O-ring Handbook

ceetak
sealing solutions




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Recommendations on product and material selection are based on technical information available to Ceetak, and are offered as a guide to help the user identify suitable products for their application. Any reliance placed on such information by the user is strictly at the user's risk. Each user should make their own tests to determine the suitability for their own particular application. Ceetak Ltd offers no express or implied warranties concerning the compatibility of a product or material from this guide.

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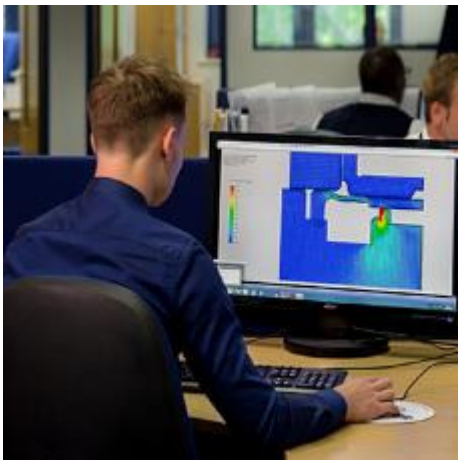
Ceetak Ltd is a leading UK designer and supplier of seals and sealing solutions. Established for over 45 years, and part of the Ceetak Holdings Group, our Head Office is based in Bedford, England.
Our products and systems are used throughout all major industries, from the most technically demanding applications, to high quality, high volume, precision components.
We have a team of Application Engineers ready to assist in the design of seals for all applications. They fully understand the variety of technical challenges when designing and manufacturing components for critical conditions.

Engineering Design and Quality Assurance
We provide unrivalled technical and engineering support to ensure our customers benefit from the best possible performance at optimum cost. We are dedicated to providing a complete design service, from initial seal geometry and profile choice, to material selection and prototyping, through to final production.



Working closely with your engineers we provide the most effective sealing solution for each bespoke application. Our application Engineers utilise years of seal design experience and materials expertise, alongside technologies such as 2D/3D CAD and FEA analytical programmes to simulate performance before finalising each individual seal design.
We provide both in-house and on-site technical support and have the skills, experience and resources to assist customers in all industries; regardless of the complexity or challenges involved in each application

To meet the required standards and approvals demanded by industry, strict quality procedures are maintained at all stages of design, development and manufacture. We are ISO9001:2015, AS9120B and ISO14001:2004 approved, with our manufacturing partners also carrying IATF16949:2009 and ISO13485 approvals.

Ceetak has a dedicated team of Quality Engineers and Quality Inspectors ensuring that advanced product quality planning is at the heart of our quality function.
Fundamental activities include, mitigation of risk during all manufacturing processes, anticipating potential risks, regular review of process controls and stability, PPAP review,

continuous monitoring of production SPC data, regular audits of manufacturing facilities and monthly manufacturing performance monitoring.
Our stringent quality principles and proactive controls mean our customers have reduced claims and associated costs, increased change control and prevention of productivity loss and line-stops.

Core Markets

Ceetak's trusted products can be found in critical applications in the furthest reaches of space, and the depths of our oceans. Our product range and quality approvals help Ceetak support clients across a broad range of key industries.

Automotive

Heavy Duty Transportation

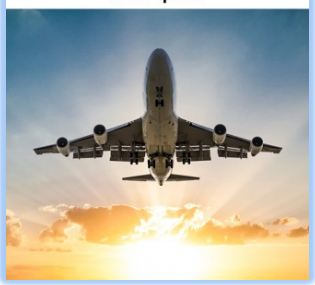
General Industrial

Oil & Gas

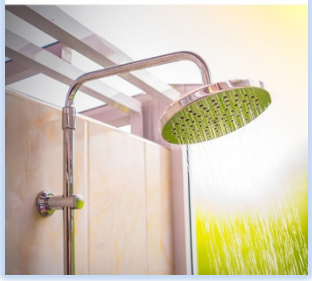
Renewable Energy

Military & Defence

Aerospace



Water & Utilities



Hydraulics & Pneumatics

Life Sciences & Medical

Engineering Support – Our Resources

Our engineers draw on over 100 years of experience to provide cost effective sealing solutions designed with our customers in mind.

Ceetak's team of expert polymer and application engineers work to provide unrivalled technical and engineering support, to deliver optimised solutions to meet our customer's needs.

Ceetak technical engineers are dedicated to offer a complete design service, supporting customer applications through hardware and sealing system architecture, whilst our polymer experts are able to recommend and select the most appropriate materials from our extensive range of over 1800 materials.

A number of dedicated calculation programmes and 2D & 3D CAD work in conjunction with our material models within our non-linear Finite Element Analysis (FEA) software to investigate and validate design scenarios to demonstrate best possible performance and to accelerate the customer's route to market.

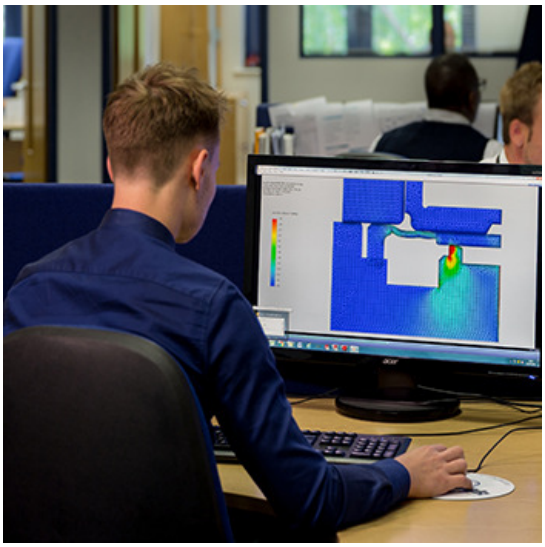
Our proprietary stress strain material models and programming parameters help ensure that our FEA models resemble real-life application conditions.

Ceetak present considered sealing proposals including detailed guidance on hardware interface parameters necessary to support our products.

Once the sealing system is agreed, Ceetak have the knowledge and expertise to determine the most appropriate manufacturing methods and tool design for effective production of parts.

Ceetak are able to offer further support with our 3D printing capabilities, linked to our CAD models which can provide customers with samples on a short turnaround, to allow investigation into installation and fit.

Ceetak's team of engineers are able to offer both onsite and in-house technical support for even the most challenging applications, assisting customers across all industry sectors. Our experience can help to accelerate your design process from concept, prototyping to final production and release to market.

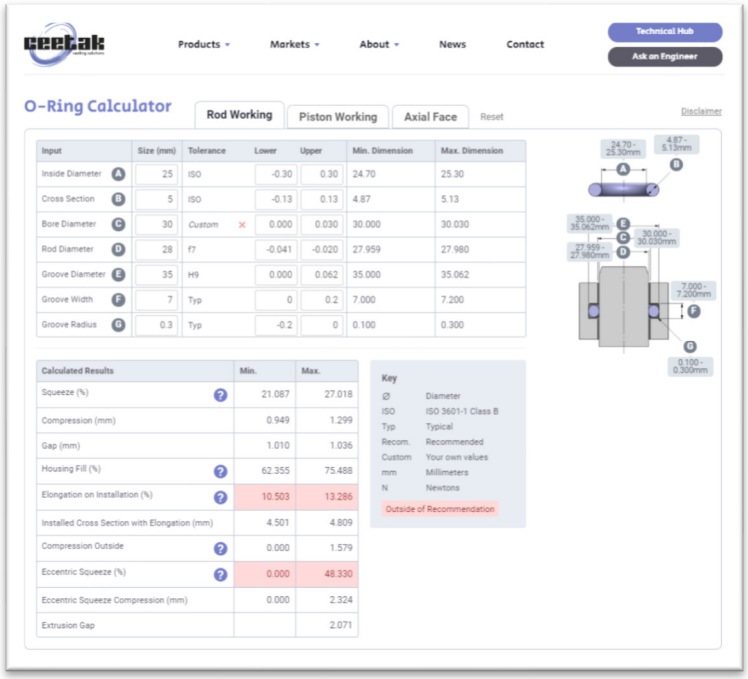


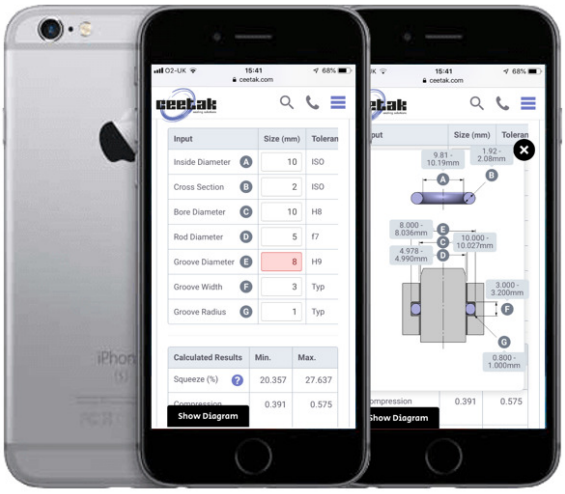
Ceetak
O-ring Catalogue

Engineering Support – Online Tools

Ceetak Sealing Solutions have a range of tools dedicated to supporting engineers in the design and specification of their sealing system.

