16		1.037		26.34					
X-320	1.125	1.500	1 1/8		1.100	.012	27.94	0.31				
X-321	1.187	1.562	1 3/16		1.162		29.52					
X-322	1.250	1.625	1 1/4		1.225		31.12					
X-323	1.312	1.687	1 5/16		1.287		32.69					
X-324	1.375	1.750	1 3/8		1.350		34.29					
X-325	1.500	1.875	1 1/2		1.475	.015	37.47	0.38				
X-326	1.625	2.000	1 5/8		1.600		40.64					
X-327	1.750	2.125	1 3/4		1.725		43.82					
X-328	1.875	2.250	1 7/8		1.850		46.99					
X-329	2.000	2.375	2		1.975	.018	50.17	0.46				
X-330	2.125	2.500	2 1/8		2.100		53.34					
X-331	2.250	2.625	2 1/4		2.225		56.52					
X-332	2.375	2.750	2 3/8		2.350		59.69					
X-333	2.500	2.875	2 1/2		2.475	.020	62.87	0.51				
X-334	2.625	3.000	2 5/8		2.600		66.04					
X-335	2.750	3.125	2 3/4		2.725		69.22					
X-336	2.875	3.250	2 7/8		2.850		72.39					
X-337	3.000	3.375	3		2.975	.024	75.57	0.61				
X-338	3.125	3.500	3 1/8		3.100		78.74					
X-339	3.250	3.625	3 1/4		3.225		81.92					
X-340	3.375	3.750	3 3/8		3.350		85.09					
X-341	3.500	3.875	3 1/2		3.475		88.27					
X-342	3.625	4.000	3 5/8		3.600	.028	91.44	0.71				
X-343	3.750	4.125	3 3/4		3.725		94.62					
X-344	3.875	4.250	3 7/8		3.850		97.79					
X-345	4.000	4.375	4		3.975		100.97					
X-346	4.125	4.500	4 1/8		4.100		104.14					
X-347	4.250	4.625	1 1/4		4.225	.030	107.32	0.76				
X-348	4.375	4.750	4 3/8		4.350		110.49					

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-349	4.500	4.875	4 1/2	3/16	4.475	.030	113.67	0.76	.210	.005	5.33	0.13
X-350	4.625	5.000	4 5/8		4.600		116.84					
X-351	4.750	5.125	4 3/4		4.725		120.02					
X-352	4.875	5.250	4 7/8		4.850		123.19					
X-353	5.000	5.375	5		4.975	.037	126.37	0.94				
X-354	5.125	5.500	5 1/8		5.100		129.54					
X-355	5.250	5.625	5 1/4		5.225		132.72					
X-356	5.375	5.750	5 3/8		5.350		135.89					
X-357	5.500	5.875	5 1/2		5.475		139.07					
X-358	5.625	6.000	5 5/8		5.600		142.24					
X-359	5.750	6.125	5 3/4		5.725		145.42					
X-360	5.875	6.250	5 7/8		5.850		148.59					
X-361	6.000	6.375	6		5.975		151.77					
X-362	6.250	6.625	6 1/4		6.225	.040	158.12	1.02				
X-363	6.500	6.875	6 1/2		6.475		164.47					
X-364	6.750	7.125	6 3/4		6.725		170.82					
X-365	7.000	7.375	7		6.975		177.17					
X-366	7.250	7.625	7 1/4		7.225	.045	183.52	1.14				
X-367	7.500	7.875	7 1/2		7.475		189.87					
X-368	7.750	8.125	7 3/4		7.725		196.22					
X-369	8.000	8.375	8		7.975		202.57					
X-370	8.250	8.625	8 1/4		8.225	.050	208.92	1.27				
X-371	8.500	8.875	8 1/2		8.475		215.27					
X-372	8.750	9.125	8 3/4		8.725		221.62					
X-373	9.000	9.375	9		8.975		227.97					
X-374	9.250	9.625	9 1/4		9.225	.055	234.32	1.40				
X-375	9.500	9.875	9 1/2		9.475		240.67					
X-376	9.750	10.125	9 3/4		9.725		247.02					
X-377	10.000	10.375	10		9.975		253.37					
X-378	10.500	10.875	10 1/2		10.475	.060	266.07	1.52				
X-379	11.000	11.375	11		10.975		278.77					
X-380	11.500	11.875	11 1/2		11.475	.065	291.47	1.65				
X-381	12.000	12.375	12		11.975		304.17					
X-382	13.000	13.375	13		12.975		329.57					
X-383	14.000	14.375	14		13.975	.070	354.97	1.78				
X-384	15.000	15.375	15		14.975		380.37					
X-385	16.000	16.375	16		15.955	.075	405.26	1.91				
X-386	17.000	17.375	17		16.955	.080	430.66	2.03				
X-387	18.000	18.375	18		17.955	.085	456.06	2.16				
X-388	19.000	19.375	19		18.955	.090	481.41	2.29				

STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-389	20.000	20.375	20	3/16	19.955	.095	506.81	2.41	.210	.005	5.33	0.13
X-390	21.000	21.375	21		20.955		532.21					
X-391	22.000	22.375	22		21.955	.100	557.61	2.54				
X-392	23.000	23.375	23		22.940	.105	582.68	2.67				
X-393	24.000	24.375	24		23.940	.110	608.08	2.79				
X-394	25.000	25.375	25		24.940	.115	633.48	2.92				
X-395	26.000	26.375	26		25.940	.120	658.88	3.05				
X-425	4.500	5.000	4 1/2	1/4	4.475	.033	113.67	0.84	.275	.006	6.99	0.15
X-426	4.625	5.125	4 5/8		4.600		116.84					
X-427	4.750	5.250	4 3/4		4.725		120.02					
X-428	4.875	5.375	4 7/8		4.850		123.19					
X-429	5.000	5.500	5		4.975	.037	126.37	0.94				
X-430	5.125	5.625	5 1/8		5.100		129.54					
X-431	5.250	5.750	5 1/4		5.225		132.72					
X-432	5.375	5.875	5 3/8		5.350		135.89					
X-433	5.500	6.000	5 1/2		5.475		139.07					
X-434	5.625	6.125	5 5/8		5.600		142.24					
X-435	5.750	6.250	5 3/4		5.725		145.42					
X-436	5.875	6.375	5 7/8		5.850		148.59					
X-437	6.000	6.500	6		5.975		151.77					
X-438	6.250	6.750	6 1/4		6.225	.040	158.12	1.02				
X-439	6.500	7.000	6 1/2		6.475		164.47					
X-440	6.750	7.250	6 3/4		6.725		170.82					
X-441	7.000	7.500	7		6.975		177.17					
X-442	7.250	7.750	7 1/4		7.225	.045	183.52	1.14				
X-443	7.500	8.000	7 1/2		7.475		189.87					
X-444	7.750	8.250	7 3/4		7.725		196.22					
X-445	8.000	8.500	8		7.975		202.57					
X-446	8.500	9.000	8 1/2		8.475	.055	215.27	1.40				
X-447	9.000	9.500	9		8.975		227.97					
X-448	9.500	10.000	9 1/2		9.475		240.67					
X-449	10.000	10.500	10		9.975		253.37					
X-450	10.500	11.000	10 1/2		10.475	.060	266.07	1.52				
X-451	11.000	11.500	11		10.975		278.77					
X-452	11.500	12.000	11 1/2		11.475	.065	291.47					
X-453	12.000	12.500	12		11.975		304.17					
X-454	12.500	13.000	12 1/2		12.475		316.87					
X-455	13.000	13.500	13		12.975		329.57					
X-456	13.500	14.000	13 1/2		13.475	.070	342.27	1.78				
X-457	14.000	14.500	14		13.975		354.97					