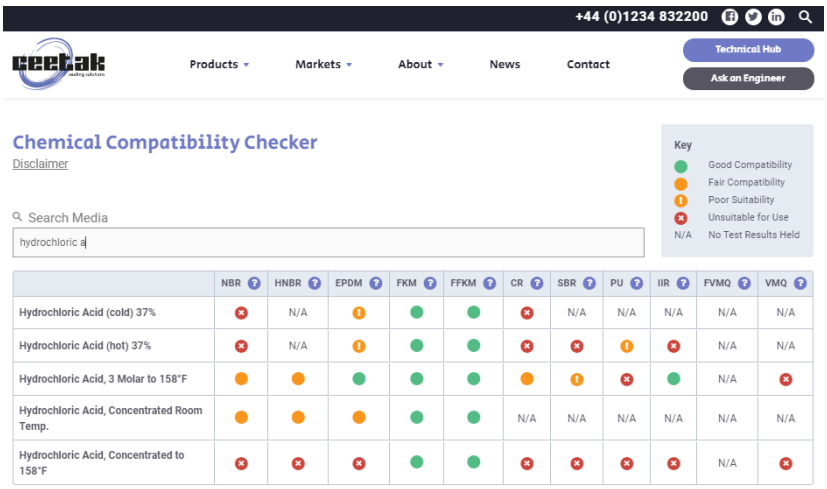
With the use of Ceetak's O-ring tool and Chemical Compatibility Checker, the process of specifying o-ring seals for your next application is made fast and simple





Our tools are designed for compatibility with mobile and desktop devices, and are backed by our engineering support team, who are available on demand should you require further guidance.

Check out the tools in our technical hub online
www.Ceetak.com



Ceetak have dedicated laboratory inspection equipment, operated by skilled technicians who support our product and material development.

In addition to our non-contact measurement, and high magnification seal inspection tools, our test and inspection facilities include provision to test components and assemblies for:

- Fluid compatibility (swell, shrinkage, chemical attack)
- Tensile strength
- Specific gravity
- Surface finish
- Elongation at break
- Stress/Strain
- Compression force
- Flex and shear strength
- Material hardness to IRHD, Shore A and Micro Shore A.
- Seal Friction

Ceetak can provide testing to certify product against international standards.

Our 3D printing capability allows us to replicate and investigate installation within customer hardware, and to help accelerate prototyping of sealing systems.

Ceetak is ISO9001:2015, ISO14001:2015 and AS9120B:2016 approved, with our manufacturing partners approved to TS16949:2009 and ISO 13485.

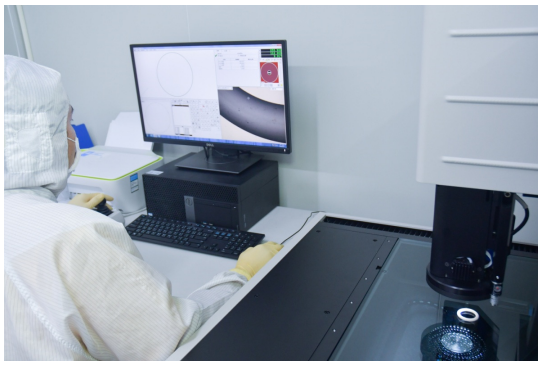
Our dedicated team of Quality Engineers and Quality Inspectors ensure that advanced product quality planning is at the heart of our quality function.

With a problem solving and Six Sigma mind-set, our Quality Team maintains the highest level of quality assurance through prevention, proactivity and continuous improvement processes.

From initial design review through to ongoing serial production; we follow strict processes in order to mitigate risk to our customers and we regularly measure, monitor and review the quality of our production parts and relevant manufacturing processes.

Test & Inspection Facilities

Our in-house Quality Control department can provide 100% visual inspection alongside physical material testing.
We provide testing to certify products against international standards, and we can also provide external laboratory testing for any special customer requirements such as materials/slabs and button testing and material approvals.



Risk Mitigation

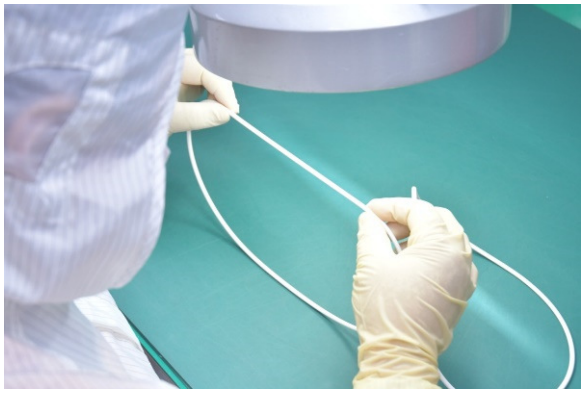
We continuously inspect and monitor our processes; from initial design and technical review through to ongoing serial production.

Planning & Capabilities

We provide our customers with First Article Inspection Reports (FAIR), Measurement Analysis (MSA), Repeatability & Reproducibility (R&R) studies, CPK & PPK studies, Process FMEA, PPAP completion, Part re-validations.

Certified Cleanliness

We utilise a complete cleanroom production process; from material blank production through to inspection and packaging using controlled materials within state of the art cleanrooms established according to quality standards such as ISO14644.



Background

The O-ring is one of the longest standing seal technologies available on the market today thanks to its versatility, ease of use and robustness.

The range of applications is endless; o-rings can be found in a simple, in the depths of our oceans and the furthest reaches of space. They are commonly used as seals, but are versatile and can also provide a damping or energising function.

The O-ring has become synonymous with sealing, and is available in a wide range of materials and sizes. Our guidance in this catalogue, supported by online tools, is designed to ease the process of selecting the right combination.

Whatever your o-ring needs, Ceetak will have the right o-ring seal for you.

Use of the O-Ring as a sealing device

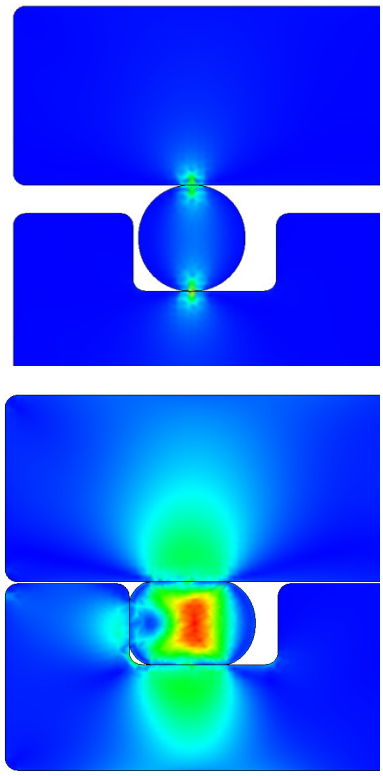
O-Rings are typically produced using elastomer materials.

Elastomers are complex polymers combining the following elements, all of which are imperative for providing reliable sealing.

1. The ability to deform when subjected to force (flexibility)
2. The ability to return to form (elasticity)
3. The ability to resist abrasion (durability)

When compressed, stresses are formed within the o-ring material. It is these stresses which provide the initial preload sealing force against the interacting mating surfaces.

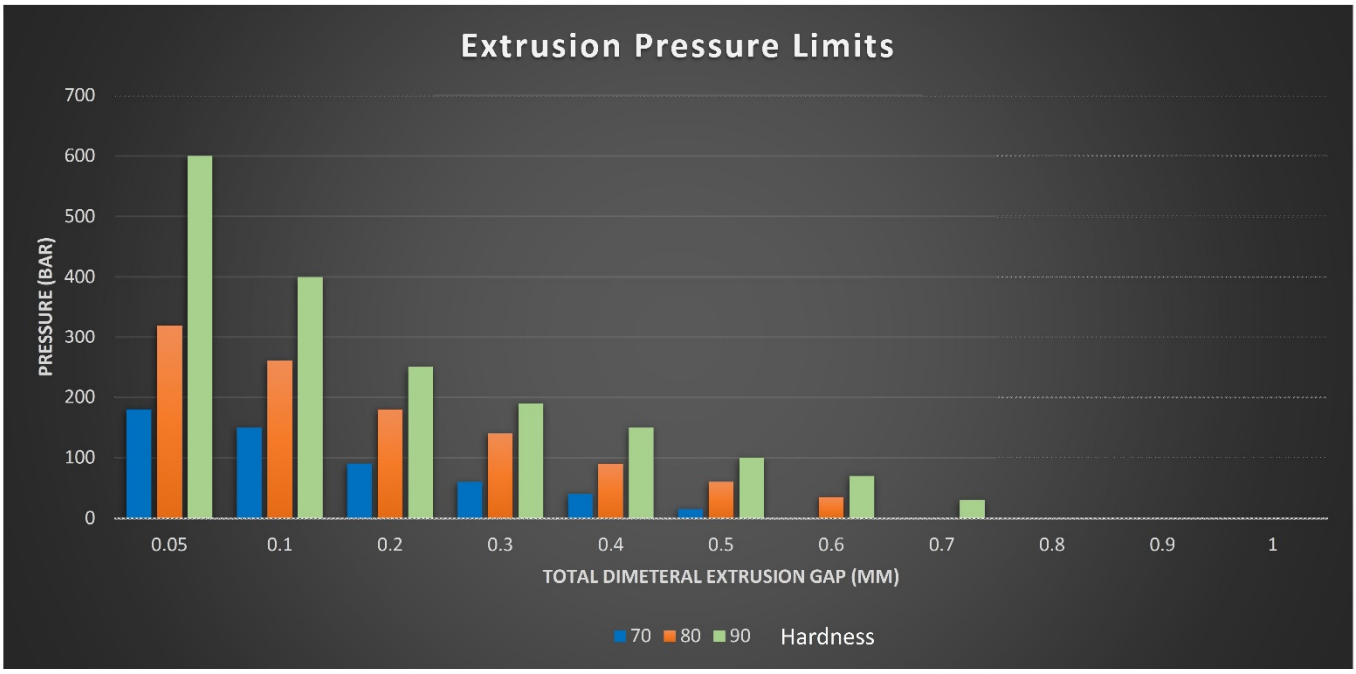
The deformation of the soft elastomer into surface voids and imperfections restricts the passage of the sealed media, whilst the elastic memory of the material ensures that the seal continues to provide a sealing force against the hardware.



The application of system pressure increases the stress on the o-ring, pushing this against the hardware counter faces, increasing the reaction forces.

Extrusion

This interaction with system pressure ensures the elastomer o-ring seals effectively until the limits of the material are breached. The pressure handling capability of an o-ring is typically limited by its resistance to yield against a gap. The material will flow and extrude into a gap if the pressure exceeds the surface tension of the elastomer. It is therefore critical for higher pressure applications, that the radial clearances observe the following charted limits:



(Extrusion chart above for reference only).

All O-rings applications should be fully tested to gauge O-ring performance.

Other Information

Section D-1 features common failure modes, and discusses chemical attack, extrusion and compression set in greater detail.

O-rings are specified usually by their internal diameter, and their cross section.

Ceetak are able to supply many of the common metric and imperial sizes from available tooling, many products already exist in our managed stores. Product sizes against the common size ranges AS568 and ISO3601 are available within this product guide.
Many others are available upon request.

O-Rings require relatively simple hardware design; however it remains important to consider a number of key factors when designing your hardware.

Axial Installation
It is important to consider the direction of pressure when designing a groove for axial installation. For applications with internal pressure, the ring should be sized to have a slight compression at the OD, typically up to 2%. For applications with external pressure, the housing should be designed to suit a ring with a slight ID stretch, typically up to 3%. Prestressing of the seal ring against the supporting counter face reduces displacement of the ring under pressure conditions, ensures the rings are installed concentrically. This is particularly important under pulsating pressure conditions where fretting could create wear of the seal.

Radial Installation
A preloading of the ring against the groove seating face helps to ensure a smooth installation, reducing the risk of ring displacement and rolling.
For rod seals, the seal outside diameter should be a little larger than the groove to provide an initial OD interference, generally to a maximum of 3%, although some larger o-rings can accommodate a little more. For piston seals, the groove should be designed to provide a little stretch, to a maximum of 6%.

Ceetak recommend that the seal is compressed by a minimum of 10%, and a maximum of 35% for static applications, and between 6% and 18% when sealing dynamic applications.
The installed squeeze is designed to counter manufacturing tolerances, compensate for compression set, and provide the initial sealing force prior to application of fluid pressure.

In all cases, Ceetak recommend the groove fill does not exceed 85% at ambient temperature.
It is important to consider that whilst elastomers generally are considered as deformable, they are also incompressible. The volume of the product must be accommodated within the housing, leaving additional clearance to enable pressure energisation around the o-ring face, and to accommodate expansion due to thermal and chemical effect on the materials.

If in doubt, please contact Ceetak Ltd for further technical guidance.

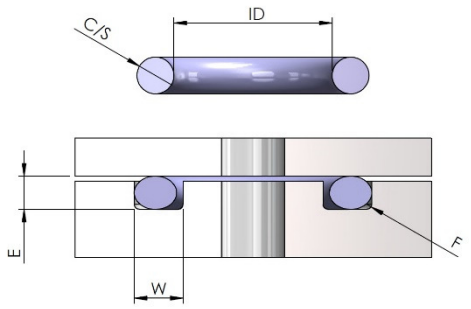
Ceetak's O-Ring Calculator Tool is available through our website to assist in calculation suitable rectangular groove sizes.
Please contact us for guidance on non-rectangular groove sections, such as dovetail or triangular grooves.

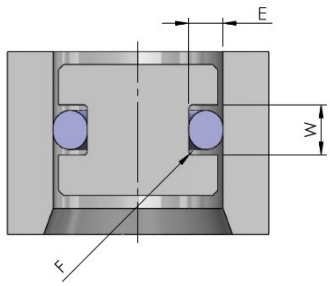
For effective sealing, the following surface finishes should be observed on all groove and seal interfaces.

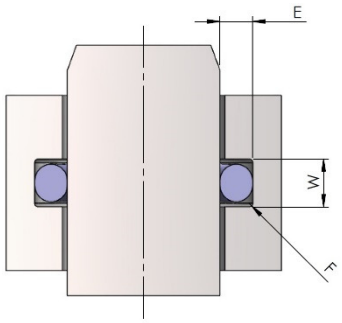
Installation
Installation should be completed in a clean environment.
Where tools are to be used to aid the fitter, these should be manufactured from a material which is softer than the mating hardware.
Tools should not have sharp edges.
When designing the hardware, it is important to consider the installation path, and ensure that sharp features such as splines, threads and other sharp edges are reduced or smoothed. Where necessary, an installation sleeve should be considered, to cover these features during installation.

A common installation failure mode is from rolling of the o-ring. Particularly where the rings are of a large diameter, or where the rings are fitted with a long stroke. Ceetak can recommend suitable lubricants to ease installation under these conditions.