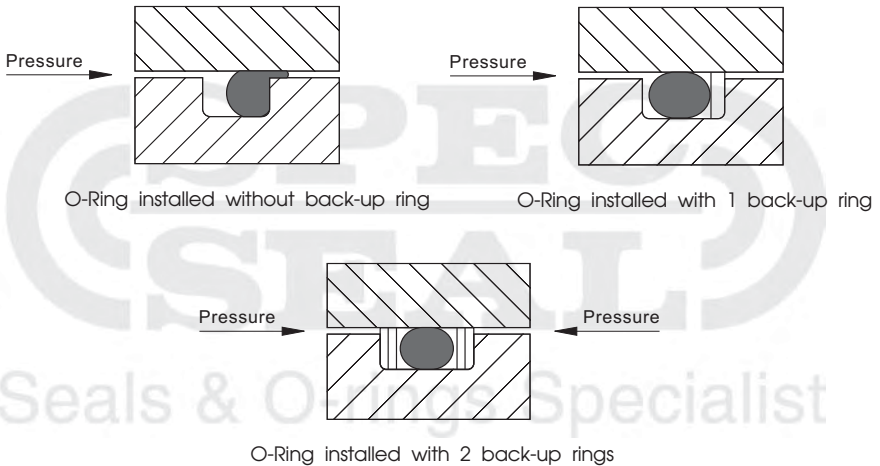
STANDARD X-RING SIZES

Part No.	Rod	Bore	Nominal Sizes		Actual Sizes							
			ID (in)	C/S (in)	ID (in)	+/-	ID (mm)	+/-	CS (in)	+/-	CS (mm)	+/-
X-458	14.500	15.000	14 1/2	1/4	14.475	.070	367.67	1.78	.275	.006	6.99	0.15
X-459	15.000	15.500	15		14.975		380.37					
X-460	15.500	16.000	15 1/2		15.475		393.07					
X-461	16.000	16.500	16		15.955	.075	405.26	1.91				
X-462	16.500	17.000	16 1/2		16.455		417.96					
X-463	17.000	17.500	17		16.955	.080	430.66	2.03				
X-464	17.500	18.000	17 1/2		17.455	.085	443.36	2.16				
X-465	18.000	18.500	18		17.955		456.06					
X-466	18.500	19.000	18 1/2		18.455		468.76					
X-467	19.000	19.500	19		18.955	.090	481.46	2.29				
X-468	19.500	20.000	19 1/2		19.455		494.16					
X-469	20.000	20.500	20		19.955	.095	506.86	2.41				
X-470	21.000	21.500	21		20.955		532.26					
X-471	22.000	22.500	22		21.955	.100	557.66	2.54				
X-472	23.000	23.500	23		22.940	.105	582.68	2.67				
X-473	24.000	24.500	24		23.940	.110	608.08	2.79				
X-474	25.000	25.500	25		24.940	.115	633.48	2.92				
X-475	26.000	26.500	26		25.940	.120	658.88	3.05				

General

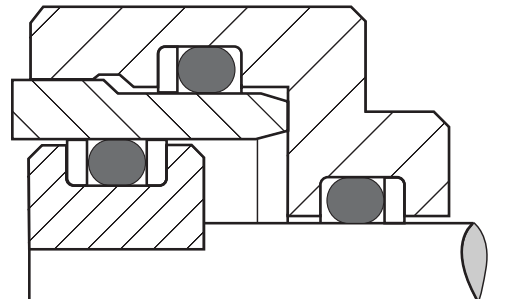
Back-up rings are always used with O-rings and used to prevent O-rings from gap extrusion. In case of high pressure O-rings can be forced into the sealed gap and finally get destroyed.

Back-up rings do not provide any sealing function. The use of a back-up ring produces a reliable O-ring seal effective over a wide pressure and temperature range. This also applies to X-rings which can also be fitted together with back-up rings.

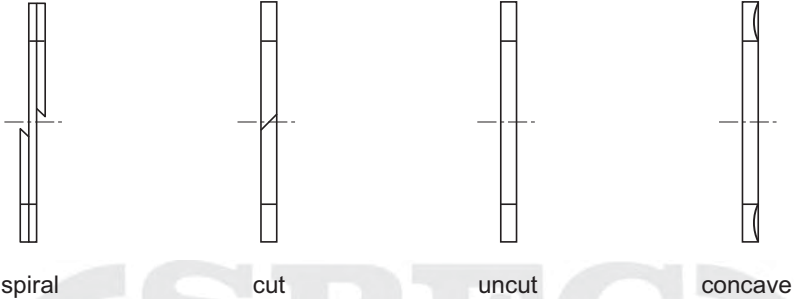


Designs

Back-up rings are used for external and internal sealing. They are used for radial dynamic and radial static installation.



There are four type of standard back-up rings as follows.



Materials

Back-up rings are available in virtually all synthetic materials for example. PTFE, PA, POM, PU, NBR, FPM, and EPDM etc.

Operating Condition

The back-up rings are essential if one of the following conditions is applied.

- Pressures above 80 bar.
- Wide tolerances for the dimensions of the gap between the parts to be sealed.
- High speed.
- High temperature.
- Fluctuating pressure.

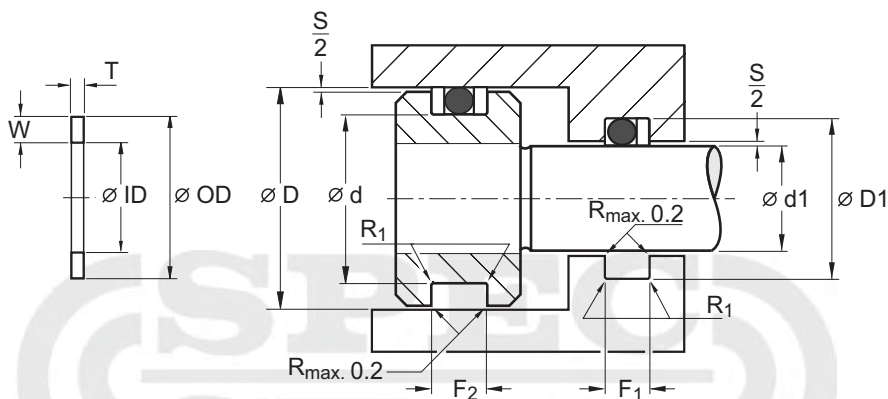
Installations

Normally back-up rings are installed in the lower pressure side. The back-up rings dimensions normally have to be adapted to the housing of the standard O-ring. To find out the size of the back-up rings, the following parameters are required.

- Housing dimensions with tolerances.
- Type of application (static, dynamic sealing)
- O-ring dimensions including medium, pressure and temperature.

Please contact us for any further information and assistance.