Application	Surface	Roughness um, Ra
Dynamic	Sealing Face	≤0.4
	Groove Counter face and Side Walls	≤1.6
Static	Sealing Surface	≤1.6
	Groove Counter face and Side Walls	≤1.6







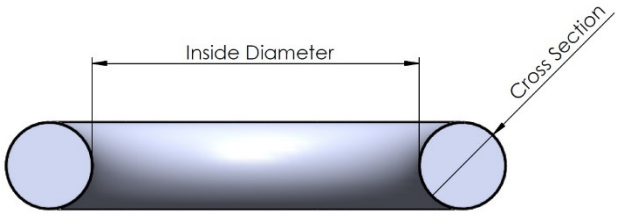
O-ring Cross Section	Groove Depth E		Groove Width W (Radial Installation)	Groove Width W (Axial Installation)	Corner Radius F (Max)
	Dynamic	Static			
1.00	NA	0.70	1.40	1.40	0.3
1.25	NA	0.90	1.70	1.70	0.3
1.50	1.25	1.10	2.00	2.10	0.4
1.78	1.45	1.30	2.40	2.60	0.4
1.80	1.45	1.30	2.40	2.60	0.4
1.83	1.50	1.35	2.50	2.60	0.4
2.00	1.65	1.50	2.70	2.80	0.4
2.40	2.05	1.80	3.20	3.30	0.4
2.50	2.15	1.90	3.30	3.40	0.4
2.62	2.25	2.00	3.60	3.80	0.4
2.65	2.25	2.00	3.60	3.80	0.4
2.80	2.40	2.10	3.70	3.90	0.4
2.92	2.50	2.20	3.90	4.00	0.6
3.00	2.60	2.30	4.00	4.10	0.6
3.50	3.05	2.65	4.60	4.80	0.6
3.53	3.10	2.70	4.70	4.80	0.6
4.00	3.50	3.10	5.20	5.30	0.6
4.50	4.00	3.50	5.80	6.00	0.6
5.00	4.40	4.00	6.60	6.70	0.6
5.33	4.70	4.30	7.10	7.30	0.6
5.70	5.00	4.60	7.20	7.40	0.6
6.00	5.30	4.90	7.40	7.60	0.6
6.50	5.70	5.40	8.00	8.20	0.6
6.99	6.10	5.80	9.50	9.80	0.8
8.40	7.50	7.10	10.00	10.30	0.8
10.00	9.10	8.60	11.60	12.00	0.8

Dimensional Tolerance overview

Dimension Tolerances

Dimensional variation from the moulding process is unavoidable. Dimensional variation can be created from mould cavity variations, differing shrinkage rates, and variations in material recipe and process parameters. Ceetak mould product in accordance ISO3601-1, internationally recognised and recommended for products of this type.
Each O-ring size range is designated a dimensional tolerance range.

ISO3601-1 refers tolerance to the Inside Diameter and Cross Section of the product.



O-ring dimensional tolerance should always be considered when calculating groove and installation parameters. The combined effect of housing and seal tolerance may affect the effectiveness and life expectation of the seal.

Ceetak Sealing Solution's O-ring calculator is available online to provide assistance with hardware groove design for the o-ring.

Below tolerances are according to ISO 3601-1 for elastomeric O-rings Cross sections and inside diameters.

Cross section	
Up to ≤	**Tolerance**
1.80	±0.08
2.65	±0.09
3.55	±0.10
5.30	±0.13
7.00	±0.15
8.00	±0.18
10.00	±0.21
12.00	±0.25

Inside Diameter Tolerances										
ID Range (mm)	1.80 to 6.30	6.70 to 11.20	11.80 to 21.20	22.40 to 40.00	41.20 to 80.00	82.50 to 160.0	165 to 300	300 to 650	670 to 910	910 to 1180
Tolerance (mm)	±0.13	±0.16	±0.19	±0.95%	±0.86%	±0.78%	±0.74%	±0.67%	±0.60%	±0.55%
				Percentage of inside diameter						

O-ring Coatings

Ceetak offer a range of coatings that can be applied to O-rings. Once a coating is applied this creates a low friction substrate on the surface of the O-ring therefore decreasing the insertion force of the product during assembly. Also the low friction coating allows the O-ring to be non-stick during feeding initial assembly out of the bag, depending on the coating type.

In comparison to uncoated O-rings, coated O-rings can greatly reduce the required insertion force, depending on coating reducing to approximately half the force of a coated ring.
This reduced force therefore improves the O-rings resistance to being damaged during the installation procedure. In the long-term reducing assembly time and costs due to the minimising of surface defects created during a poor uncoated O-ring assembly.

Our coatings include a versatile range of coatings from lower cost ease of application to high-end high-performance coatings. Depending of the coating they can be applied in house or in a specialised manufacturing site (high performance coatings). Covering markets from general industrial, Oil & Gas to Life Science medical applications.

Please note coatings are generally used for static to very slow intermittent applications. Or one-off dynamic operation applications. This is because coatings are semi-permanent and can abrade is rubbed at consistent speeds across a surface.
Therefore, for long term dynamic seals please consider the full range of Ceetak Sealing Solution products, e.g. PTFE seals, lip seals etc.

Advantages

- Low friction, low insertion forces
- Minimises installation & assembly damage
- More cost effective assembly process
- Has potential to minimise contamination
- Non-stick coatings to minimise O-rings sticking together during assembly feed.
- PTFE coatings available in a range of colours
- Applicable to a high range of elastomer types.

Coating Types

Code	Coating	Description
S	Silicone Dry coat	Silicone dry coating applied at our manufacturing site. General use
P	PTFE	Dry low friction coating, available in various colours. Applied as a PTFE layer to O-rings
N	Polymer N	Polymer based coating, applied at the molecular level, creating a thin coating film on O-rings
F	PFPE	High performance Perfluoro coating, applied as a fluid
M	MoS^2	Powder coating applied as a thin layer of powder on the O-ring surface.

The range of Ceetak coatings have been benchmarked for general performance in house using our dedicated tension force equipment.

In the field each application varies, therefore it is recommended customers consult with Ceetak's vastly experienced technical team of engineers to make the best coating selection for a customer's application.

Further to this, as above all applications vary and it is highly recommended coatings are sampled and tested to qualify the application.

	Coating				
Feature	**S**	**P**	**N**	**F**	**M**
Type	Silicone	PTFE	Polymer N	PFPE	MoS^2
Colour	Clear	Various Colours	Clear	Clear	Silver
Consistency	Dry	Dry	Dry	Fluid	Powder
Function	Static, Installation coating	Slow infrequent dynamic applications	Low Breakout friction	Low friction, high performance	Installation, low qty assemblies

Ceetak have an extensive range of elastomer and engineered plastic materials to meet our customer's needs, which includes a wide range of virgin and filled PTFE, TFM, PEEK, UHMWPE, Polypropylene and Polyamide materials along with a wide range of base elastomers including (but not limited to) the following:

Nitrile (NBR
Fluorocarbon (FKM)
Ethylene Propylene (EPDM)
Hydrogenated Nitrile (HNBR)
Vamac (AEM)
Neoprene (CR)
Polyacrylate Acrylic (ACM)
Silicone (VMQ)
Fluorosilicone (FMVQ)
Perfluoroelastomers (FFKM)
Polyurethane (PU

Our portfolio of standard materials with special approvals allows Ceetak to cater for applications requiring NORSOK, API, WRAS, FDA & ISO10993. Where necessary, our experienced materials engineers work in conjunction with our manufacturing facilities and materials laboratories to develop our base materials to meet special ASTM or ISO call-out requirements, or individual customer specifications such as chemical/fluid testing or compressive stress relaxation duration tests.

Hydrogenated Nitrile (HNBR)
Developed to meet higher temperatures than NBR, manufactured by selectively hydrogenating NBR butadiene groups.
Enhanced resistance to oil, fuel and alkali solutions.
Good mechanical properties, abrasion resistance and tear strength
Enhanced upper operating temperature limit, with a typical range of -30°C to 140°C.

Nitrile (NBR)
Nitrile remains one of the most commonly available materials used within the sealing industry.
Good resistance to oil, fuel and alkali solutions.
Excellent resistance to petroleum based hydraulics and is resistant to hydrocarbon solvents.
Good mechanical properties, abrasion resistance and tear strength. Temperature operating range is -35°C to 100 °C.