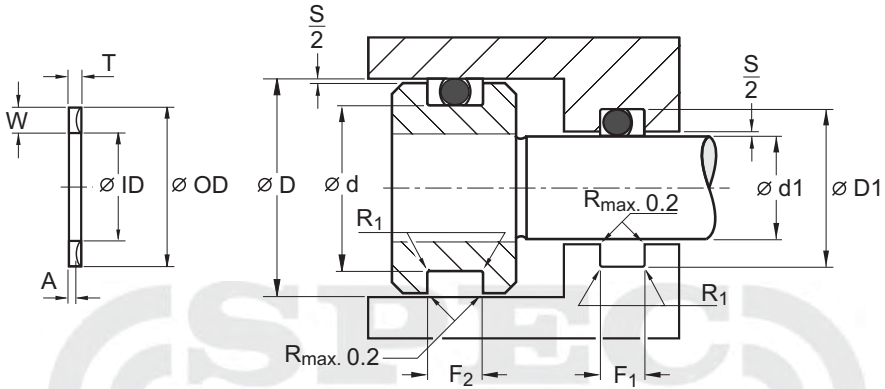
INSTALLATION RECOMMENDATION CUT & UNCUT BACK-UP RING



Installation Dimensions

Cross section	Back-up ring dimensions		Groove dimensions					Metrical Clearance S max.
			Groove dia.		Groove width**		Radius R ₁	
AS 568 A	Width (W)	Thickness (T)	d-0.1	D1+0.1	1 back-up ring F ₁ +0.2	2 back-up rings F ₂ +0.2		
1.78	1.45	1.4	D- 2.9	d1+ 2.9	3.8	5.2	0.2	0.12
2.62	2.25	1.4	D- 4.5	d1+ 4.5	5.0	6.4	0.3	0.12
3.53	3.1	1.4	D- 6.2	d1+ 6.2	6.2	7.6	0.4	0.15
5.33	4.7	1.7	D- 9.4	d1+ 9.4	8.8	10.5	0.6	0.15
7.0	6.1	2.5	D-12.2	d1+12.2	12.0	14.5	0.6	0.20

INSTALLATION RECOMMENDATION CONCAVE BACK-UP RING



Installation Dimensions

Back-up ring Groove dimensions								Radius R1	O-Ring		Clearance
Series	Dimensions			Groove dia.		Groove width**			Cross section	Series	
	Width (W)	Thickness (A)	Thickness (T)	d-0.1	D1+0.1	1 back-up ring F1+0.2	2 back-up rings F2+0.2				
8-004 to 8-050	1.35	1.14	1.24	D-29	d1+29	3.6	5.0	0.2	1.78	000	0.12
8-102 to 8-178	2.18	1.14	1.35	D-45	d1+45	4.5	5.9	0.3	2.62	100	0.12
8-201 to 8-284	3.00	1.02	1.27	D-62	d1+62	5.6	7.0	0.4	3.53	200	0.15
8-309 to 8-395	4.65	1.52	1.93	D-94	d1+97	7.9	9.6	0.6	5.33	300	0.15
8-425 to 8-475	5.99	2.44	2.97	D-122	d1+122	10.7	13.2	0.6	7.00	400	0.20

Order example

8 - 212 - NBR-90

Series _____

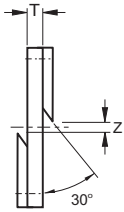
Part No. _____

Standard material (NBR) _____

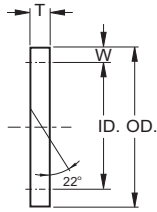
Concave Back-up ring standard sizes series 8-XXX

 1.35 mm		 2.18 mm		 3.00 mm		 4.65 mm		 5.99 mm	
Series No.	ID. mm.	Series No.	ID. mm.	Series No.	ID. mm.	Series No.	ID. mm.	Series No.	ID. mm.
8-004	2.44	8-102	1.96	8-201	5.13	8-309	11.43	8-425	115.60
8-005	3.23	8-103	2.77	8-202	6.73	8-310	13.03	8-426	118.77
8-006	3.56	8-104	2.56	8-203	3.30	8-311	14.60	8-427	121.95
8-007	4.34	8-105	4.34	8-204	9.90	8-312	16.20	8-428	125.20
8-008	5.13	8-106	5.13	8-205	11.56	8-313	17.78	8-429	128.30
8-009	5.94	8-107	5.94	8-206	13.16	8-314	19.38	8-430	131.47
8-010	6.73	8-108	6.73	8-207	14.73	8-315	20.96	8-431	134.65
8-011	8.91	8-109	8.31	8-208	16.33	8-316	22.56	8-432	137.82
8-012	9.91	8-110	9.91	8-209	17.90	8-317	24.13	8-433	141.00
8-013	11.56	8-111	11.48	8-210	19.46	8-318	25.73	8-434	144.17
8-014	13.16	8-112	13.08	8-211	21.03	8-319	27.31	8-435	147.35
8-015	14.73	8-113	14.66	8-212	22.63	8-320	28.91	8-436	150.52
8-016	16.33	8-114	16.26	8-213	24.21	8-321	30.42	8-437	153.70
8-017	17.91	8-115	17.83	8-214	25.81	8-322	32.08	8-438	156.96
8-018	19.51	8-116	19.43	8-215	27.38	8-323	33.43	8-439	165.71
8-019	21.08	8-117	21.11	8-216	28.98	8-324	35.26	8-440	172.06
8-020	22.68	8-118	22.68	8-217	30.56	8-325	38.43	8-441	178.41
8-021	24.25	8-119	24.28	8-218	32.18	8-326	41.61	8-442	184.76
8-022	25.66	8-120	25.86	8-219	33.88	8-327	44.78	8-443	191.11
8-023	27.43	8-121	27.46	8-220	35.48	8-328	47.96	8-444	197.46
8-024	29.03	8-122	29.03	8-221	37.06	8-329	51.13	8-445	203.81
8-025	30.61	8-123	30.63	8-222	38.66	8-330	54.31	8-446	210.51
8-026	32.21	8-124	32.21	8-223	41.83	8-331	57.61	8-447	229.21
8-027	33.78	8-125	33.81	8-224	45.01	8-332	60.78	8-448	241.91
8-028	35.38	8-126	35.38	8-225	48.18	8-333	63.96	8-449	254.61
8-029	38.56	8-127	36.98	8-226	51.36	8-334	67.13	8-450	267.31
8-030	41.73	8-128	38.56	8-227	54.53	8-335	70.31	8-451	280.01
8-031	44.91	8-129	40.16	8-228	57.71	8-336	73.48	8-452	292.71
8-032	48.08	8-130	41.73	8-229	60.88	8-337	76.66	8-453	305.41
8-033	51.26	8-131	43.33	8-230	64.06	8-338	79.83	8-454	318.11
8-034	54.43	8-132	44.91	8-231	66.83	8-339	83.13	8-455	330.81
8-035	57.61	8-133	46.51	8-232	70.00	8-340	86.31	8-456	343.51
8-036	60.78	8-134	48.08	8-233	73.18	8-341	89.48	8-457	356.21
8-037	63.96	8-135	49.68	8-234	76.35	8-342	92.66	8-458	368.91
8-038	67.13	8-136	51.26	8-235	79.53	8-343	95.83	8-459	381.61
8-039	70.31	8-137	52.86	8-236	82.70	8-344	99.01	8-460	394.31
8-040	73.48	8-138	54.43	8-237	85.88	8-345	102.31	8-461	406.50
8-041	76.66	8-139	55.03	8-238	89.05	8-346	105.49	8-462	419.20
8-042	83.01	8-140	57.61	8-239	92.23	8-347	108.66	8-463	431.90
8-043	89.36	8-141	59.21	8-240	95.40	8-348	111.84	8-464	444.60
8-044	95.71	8-142	60.78	8-241	98.58	8-349	115.01	8-465	457.30
8-045	102.06	8-143	62.38	8-242	101.75	8-350	118.19	8-466	470.00
8-046	108.41	8-144	63.96	8-243	104.93	8-351	121.36	8-467	482.70
8-047	114.76	8-145	65.56	8-244	108.10	8-352	124.54	8-468	495.40
8-048	121.11	8-146	67.13	8-245	111.28	8-353	127.71	8-469	508.10
8-049	127.46	8-147	68.73	8-246	114.45	8-354	130.89	8-470	533.50
8-050	133.81	8-148	70.31	8-247	117.63	8-355	134.09	8-471	558.90
		8-149	71.91	8-248	121.11	8-356	137.24	8-472	584.30
		8-150	73.48	8-249	124.28	8-357	140.41	8-473	609.70
		8-151	76.66	8-250	127.46	8-358	143.59	8-474	635.10
		8-152	83.01	8-251	130.63	8-359	146.76	8-475	660.50
		8-153	89.36	8-252	133.81	8-360	149.94		
		8-154	95.71	8-253	136.98	8-361	153.11		
		8-155	102.06	8-254	140.16	8-362	156.26		
		8-156	108.41	8-255	143.33	8-363	159.41		
		8-157	114.76	8-256	146.51	8-364	172.16		
		8-158	121.11	8-257	149.68	8-365	178.51		
		8-159	127.46	8-258	152.86	8-366	184.86		
		8-160	133.81	8-259	159.21	8-367	191.21		
		8-161	140.16	8-260	165.56	8-368	197.56		
		8-162	146.51	8-261	171.91	8-369	203.91		
		8-163	152.86	8-262	178.26	8-370	210.26		
		8-164	159.21	8-263	184.61	8-371	216.61		
		8-165	165.56	8-264	190.96	8-372	222.96		
		8-166	171.91	8-265	197.31	8-373	229.31		
		8-167	178.26	8-266	203.66	8-374	235.66		
		8-168	184.61	8-267	210.01	8-375	242.01		
		8-169	190.96	8-268	216.36	8-376	248.36		
		8-170	197.31	8-269	222.71	8-377	254.71		
		8-171	203.66	8-270	229.06	8-378	261.06		
		8-172	210.01	8-271	235.41	8-379	267.41		
		8-173	216.36	8-272	241.76	8-380	273.76		
		8-174	222.71	8-273	248.11	8-381	280.11		
		8-175	229.06	8-274	254.46	8-382	286.46		
		8-176	235.41	8-275	260.81	8-383	292.81		
		8-177	241.76	8-276	267.16	8-384	300.16		
		8-178	248.11	8-277	273.51	8-385	306.51		
				8-278	279.86	8-386	312.86		
				8-279	286.21	8-387	319.21		
				8-280	292.56	8-388	325.56		
						8-389	331.91		
						8-390	338.26		
						8-391	344.61		
						8-392	350.96		
						8-393	357.31		
						8-394	363.66		
						8-395	370.01		