Fluorocarbon (FKM)
A highly fluorinated polymer good at working for a prolonged time at elevated temperatures.
FKM properties are influenced by the polymer structure and fluorine content.
Excellent resistance to oils, fuels and hydraulic fluids at high temperatures.
Good resistance to flame and has low permeability rates with gases and vapours and low outgassing in vacuum applications
Operating temperature range is typically -20°C to 200°C
Many grades are available A, B, F, B70, ETP, type GLT, GFLT offer improved low temperature performance below -20°C.

Ethylene Propylene Diene Monomer (EPDM)
A synthetic elastomer primarily from ethylene and propylene
Offers excellent heat, ozone and sunlight resistance.
Good low temperature flexibility, good resistance to alkalis, acids and oxygenated solvents, often used for weather resistant seals and glycol based brake fluids.
Improved resistance in water and steam
Operating temp -50 °C to 150 °C. Steam up to 180C

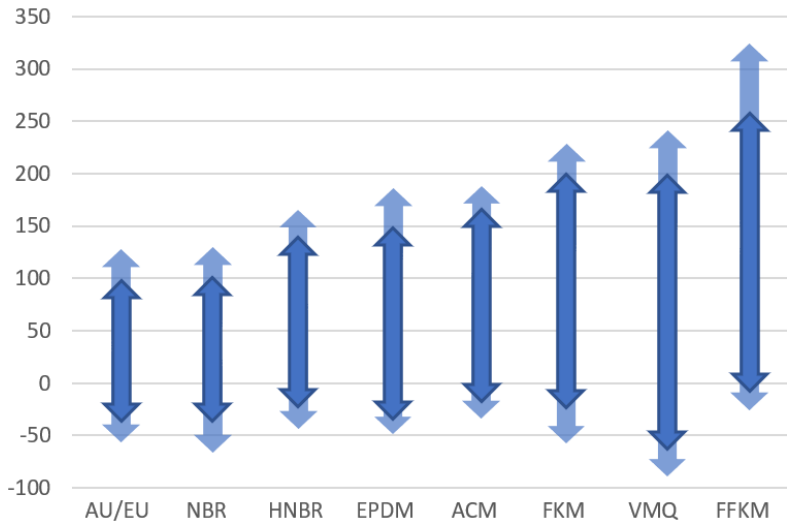
Polyacrylate (ACM)
Characterised by its resistance to ozone oxidation and oil at elevated temperatures
Has good resistance to mineral oil, oxygen and ozone and higher temperature range than NBR
Temperature range is -21°C to 177°C

Silicone (VMQ)
A family of elastomers used for sealing and insulation with excellent long term stability in extreme environments. Silicone has good Ozone and Weather resistance as well as good insulating and physiologically neutral properties. Often used in medical, and food & beverage industries. Liquid Silicone Rubber (LSR) available for improved tear resistance. Operating temperature range is -60°C to 200°C.

Polyurethane (AU, EU)
A material characterised by excellent strength, wear and extrusion resistance.
Polyurethane has high tensile strength good elasticity and excellent abrasion resistance
Compatible with low temperature water up to 50C
Compatible with mineral oil and grease, Silicone oils and grease and Pure aliphatic hydrocarbons (propane and butane)
Temperature range is -35°C to 100°C

Perfluoroelastomer (FFKM)
A fully fluorinated polymer, this is highly resistant to chemicals and stable at extremely high temperatures.
High resistance to solvents, acids, water and steam.
Low swelling with almost all known media
Often found in chemical process industries
Temperature range is -26°C to 320°C.

Compound temperature ranges



Material Range

Ceetak have an extensive range of elastomer and engineered plastic materials to meet our customers' needs.

Our range includes over 1800 materials covering most recognised elastomer groups, sourced from globally renowned manufacturers, along with a wide range of virgin and filled PTFE, TFM, PEEK, UHMWPE, Polypropylene and Polyamide materials.

Our engineers can assist in selecting a grade to suit the application needs, based within the following compound groups.

- Nitrile (NBR
- Fluorocarbon (FKM)
- Ethylene Propylene (EPDM)
- Hydrogenated Nitrile (HNBR)
- Vamac (AEM)
- Neoprene (CR)
- Polyacrylate Acrylic (ACM)
- Silicone (VMQ)
- Fluorosilicone (FMVQ)
- Perfluoroelastomers (FFKM)
- Polyurethane (PU)

Material Development

We work closely with our compounders to develop materials to comply with shifting industry standards & endeavour to remain at the forefront of technology, keeping up with increasingly challenging application demands as our customers expect more from the engineered sealing solution.

Ceetak have developed compounds for specific industries. Our portfolio of materials with widely recognised approvals allows Ceetak to cater for a number of industries, including those requiring the following:

Food and Pharmaceutical:

ISO10993 – Approved Compounds: PP, VMQ, EPDM, TPE

FDA – Approved Compounds: PU, NBR, VMQ, EPDM, POM, FKM, PTFE, PP, UHMWPE, TPE

USP VI – Approved Compounds: VMQ, PTFE, TPE, EPDM, FKM

3A – Approved Compounds: VMQ, FKM

Sour fluid resistance

API 6A – Approved compounds: FKM

Gasoline, Gas appliances and pipework

DIN EN 549 – Approved compounds: FKM, HNBR and NBR

UL157 – (Automotive) - Approved compounds: CR, FKM, FVMQ, NBR

Rapid Gas Decompression:

NORSOK M710 - Approved compounds: FFKM, FKM, HNBR

NACE TM0297 - Approved compounds: FFKM, FKM

Total EP PVV 142 – Approved Compounds: FKM, HNBR

Drinking Water Approvals

ACS (France) - Approved compounds: EPDM
KTW & W-270 (Germany) - Approved Compounds: EPDM

WRAS (UK) - Approved compounds: EPDM and NBR materials
NSF61 (USA) - Approved compounds: EPDM, NBR and VMQ materials

Bespoke Materials to Meet Customer Needs

Where necessary, our experienced materials engineers work in conjunction with our manufacturing facilities and materials laboratories to develop our base materials in order to meet special ASTM or ISO call-out requirements, or individual customer demands.

We are able to support development testing of these materials to ensure they meet requirements of chemical/fluid compatibility, compressive stress relaxation tests and other mechanical demands.

Contact our engineers for further information regarding these materials.

At Ceetak we pride ourselves on using base compounds from globally renowned suppliers,

Elastomer Energiser Materials

Where seals require the use of an elastomer energising element, or component within a multi part seal kit, the following material codes can be used to specify and constrain the accompanying elastomer.

supply, traceability, shelf life restrictions or other such demand within your programme life, Ceetak would recommend individual elastomer codes are specified. Please contact Ceetak for assistance in material selection tailored to you.

Material	Ceetak Spec	ASTM D2000	Temperature (Static)
NBR 70	N70C637	M2BG 710 A14 B14 EF11 EO14 EO34	-30°C to +100°C
NBR 90	N90CH99	M2BG 910 A14 B14 EF11 EO14 EO34	-30°C to +100°C
FKM 75	V75C646	M2HK 810 A1-10 B38 EF31 EO78	-20°C to +200°C
FKM 90	V90CJ01	M2HK 910 A1-10 B38 EF31 EO78	-20°C to +200°C
HNBR 80	HN80CJ02	M2DH 810 A26 B16 EO16 EO36	-35°C to +150°C
EPDM 70	E70CJ03	M2DA 710 A26 B36 EA14	-50°C to +150°C

These elastomers meet the minimum requirements of the ASTM reference detailed and may be supplied from multiple sources and batches depending on stock at time of order. Where the operating conditions of your application demand a specific matched elastomer, there is a need for consistent source of

Standard Material Specification Data

Material: **NBR70**
Compound Ref: **N70**
Specification: **ASTM D2000 M2BG 710 A14 B14 EA14 EO14 EO34**
Colour: **Black**
Temperature Range: **-30°C to +100°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	70±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	250 min
Specific Gravity	ASTM D297	g/cm3	±0.03
Compression Set (B14)	ASTM D395-03 (22Hrs. @ 100°C)	%	25 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 100°C (A14) ASTM D573	Hardness Change	°	±15
	Tensile Strength Change	%	±30
	Elongation Change	%	-50 max

Change in Physical Properties

Test	Property	Units	Specification
Water 70 Hrs. @ 100°C (EA14) ASTM D471	Hardness Change	°	±10
	Tensile Strength Change	%	n/a
	Elongation Change	%	n/a
	Volume Change	%	±15
ASTM Oil No. 1 70 Hrs. @ 100°C (EO14) ASTM D471	Hardness Change	°	-5 to +10
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-45 max
	Volume Change	%	-10 to +5
ASTM Oil No. 3 70 Hrs. @ 100°C (EO34) ASTM D471	Hardness Change	°	-10 to +5
	Tensile Strength Change	%	-45 max
	Elongation Change	%	-45 max
	Volume Change	%	0 to +25

*Temperature rating subject to full application review

Standard Material Specification Data

Material: **NBR90**
Compound Ref: **N90**
Specification: **ASTM D2000 M2BG 910 A14 B14 EF11 EO14 EO34**
Colour: **Black**
Temperature Range: **-30°C to +100°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	90±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	100 min
Specific Gravity	ASTM D297	g/cm3	+/- 0.03
Compression Set (B14)	ASTM D395-03 (22Hrs. @ 100°C)	%	25 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 100°C (A14) ASTM D573	Hardness Change	°	+15 max
	Tensile Strength Change	%	-20 max
	Elongation Change	%	-40 max

Change in Physical Properties

Test	Property	Units	Specification
Fuel A 70 Hrs. @ 23°C (EF11) ASTM D471	Hardness Change	°	+/- 10
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-25 max
	Volume Change	%	-5 to +10
ASTM Oil No. 1 70 Hrs. @ 100°C (EO14) ASTM D471	Hardness Change	°	-5 to +10
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-45 max
	Volume Change	%	-10 to + 5
ASTM Oil No. 3 70 Hrs. @ 100°C (EO34) ASTM D471	Hardness Change	°	-10 to + 5
	Tensile Strength Change	%	-45 max
	Elongation Change	%	-45 max
	Volume Change	%	0 to +25

*Temperature rating subject to full application review

Standard Material Specification Data

Material: **FKM75**
Compound Ref: **V75**
Specification: **ASTM D2000 M2HK810 A1-10 B38 EF31 EO78**
Colour: **Black**
Temperature Range: **-20°C to +200°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	75±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	150 min
Specific Gravity	ASTM D297	g/cm3	1.08 to 2.03
Compression Set (B38)	ASTM D395-03 (22Hrs. @ 200°C)	%	50 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 250°C	Hardness Change	°	+10 max
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-25 max

Change in Physical Properties

Test	Property	Units	Specification
Fuel C 70 Hrs. @ 23°C (EF31) ASTM D471	Hardness Change	°	+/- 5
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-20 max
	Volume Change	%	0 to +10
Service liquid No. 101 70 Hrs. @ 200°C (EO78) ASTM D471	Hardness Change	°	-15 ~ +5
	Tensile Strength Change	%	-40 max
	Elongation Change	%	-20 max
	Volume Change	%	0 ~ +15

*Temperature rating subject to full application review

Standard Material Specification Data

Material: **FKM90**
Compound Ref: **V90**
Specification: **ASTM D2000 M2HK 910 A1-10 B38 EF31 EO78**
Colour: **Black**
Temperature Range: **-20°C to +200°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	90±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	100 min
Specific Gravity	ASTM D297	g/cm3	+/- 0.03
Compression Set (B38)	ASTM D395-03 (22Hrs. @ 200°C)	%	50 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 250°C (A1-10) ASTM D573	Hardness Change	°	+10 max
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-25 max

Change in Physical Properties

Test	Property	Units	Specification
Fuel C 70 Hrs. @ 23°C (EF31) ASTM D471	Hardness Change	°	+/- 5
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-20 max
	Volume Change	%	0 to +10
Service liquid No. 101 70 Hrs. @ 100°C (EO78) ASTM D471	Hardness Change	°	-15 to +5
	Tensile Strength Change	%	-40 max
	Elongation Change	%	-20 max
	Volume Change	%	0 to + 15

*Temperature rating subject to full application review

Standard Material Specification Data

Material: **HNBR80**
Compound Ref: **H80**
Specification: **ASTM D2000 M2DH 810 A26 B16 EO16 EO36**
Colour: **Black**
Temperature Range: **-35°C to +150°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	80±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	100 min
Specific Gravity	ASTM D297	g/cm3	+/- 0.03
Compression Set (B16)	ASTM D395-03 (22Hrs. @ 150°C)	%	30 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 150°C (A26) ASTM D573	Hardness Change	°	+10 max
	Tensile Strength Change	%	-25 max
	Elongation Change	%	-30 max

Change in Physical Properties

Test	Property	Units	Specification
ASTM Oil No. 1 70 Hrs. @ 150°C (EO16) ASTM D471	Hardness Change	°	-5 to + 10
	Tensile Strength Change	%	-20 max
	Elongation Change	%	-30 max
	Volume Change	%	+/- 5
ASTM Oil No. 3 70 Hrs. @ 150°C (EO36) ASTM D471	Hardness Change	°	-15 max
	Tensile Strength Change	%	-40 max
	Elongation Change	%	-40 max
	Volume Change	%	+25 max

*Temperature rating subject to full application review

Standard Material Specification Data

Material: **EPDM70**
Compound Ref: **E70**
Specification: **ASTM D2000 M2DA 710 A26 B36 EA14**
Colour: **Black**
Temperature Range: **-50°C to +150°C**

Original Physical Properties

Property	Test	Units	Specification
Hardness	ASTM D2240-05	Shore A	70±5
Tensile Strength	ASTM D412-06a	MPa	10 min
Elongation	ASTM D412-06a	%	200 min
Specific Gravity	ASTM D297	g/cm3	+/- 0.03
Compression Set	ASTM D395-03 (22Hrs. @ 150°C)	%	40 max

Change in Physical Properties

Test	Property	Units	Specification
Heat Ageing in Air 70 Hrs. @ 150°C (A26) ASTM D573	Hardness Change	°	+10 max
	Tensile Strength Change	%	-20 max
	Elongation Change	%	-20 max

Change in Physical Properties

Test	Property	Units	Specification
Water 70 Hrs. @ 100°C (EA14) ASTM D471	Volume Change	%	+/- 5

*Temperature rating subject to full application review

Ceetak

O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
1.6mm Cross Section				
3.1	0.15	1.60	+/- 0.08	BS4518 0031-16
4.1	0.15	1.60	+/- 0.08	BS4518 0041-16
5.1	0.15	1.60	+/- 0.08	BS4518 0051-16
6.1	0.15	1.60	+/- 0.08	BS4518 0061-16
7.1	0.15	1.60	+/- 0.08	BS4518 0071-16
8.1	0.15	1.60	+/- 0.08	BS4518 0081-16
9.1	0.15	1.60	+/- 0.08	BS4518 0091-16
10.1	0.2	1.60	+/- 0.08	BS4518 0101-16
11.1	0.2	1.60	+/- 0.08	BS4518 0111-16
12.1	0.2	1.60	+/- 0.08	BS4518 0121-16
13.1	0.2	1.60	+/- 0.08	BS4518 0131-16
14.1	0.2	1.60	+/- 0.08	BS4518 0141-16
15.1	0.2	1.60	+/- 0.08	BS4518 0151-16
16.1	0.2	1.60	+/- 0.08	BS4518 0161-16
17.1	0.2	1.60	+/- 0.08	BS4518 0171-16
18.1	0.25	1.60	+/- 0.08	BS4518 0181-16
19.1	0.25	1.60	+/- 0.08	BS4518 0191-16
22.1	0.25	1.60	+/- 0.08	BS4518 0221-16
25.1	0.25	1.60	+/- 0.08	BS4518 0251-16
27.1	0.25	1.60	+/- 0.08	BS4518 0271-16
29.1	0.25	1.60	+/- 0.08	BS4518 0291-16
32.1	0.3	1.60	+/- 0.08	BS4518 0321-16
35.1	0.3	1.60	+/- 0.08	BS4518 0351-16
37.1	0.3	1.60	+/- 0.08	BS4518 0371-16