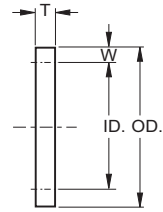
TABLE OF DIMENSIONS OF BACK-UP RINGS (JIS B 2407)



spiral (T1)



cut (T2)



endless (T3)

(Unit : mm)

Nominal size Of back up ring	Spiral				biasecut and endless					Applicable O-ring nominal size by JIS B 2401
	ID.	Width (W)	Thickness (T)	Clearance (Z)	ID.		OD.		Thickness (T)	
P 3	3	$1.5 \pm \begin{smallmatrix} 0.03 \\ 0.05 \end{smallmatrix}$	$0.7\mu 0.05$	$1.2 \mu 0.4$	3	$\begin{smallmatrix} +0.15 \\ 0 \end{smallmatrix}$	6	$\begin{smallmatrix} 0 \\ -0.15 \end{smallmatrix}$	$1.25 \mu 0.1$	P 3
P 4	4				4		7			P 4
P 5	5				5		8			P 5
P 6	6				6		9			P 6
P 7	7				7		10			P 7
P 8	8				8		11			P 8
P 9	9				9		12			P 9
P 10	10				10		13			P 10
P 10A	10	$2.0 \pm \begin{smallmatrix} 0.03 \\ 0.05 \end{smallmatrix}$	$0.7\mu 0.05$	$1.4 \mu 0.8$	10	$\begin{smallmatrix} +0.15 \\ 0 \end{smallmatrix}$	14	$\begin{smallmatrix} 0 \\ -0.15 \end{smallmatrix}$	$1.25 \mu 0.1$	P 10A
P 11	11				11		15			P 11
P 11.2	11.2				11.2		15.2			P 11.2
P 12	12				12		16			P 12
P 12.5	12.5				12.5		16.5			P 12.5
P 14	14				14		18			P 14
P 15	15				15		19			P 15
P 16	16				16		20			P 16
P 18	18				18		22			P 18
P 20	20				20		24			P 20
P 21	21				21		25			P 21
P 22	22				22		26			P 22
P 22A	22	$3.0 \pm \begin{smallmatrix} 0.03 \\ 0.05 \end{smallmatrix}$	$0.7\mu 0.05$	$2.5 \mu 1.5$	22	$\begin{smallmatrix} +0.20 \\ 0 \end{smallmatrix}$	28	$\begin{smallmatrix} 0 \\ -0.20 \end{smallmatrix}$	$1.25 \mu 0.1$	P 22A
P 22.4	22.4				22.4		28.4			P 22.4
P 24	24				24		30			P 24
P 25	25				25		31			P 25
P 25.5	25.5				25.5		31.5			P 25.5
P 26	26				26		32			P 26
P 28	28				28		34			P 28
P 29	29				29		35			P 29
P 29.5	29.5				29.5		35.5			P 29.5
P 30	30				30		36			P 30
P 31	31				31		37			P 31
P 31.5	31.5				31.5		37.5			P 31.5

Back-up Ring

(Unit : mm)

Nominal size Of back up ring	Spiral				biascut and endless					Applicable O-ring nominal size by JIS B 2401
	ID.	Width (W)	Thickness (T)	Clearance (Z)	ID.		OD.		Thickness (T)	
P 32	32	3.0 + ^{0.03} _{0.05}	0.7 μ0.05	2.5 μ1.5	32	+0.20 0	38	0 -0.20	1.25 μ0.1	P 32
P 34	34				40		P 34			
P 35	35				41		P 35			
P 35.5	35.5				41.5		P 35.5			
P 36	36				42		P 36			
P 38	38				44		P 38			
P 39	39				45		P 39			
P 40	40				46		P 40			
P 41	41				47		P 41			
P 42	42				48		P 42			
P 44	44				50		P 44			
P 45	45				51		P 45			
P 46	46				52		P 46			
P 48	48				54		P 48			
P 49	49				55		P 49			
P 50	50				56		P 50			
P 48A	48	5.0 + ^{0.03} _{0.05}	0.9 μ0.06	4.5 μ1.5	48	+0.25 0	58	0 -0.25	1.9 μ0.13	P 48A
P 50A	50				60		P 50A			
P 52	52				62		P 52			
P 53	53				63		P 53			
P 55	55				65		P 55			
P 56	56				66		P 56			
P 58	58				68		P 58			
P 60	60				70		P 60			
P 62	62				72		P 62			
P 63	63				73		P 63			
P 65	65				75		P 65			
P 67	67				77		P 67			
P 70	70				80		P 70			
P 71	71				81		P 71			
P 75	75				85		P 75			
P 80	80				90		P 80			
P 85	85				95		P 85			
P 90	90				100		P 90			
P 95	95				105		P 95			
P 100	100				110		P 100			
P 102	102				112		P 102			
P 105	105				115		P 105			
P 110	110				120		P 110			
P 112	112				122		P 112			
P 115	115				125		P 115			
P 120	120				130		P 120			
P 125	125				135		P 125			
P 130	130				140		P 130			
P 132	132	142	P 132							