Ceetak

O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
2.4mm Cross Section				
3.6	0.15	2.40	+/- 0.09	BS4518 0036-24
4.6	0.15	2.40	+/- 0.09	BS4518 0046-24
5.6	0.15	2.40	+/- 0.09	BS4518 0056-24
6.6	0.15	2.40	+/- 0.09	BS4518 0066-24
7.6	0.15	2.40	+/- 0.09	BS4518 0076-24
8.6	0.15	2.40	+/- 0.09	BS4518 0086-24
9.6	0.15	2.40	+/- 0.09	BS4518 0096-24
10.6	0.2	2.40	+/- 0.09	BS4518 0106-24
11.6	0.2	2.40	+/- 0.09	BS4518 0116-24
12.6	0.2	2.40	+/- 0.09	BS4518 0126-24
13.6	0.2	2.40	+/- 0.09	BS4518 0136-24
14.6	0.2	2.40	+/- 0.09	BS4518 0146-24
15.6	0.2	2.40	+/- 0.09	BS4518 0156-24
16.6	0.2	2.40	+/- 0.09	BS4518 0166-24
17.6	0.2	2.40	+/- 0.09	BS4518 0176-24
18.6	0.25	2.40	+/- 0.09	BS4518 0186-24
19.6	0.25	2.40	+/- 0.09	BS4518 0196-24
20.6	0.25	2.40	+/- 0.09	BS4518 0206-24
21.6	0.25	2.40	+/- 0.09	BS4518 0216-24
24.6	0.25	2.40	+/- 0.09	BS4518 0246-24
27.6	0.25	2.40	+/- 0.09	BS4518 0276-24
29.6	0.25	2.40	+/- 0.09	BS4518 0296-24
31.6	0.3	2.40	+/- 0.09	BS4518 0316-24
34.6	0.3	2.40	+/- 0.09	BS4518 0346-24
35.6	0.3	2.40	+/- 0.09	BS4518 0356-24
37.6	0.3	2.40	+/- 0.09	BS4518 0376-24
39.6	0.3	2.40	+/- 0.09	BS4518 0396-24
41.6	0.3	2.40	+/- 0.09	BS4518 0416-24
44.6	0.3	2.40	+/- 0.09	BS4518 0446-24
45.6	0.3	2.40	+/- 0.09	BS4518 0456-24
47.6	0.3	2.40	+/- 0.09	BS4518 0476-24
49.6	0.3	2.40	+/- 0.09	BS4518 0496-24
51.6	0.4	2.40	+/- 0.09	BS4518 0516-24
54.6	0.4	2.40	+/- 0.09	BS4518 0546-24
55.6	0.4	2.40	+/- 0.09	BS4518 0556-24
57.6	0.4	2.40	+/- 0.09	BS4518 0576-24

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O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
58.6	0.4	2.40	+/- 0.09	BS4518 0586-24
59.6	0.4	2.40	+/- 0.09	BS4518 0596-24
61.6	0.4	2.40	+/- 0.09	BS4518 0616-24
62.6	0.4	2.40	+/- 0.09	BS4518 0626-24
63.6	0.4	2.40	+/- 0.09	BS4518 0636-24
64.6	0.4	2.40	+/- 0.09	BS4518 0646-24
67.6	0.4	2.40	+/- 0.09	BS4518 0676-24
69.6	0.4	2.40	+/- 0.09	BS4518 0696-24
3.0mm Cross Section				
19.5	0.25	3.00	+/- 0.10	BS4518 0195-30
21.5	0.25	3.00	+/- 0.10	BS4518 0215-30
22.5	0.25	3.00	+/- 0.10	BS4518 0225-30
24.5	0.25	3.00	+/- 0.10	BS4518 0245-30
25.5	0.25	3.00	+/- 0.10	BS4518 0255-30
26.5	0.25	3.00	+/- 0.10	BS4518 0265-30
27.5	0.25	3.00	+/- 0.10	BS4518 0275-30
29.5	0.25	3.00	+/- 0.10	BS4518 0295-30
31.5	0.3	3.00	+/- 0.10	BS4518 0315-30
32.5	0.3	3.00	+/- 0.10	BS4518 0325-30
34.5	0.3	3.00	+/- 0.10	BS4518 0345-30
35.5	0.3	3.00	+/- 0.10	BS4518 0355-30
36.5	0.3	3.00	+/- 0.10	BS4518 0365-30
37.5	0.3	3.00	+/- 0.10	BS4518 0375-30
39.5	0.3	3.00	+/- 0.10	BS4518 0395-30
41.5	0.3	3.00	+/- 0.10	BS4518 0415-30
42.5	0.3	3.00	+/- 0.10	BS4518 0425-30
44.5	0.3	3.00	+/- 0.10	BS4518 0445-30
49.5	0.3	3.00	+/- 0.10	BS4518 0495-30
54.5	0.4	3.00	+/- 0.10	BS4518 0545-30
55.5	0.4	3.00	+/- 0.10	BS4518 0555-30
57.5	0.4	3.00	+/- 0.10	BS4518 0575-30
59.5	0.4	3.00	+/- 0.10	BS4518 0595-30
62.5	0.4	3.00	+/- 0.10	BS4518 0625-30
64.5	0.4	3.00	+/- 0.10	BS4518 0645-30
69.5	0.4	3.00	+/- 0.10	BS4518 0695-30
74.5	0.4	3.00	+/- 0.10	BS4518 0745-30
79.5	0.4	3.00	+/- 0.10	BS4518 0795-30

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O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
84.5	0.5	3.00	+/- 0.10	BS4518 0845-30
89.5	0.5	3.00	+/- 0.10	BS4518 0895-30
94.5	0.5	3.00	+/- 0.10	BS4518 0945-30
99.5	0.5	3.00	+/- 0.10	BS4518 0995-30
104.5	0.5	3.00	+/- 0.10	BS4518 1045-30
109.5	0.5	3.00	+/- 0.10	BS4518 1095-30
114.5	0.5	3.00	+/- 0.10	BS4518 1145-30
119.5	0.5	3.00	+/- 0.10	BS4518 1195-30
124.5	0.6	3.00	+/- 0.10	BS4518 1245-30
129.5	0.6	3.00	+/- 0.10	BS4518 1295-30
134.5	0.6	3.00	+/- 0.10	BS4518 1345-30
139.5	0.6	3.00	+/- 0.10	BS4518 1395-30
144.5	0.6	3.00	+/- 0.10	BS4518 1445-30
149.5	0.6	3.00	+/- 0.10	BS4518 1495-30
154.5	0.6	3.00	+/- 0.10	BS4518 1545-30
159.5	0.6	3.00	+/- 0.10	BS4518 1595-30
164.5	0.6	3.00	+/- 0.10	BS4518 1645-30
169.5	0.6	3.00	+/- 0.10	BS4518 1695-30
174.5	0.6	3.00	+/- 0.10	BS4518 1745-30
179.5	0.6	3.00	+/- 0.10	BS4518 1795-30
184.5	0.8	3.00	+/- 0.10	BS4518 1845-30
189.5	0.8	3.00	+/- 0.10	BS4518 1895-30
194.5	0.8	3.00	+/- 0.10	BS4518 1945-30
199.5	0.8	3.00	+/- 0.10	BS4518 1995-30
209.5	0.8	3.00	+/- 0.10	BS4518 2095-30
219.5	0.8	3.00	+/- 0.10	BS4518 2195-30
229.5	0.8	3.00	+/- 0.10	BS4518 2295-30
239.5	0.8	3.00	+/- 0.10	BS4518 2395-30
244.5	0.8	3.00	+/- 0.10	BS4518 2445-30
249.5	0.8	3.00	+/- 0.10	BS4518 2495-30
5.7mm Cross Section				
44.3	0.3	5.70	+/- 0.12	BS4518 0443-57
45.3	0.3	5.70	+/- 0.12	BS4518 0453-57
49.3	0.3	5.70	+/- 0.12	BS4518 0493-57
52.3	0.4	5.70	+/- 0.12	BS4518 0523-57