Back-up Ring

(Unit : mm)

Nominal size Of back up ring	Spiral				biacut and endless				Applicable O-ring nominal size by JIS B 2401	
	ID.	Width (W)	Thickness (T)	Clearance (Z)	ID.		OD.			Thickness (T)
P 135	135	5.0 ^{+ 0.03} _{0.05}	0.9 _{μ0.06}	4.5 _{μ1.5}	135	+ 0.25 0	145	0 - 0.25	1.9 _{μ0.13}	P 135
P 140	140				140		150			P 140
P 145	145				145		155			P 145
P 150	150				150		160			P 150
P 150	150	7.5 ^{+ 0.03} _{0.05}	1.4 _{μ0.08}	6.0 _{μ2.0}	150	+ 0.30 0	165	0 - 0.30	2.75 _{μ0.15}	P 150A
P 155	155				155		170			P 155
P 160	160				160		175			P 160
P 165	165				165		180			P 165
P 170	170				170		185			P 170
P 175	175				175		190			P 175
P 180	180				180		195			P 180
P 185	185				185		200			P 185
P 190	190				190		205			P 190
P 195	195				195		210			P 195
P 200	200				200		215			P 200
P 205	205				205		220			P 205
P 209	209				209		224			P 209
P 210	210				210		225			P 210
P 215	215				215		230			P 215
P 220	220				220		235			P 220
P 225	225				225		240			P 225
P 230	230				230		245			P 230
P 235	235				235		250			P 235
P 240	240				240		255			P 240
P 245	245				245		260			P 245
P 250	250				250		265			P 250
P 255	255				255		270			P 255
P 260	260				260		275			P 260
P 265	265				265		280			P 265
P 270	270				270		285			P 270
P 275	275				275		290			P 275
P 280	280				280		295			P 280
P 285	285				285		300			P 285
P 290	290				290		305			P 290
P 295	295				295		310			P 295
P 300	300				300		315			P 300
P 315	315				315		330			P 315
P 320	320				320		335			P 320
P 335	335				335		350			P 335
P 340	340				340		355			P 340
P 355	355				355		370			P 355
P 360	360				360		375			P 360
P 375	375				375		390			P 375
P 385	385				385		400			P 385
P 400	400				400		415			P 400

Back-up Ring

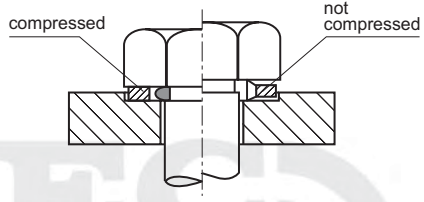
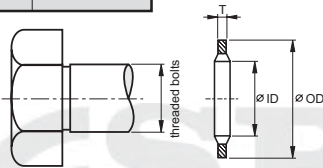
(Unit : mm)

Nominal size Of back up ring	Spiral				biascut and endless						Applicable O-ring nominal size by JIS B 2401
	ID.	Width (W)	Thickness (T)	Clearance (Z)	ID.		OD.		Thickness (T)		
G 25	25	2.5 ⁺ _{0.03} 0.05	0.7μ0.05	4.5 μ1.5	25	+0.20 0	30	0 -0.20	1.25 μ0.10	G 25	
G 30	30				35		G 30				
G 35	35				40		G 35				
G 40	40				45		G 40				
G 45	45				50		G 45				
G 50	50				55		G 50				
G 55	55				60	G 55					
G 60	60				65	G 60					
G 65	65				70	G 65					
G 70	70				75	G 70					
G 75	75				80	G 75					
G 80	80				85	G 80					
G 85	85				90	G 85					
G 90	90				95	G 90					
G 95	95				100	G 95					
G 100	100				105	G 100					
G 105	105				110	G 105					
G 110	110				115	G 110					
G 115	115				120	G 115					
G 120	120				125	G 120					
G 125	125				130	G 125					
G 130	130	135	G 130								
G 135	135	140	G 135								
G 140	140	145	G 140								
G 145	145	150	G 145								
G 150	150	5.0 ⁺ _{0.05} 0.06	0.9μ0.06	6.0 μ2.0	150	+0.30 0	160	0 -0.30	1.9 μ0.13	G 150	
G 155	155				165		G 155				
G 160	160				170		G 160				
G 165	165				175		G 165				
G 170	170				180		G 170				
G 175	175				185		G 175				
G 180	180				190	G 180					
G 185	185				195	G 185					
G 190	190				200	G 190					
G 195	195				205	G 195					
G 200	200				210	G 200					
G 210	210				220	G 210					
G 220	220				230	G 220					
G 230	230				240	G 230					
G 240	240				250	G 240					
G 250	250				260	G 250					
G 260	260				270	G 260					
G 270	270				280	G 270					
G 280	280				290	G 280					
G 290	290				300	G 290					
G 300	300				310	G 300					

Bonded Seals

The Bonded Seal is a static seal which is used as a sealing ring fitted under bolt heads and nuts. Application of the Bonded Seal, which incorporates a metal ring serving to carry the pressure load, eliminates the need for a washer. In order to avoid damage to the sealing lip, the inside diameter of the Bonded Seal should be 0.5-1 mm larger than the external thread diameter. Excessive tightening is not required: tight is locked!

p max	650 bar
T	-40+110°C



Dimensions				Thread size	
ID.	OD.	T		Metric threads	Whitworth threads
M 3.1	6.4	1.3		2.5	
M 4.1	7.2	1.0		3	
M 4.1	7.3	1.3		3	
M 4.5	7.0	1.0		3.5	
M 5.7	9.0	1.0		4	
M 5.7	10.0	1.0		4	
M 6.2	9.2	1.0		5	
M 6.7	10.0	1.0		5	
M 6.7	11.0	1.0		5	
M 6.9	13.2	1.3		6	
M 7.0	13.4	1.3		6	
M 7.1	12.0	1.0		6	
M 7.3	10.2	1.0		6	1/4
M 8.5	13.4	1.0		7	
M 8.7	13.0	1.0		7	
M 8.7	14.0	1.0		7	
M 8.7	14.2	1.3		7	
M 8.7	16.0	1.0		7	
M 9.3	13.3	1.0		8	5/16
M 10.35	16.0	2.0		8	
M 10.7	16.0	1.5		8	
M 10.7	18.0	1.5		8	
M 11.4	16.3	1.5		10	3/8
M 11.8	18.5	1.5		10	
M 11.8	19.1	1.5		10	
M 12.7	18.0	1.5		10	
M 12.7	20.0	1.5		10	
M 13.7	20.0	1.5		12	7/16
M 13.7	20.6	2.1		12	
M 13.7	22.0	1.5		12	
M 14.0	18.7	1.5		12	
M 14.7	22.0	1.5		12	
M 14.9	22.3	2.1		12	

Dimensions				Thread size	
ID.	OD.	T		Metric threads	Whitworth threads
M 16.0	22.7	1.5		14	1/2
M 16.5	25.5	2.1		14	
M 16.7	24.0	1.5		14	1/2
M 17.4	24.0	1.5		14	
M 18.0	24.7	1.5		16	
M 18.2	25.4	2.5		16	
M 18.7	26.0	1.5		16	5/8
M 20.7	28.0	1.5		16	5/8
M 21.5	28.7	2.5		18	
M 22.5	28.0	1.5		20	
M 22.7	30.0	2.0		20	
M 24.7	32.0	2.0		20	3/4
M 26.7	35.0	2.0		22	7/8
M 27.0	35.0	2.5		24	
M 27.2	36.0	2.0		24	7/8
M 28.7	37.0	2.0		24	
M 31.0	39.0	2.0		27	1
M 32.6	41.4	3.4		27	
M 33.7	42.0	2.0		27	1
M 33.9	42.9	3.4		27	
M 34.3	43.0	2.0		27	
M 36.7	46.0	2.0		30	1 1/8
M 40.0	51.0	2.5		33	1 1/4
M 42.7	53.0	3.0		36	1 3/8
M 48.7	59.0	3.0		36	1 1/2
M 51.7	63.5	3.4		39	
M 53.3	64.5	3.0		42	1 5/8
M 60.7	73.0	3.0		48	1 3/4
M 76.08	90.3	3.4		60	2 1/2
M 89.09	101.48	3.25		72	2 3/4
M 127.0	143.67	5.0			4 1/2

Frequently Asked Questions (FAQ)

คำถามเกี่ยวกับโอริงที่ถูกถามประจำ

Q & A

- Q :** เราสามารถใช้โอริงแทนซีลที่ถูกสับหรือที่แกนในงานลักษณะงานเคลื่อนที่ได้หรือไม่ ?
- A :** ในอดีตมีการนำโอริงมาใช้เป็นซีลที่ถูกสับและที่แกน เพื่อนำไปใช้งานในลักษณะงานเคลื่อนที่ค่อนข้างมาก เพราะสามารถหาซื้อทั่วไปได้สะดวก สามารถหาอะไหล่ทดแทนได้ง่ายและมีราคาถูก แต่ปัญหาที่ตามมาคือ โอริงที่ประกอบอยู่ในร่องของชิ้นงานเมื่อนำมาใช้งานแล้ว จะเกิดการมวนตัว (Twisted) เพราะมีการเสียดสีไปมาระหว่างผิวของชิ้นงานกับตัวโอริง จึงทำให้โอริงชำรุดฉีกขาดได้ ระยะหลังจึงนิยมใช้ซีลกับงานลักษณะเคลื่อนที่แทนโอริง
- Q :** ขนาดมาตรฐานของโอริงที่มีการกำหนดขึ้น มีความสำคัญอย่างไร และนิยมใช้มาตรฐานใดมากที่สุด ?
- A :** เครื่องจักรต่างๆ ที่นำเข้ามาใช้งานในประเทศไทยมีแหล่งผลิตที่หลากหลาย หากเราทราบประเทศหรือโซนที่ผลิตเครื่องจักรนั้นๆ ก็จะสามารถทราบถึงขนาดที่เป็นมาตรฐานของโอริงในเครื่องจักรเหล่านั้นได้ แต่ทั้งนี้ก็ยังขึ้นอยู่กับความสะดวกและราคาซึ่งเป็นปัจจัยให้ผู้ผลิตเครื่องจักรต้องคำนึงด้วย มาตรฐานโดยมากที่นิยมใช้คือมาตรฐานอเมริกัน (American Standard) โดยมีชื่อย่อว่า AS Series อีกมาตรฐานที่นิยมใช้คือมาตรฐานญี่ปุ่น (Japanese Standard) มีชื่อย่อว่า JIS Series ซึ่งท่านสามารถหาข้อมูลของขนาดต่างๆ เพิ่มเติมได้จาก หน้า 24-33
- Q :** โอริงที่มีความแข็ง 70 shore A และความแข็ง 90 shore A มีความแตกต่างในการใช้งานอย่างไร ?
- A :** โดยทั่วไปเราสามารถพบเห็นโอริงที่มีความแข็ง 70 shore A มีใช้งานโดยทั่วไป แต่ในระบบไฮดรอลิกที่มีแรงดัน (Pressure) สูงเกินกว่า 100 Bar เราควรเลือกใช้โอริงที่มีความแข็ง 90 shore A เพราะสามารถทนแรงดันได้มากกว่าโดยที่ไม่จำเป็นต้องลดขนาดของช่องว่างระหว่างชิ้นงานซึ่งจะควบคุมขนาดของชิ้นงานให้ได้ตามพิสัยได้ยาก

Q : ทำไมโอริงรูปร่างไม่กลมเหมือนเดิม แต่กลายเป็นเหลี่ยมเมื่อนำออกมาจากร่องของชิ้นงาน ?

A : รางที่ใช้ในการผลิตโอริงอาจมีชื่อเรียกที่เหมือนกันแต่กรรมวิธีในการผลิต รวมถึงส่วนผสมที่ผสมกับยางเพื่อใช้ผลิตโอริงจะมีสูตรในการผลิตแตกต่างกันไป จึงทำให้คุณสมบัติต่างๆ รวมถึงค่าการคืนตัวของเนื่อยาง (Compression Set) มีความแตกต่างกัน ดังนั้นโอริงที่มีการคืนตัวของเนื่อยางที่ดีเมื่อใช้งานไปแล้ว เมื่อนำออกมาจากร่องชิ้นงานจะมีเปอร์เซ็นต์ในการคืนตัวของเนื่อยางสูง จึงทำให้สามารถคงรูปร่างทรงกลมได้ค่อนข้างดี ซึ่งผิดกับยางที่มีคุณภาพต่ำซึ่งมีเปอร์เซ็นต์การคืนตัวของเนื่อยางต่ำ ยางก็จะเปลี่ยนรูปร่างไปตามลักษณะของร่องชิ้นงานที่ใช้งานอยู่

Q : ยาง Fluorocarbon และ ยาง Viton แตกต่างกันอย่างไรร ?

A : ยางทั้ง 2 ชนิดนี้มีความสมบัติที่ใกล้เคียงกันเพียงแต่ชื่อ Fluorocarbon หรือที่มีชื่อย่อว่า FPM จะเป็นชื่อที่ใช้เรียกโดยทั่วไป แต่ชื่อ Viton จะเป็นชื่อเฉพาะซึ่งเป็นชื่อทางการค้าของ Dupont โดยผู้ที่ใช้ชื่อ Viton ได้ จะต้องใช้วัสดุที่ใช้ในการผลิตสินค้านั้นๆ เฉพาะของ Dupont เท่านั้น

Q : เมื่อต้องการนำโอริงไปใช้งานที่มีความร้อน ยาง Fluorocarbon หรือ Viton เป็นยางที่ใช้กับงานลักษณะนี้ได้ดีที่สุดจริงหรือไม่ ?

A : ก่อนอื่นคงจะต้องตรวจสอบความร้อนที่ใช้อยู่โดยใช้เครื่องมือในการตรวจสอบ เช่นใช้เทอร์โมมิเตอร์วัดในน้ำมันว่ามีอุณหภูมิเท่าไร อย่างไรก็ตามควรที่จะเน้นโดยใช้ความรู้ลึกๆ เพราะว่าอาจจะทำให้เกิดความผิดพลาดได้ ยกเช่นชนิดมีข้อดีก็จะมีข้อเสียอยู่ในตัวด้วยเช่นเดียวกัน ยาง Fluorocarbon หรือ Viton สามารถทนความร้อนได้สูงถึง 230°C ถึงแม้จะทนความร้อนได้สูงแต่จะมีค่าการคืนตัวของเนื่อยาง (Compression Set) ที่ค่อนข้างต่ำ หากเรานำไปใช้งานในที่ที่ไม่ได้มีความร้อนเท่าที่จะต้องใช้ยางประเภทนี้ จะทำให้เราไม่ได้ใช้ประโยชน์ของเนื่อยางอย่างเต็มที่ อีกทั้งยังต้องเสียค่าใช้จ่ายสูงโดยไม่ได้ประโยชน์อะไรเลยอีกด้วย

Q : ความหนาของโอริงควรจะใหญ่กว่าร่องของชิ้นงานมากน้อยเท่าไร ?

A : โดยทั่วไปลักษณะร่องของโอริงควรมีลักษณะเป็นสี่เหลี่ยมผืนผ้าในแนวนอน ทั้งนี้เพื่อให้โอริงมีพื้นที่ในการขยายตัวเมื่อมีการกดทับของชิ้นงาน ส่วนขนาดที่ถูกต้องของร่องชิ้นงานเมื่อเทียบกับความหนาของโอริงควรตรวจสอบโดยดูข้อมูลจาก หน้า 14 เพราะขนาดต่างๆ จะขึ้นอยู่กับลักษณะการใช้งานที่แตกต่างกันออกไป

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สำนักงานใหญ่:

268, 270, 272 กรุงเทพมหานคร น.ส.สิรินธร บางพลัด กรุงเทพฯ 10700

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www.specseal.co.th E-mail: info@specseal.co.th



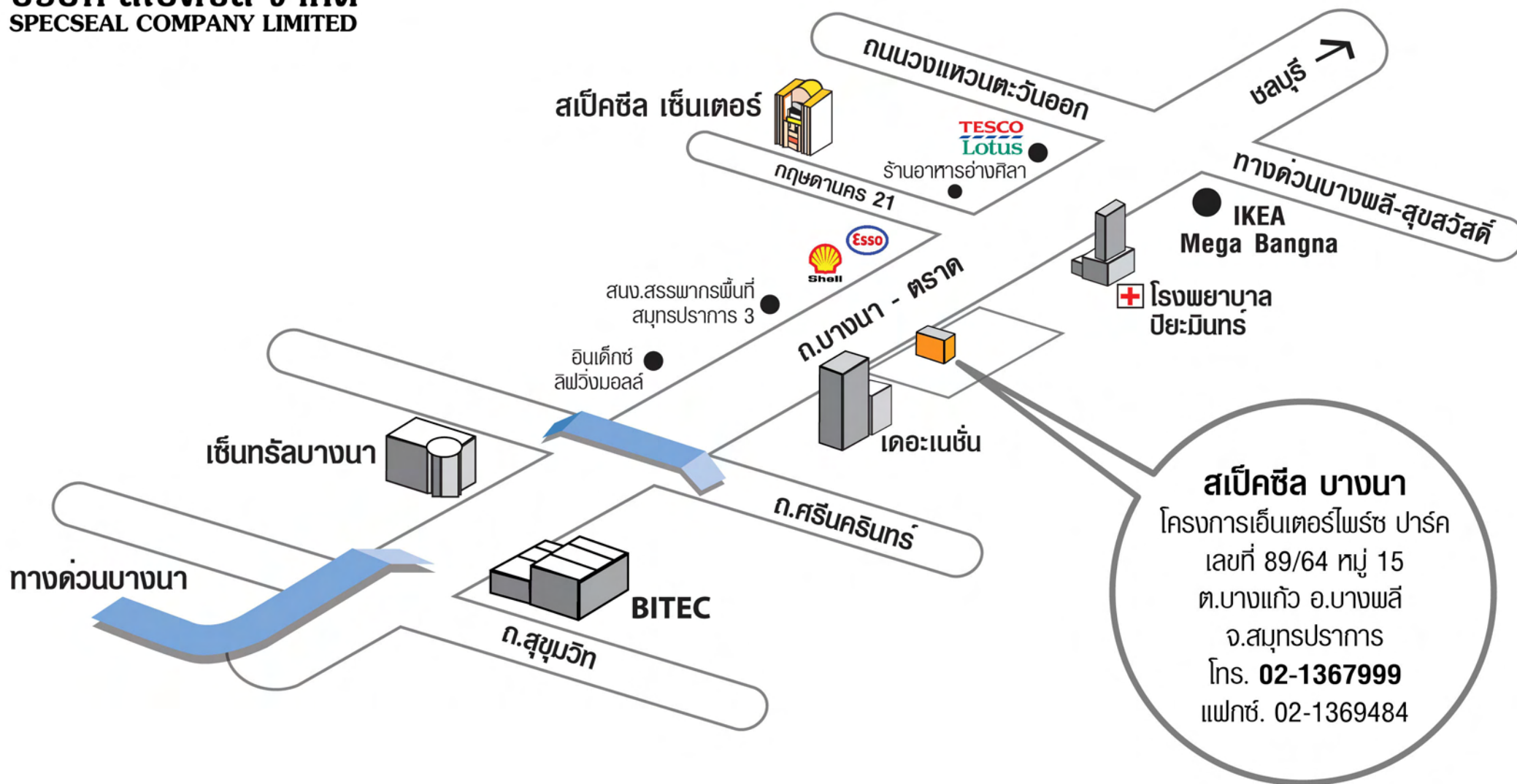
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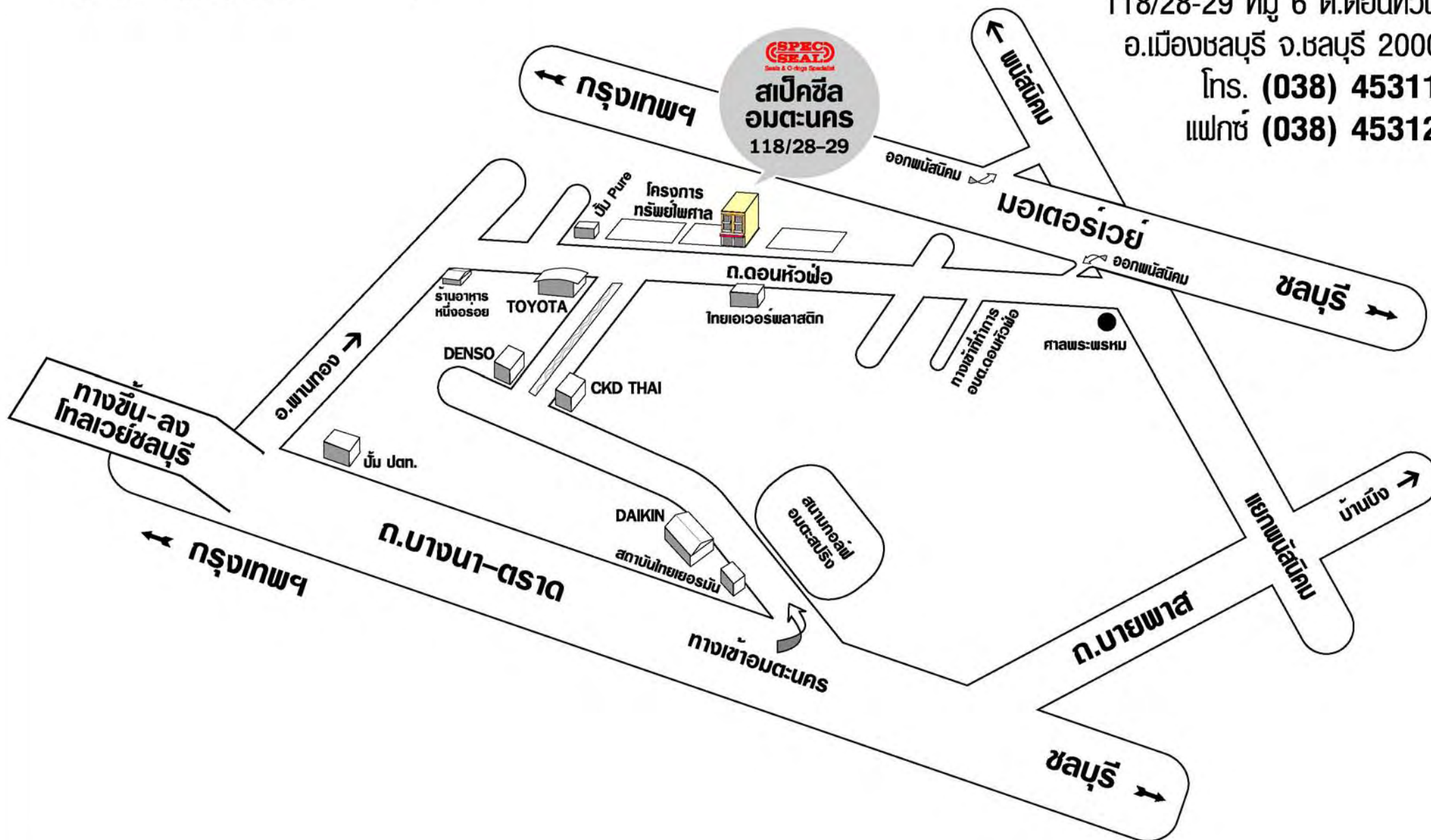


แผนที่สเป็คชีล อมตะนคร

๑.เมืองชลบุรี จ.ชลบุรี 20000

Ins. (038) 453111

แฟกซ์ (038) 453122





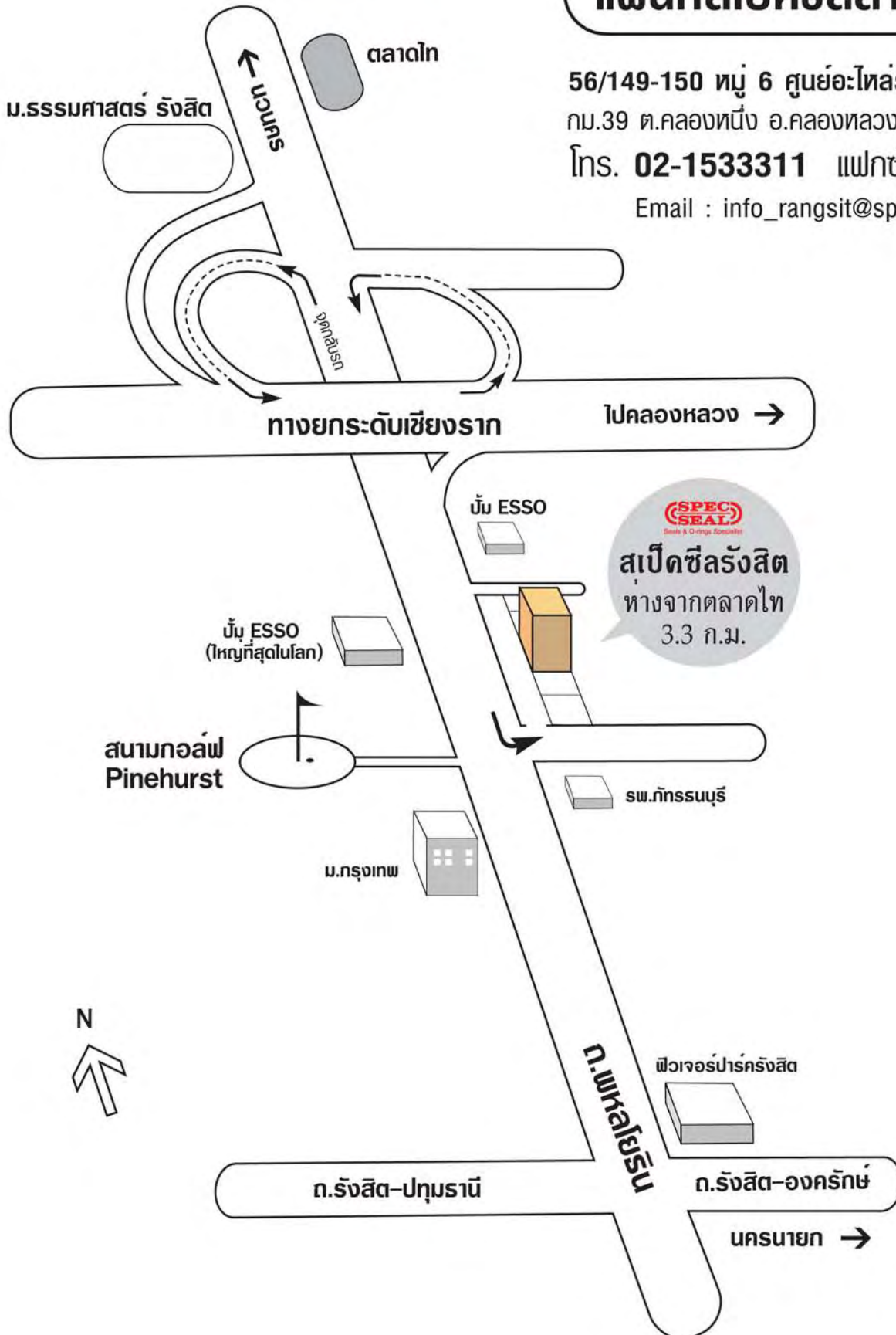
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แผนที่สเป็คซีลสาขา รังสิต

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กม.39 ต.คลองหนึ่ง อ.คลองหลวง จ.ปทุมธานี 12120

โทร. **02-1533311** แฟกซ์ **02-1533300**

Email : info_rangsit@specseal.co.th





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สเปคซีล เซ็นเตอร์

ศูนย์ฝึกอบรมวิชาชีพมาตรฐาน

99/5 หมู่ 13 ถนนด่านนคร 21 ซ.บางนา-ตราด 45
ก.บางนา-ตราด กม.7 ต.บางแก้ว อ.บางพลี
จ.สมุทรปราการ 10540

SPECSEAL Center

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