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O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
54.3	0.4	5.70	+/- 0.12	BS4518 0543-57
55.3	0.4	5.70	+/- 0.12	BS4518 0553-57
59.3	0.4	5.70	+/- 0.12	BS4518 0593-57
62.3	0.4	5.70	+/- 0.12	BS4518 0623-57
64.3	0.4	5.70	+/- 0.12	BS4518 0643-57
69.3	0.4	5.70	+/- 0.12	BS4518 0693-57
74.3	0.4	5.70	+/- 0.12	BS4518 0743-57
79.3	0.4	5.70	+/- 0.12	BS4518 0793-57
84.3	0.5	5.70	+/- 0.12	BS4518 0843-57
89.3	0.5	5.70	+/- 0.12	BS4518 0893-57
94.3	0.5	5.70	+/- 0.12	BS4518 0943-57
99.3	0.5	5.70	+/- 0.12	BS4518 0993-57
104.3	0.5	5.70	+/- 0.12	BS4518 1043-57
109.3	0.5	5.70	+/- 0.12	BS4518 1093-57
114.3	0.5	5.70	+/- 0.12	BS4518 1143-57
119.3	0.5	5.70	+/- 0.12	BS4518 1193-57
124.3	0.6	5.70	+/- 0.12	BS4518 1243-57
129.3	0.6	5.70	+/- 0.12	BS4518 1293-57
134.3	0.6	5.70	+/- 0.12	BS4518 1343-57
139.3	0.6	5.70	+/- 0.12	BS4518 1393-57
144.3	0.6	5.70	+/- 0.12	BS4518 1443-57
149.3	0.6	5.70	+/- 0.12	BS4518 1493-57
154.3	0.6	5.70	+/- 0.12	BS4518 1543-57
159.3	0.6	5.70	+/- 0.12	BS4518 1593-57
164.3	0.6	5.70	+/- 0.12	BS4518 1643-57
169.3	0.6	5.70	+/- 0.12	BS4518 1693-57
174.3	0.6	5.70	+/- 0.12	BS4518 1743-57
179.3	0.6	5.70	+/- 0.12	BS4518 1793-57
184.3	0.8	5.70	+/- 0.12	BS4518 1843-57
189.3	0.8	5.70	+/- 0.12	BS4518 1893-57
194.3	0.8	5.70	+/- 0.12	BS4518 1943-57
199.3	0.8	5.70	+/- 0.12	BS4518 1993-57
209.3	0.8	5.70	+/- 0.12	BS4518 2093-57
219.3	0.8	5.70	+/- 0.12	BS4518 2193-57
229.3	0.8	5.70	+/- 0.12	BS4518 2293-57
239.3	0.8	5.70	+/- 0.12	BS4518 2393-57
249.3	0.8	5.70	+/- 0.12	BS4518 2493-57
259.3	1	5.70	+/- 0.12	BS4518 2593-57

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O-Ring Catalogue

BS4518 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	BS4518 Size Reference
269.3	1	5.70	+/- 0.12	BS4518 2693-57
279.3	1	5.70	+/- 0.12	BS4518 2793-57
289.3	1	5.70	+/- 0.12	BS4518 2893-57
299.3	1	5.70	+/- 0.12	BS4518 2993-57
309.3	1.5	5.70	+/- 0.12	BS4518 3093-57
319.3	1.5	5.70	+/- 0.12	BS4518 3193-57
339.3	1.5	5.70	+/- 0.12	BS4518 3393-57
359.3	1.5	5.70	+/- 0.12	BS4518 3593-57
379.3	1.5	5.70	+/- 0.12	BS4518 3793-57
389.3	1.5	5.70	+/- 0.12	BS4518 3893-57
399.3	1.5	5.70	+/- 0.12	BS4518 3993-57
419.3	2	5.70	+/- 0.12	BS4518 4193-57
439.3	2	5.70	+/- 0.12	BS4518 4393-57
459.3	2	5.70	+/- 0.12	BS4518 4593-57
479.3	2	5.70	+/- 0.12	BS4518 4793-57
489.3	2	5.70	+/- 0.12	BS4518 4893-57
499.3	2	5.70	+/- 0.12	BS4518 4993-57
8.4mm Cross Section				
144.1	0.6	8.40	+/-0.15	BS4518 1441-84
149.1	0.6	8.40	+/-0.15	BS4518 1491-84
154.1	0.6	8.40	+/-0.15	BS4518 1541-84
159.1	0.6	8.40	+/-0.15	BS4518 1591-84
164.1	0.6	8.40	+/-0.15	BS4518 1641-84
169.1	0.6	8.40	+/-0.15	BS4518 1691-84
174.1	0.6	8.40	+/-0.15	BS4518 1741-84
179.1	0.6	8.40	+/-0.15	BS4518 1791-84
184.1	0.8	8.40	+/-0.15	BS4518 1841-84
189.1	0.8	8.40	+/-0.15	BS4518 1891-84
194.1	0.8	8.40	+/-0.15	BS4518 1941-84
199.1	0.8	8.40	+/-0.15	BS4518 1991-84
204.1	0.8	8.40	+/-0.15	BS4518 2041-84
209.1	0.8	8.40	+/-0.15	BS4518 2091-84
219.1	0.8	8.40	+/-0.15	BS4518 2191-84
229.1	0.8	8.40	+/-0.15	BS4518 2291-84
234.1	0.8	8.40	+/-0.15	BS4518 2341-84
239.1	0.8	8.40	+/-0.15	BS4518 2391-84
249.1	0.8	8.40	+/-0.15	BS4518 2491-84

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
1.78mm Cross section				
1.78	0.13	1.78	+/- 0.08	**004**
2.57	0.13	1.78	+/- 0.08	**005**
2.90	0.13	1.78	+/- 0.08	**006**
3.68	0.13	1.78	+/- 0.08	**007**
4.47	0.13	1.78	+/- 0.08	**008**
5.28	0.13	1.78	+/- 0.08	**009**
6.07	0.13	1.78	+/- 0.08	**010**
7.65	0.13	1.78	+/- 0.08	**011**
9.25	0.13	1.78	+/- 0.08	**012**
10.82	0.13	1.78	+/- 0.08	**013**
12.42	0.13	1.78	+/- 0.08	**014**
14.00	0.18	1.78	+/- 0.08	**015**
15.60	0.23	1.78	+/- 0.08	**016**
17.17	0.23	1.78	+/- 0.08	**017**
18.77	0.23	1.78	+/- 0.08	**018**
20.35	0.23	1.78	+/- 0.08	**019**
21.95	0.23	1.78	+/- 0.08	**020**
23.52	0.23	1.78	+/- 0.08	**021**
25.12	0.25	1.78	+/- 0.08	**022**
26.70	0.25	1.78	+/- 0.08	**023**
28.30	0.25	1.78	+/- 0.08	**024**
29.87	0.28	1.78	+/- 0.08	**025**
31.47	0.28	1.78	+/- 0.08	**026**
33.05	0.28	1.78	+/- 0.08	**027**
34.65	0.33	1.78	+/- 0.08	**028**
37.82	0.33	1.78	+/- 0.08	**029**
41.00	0.33	1.78	+/- 0.08	**030**
44.17	0.38	1.78	+/- 0.08	**031**
47.35	0.38	1.78	+/- 0.08	**032**
50.52	0.46	1.78	+/- 0.08	**033**
53.70	0.46	1.78	+/- 0.08	**034**
56.87	0.46	1.78	+/- 0.08	**035**
60.05	0.46	1.78	+/- 0.08	**036**
63.22	0.46	1.78	+/- 0.08	**037**
66.40	0.51	1.78	+/- 0.08	**038**
69.57	0.51	1.78	+/- 0.08	**039**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
72.75	0.51	1.78	+/- 0.08	**040**
75.92	0.61	1.78	+/- 0.08	**041**
82.27	0.61	1.78	+/- 0.08	**042**
88.62	0.61	1.78	+/- 0.08	**043**
94.97	0.69	1.78	+/- 0.08	**044**
101.32	0.69	1.78	+/- 0.08	**045**
107.67	0.76	1.78	+/- 0.08	**046**
114.02	0.76	1.78	+/- 0.08	**047**
120.37	0.76	1.78	+/- 0.08	**048**
126.72	0.94	1.78	+/- 0.08	**049**
133.07	0.94	1.78	+/- 0.08	**050**
2.62mm Cross section				
1.24	0.13	2.62	+/- 0.09	**102**
2.06	0.13	2.62	+/- 0.09	**103**
2.84	0.13	2.62	+/- 0.09	**104**
3.63	0.13	2.62	+/- 0.09	**105**
4.42	0.13	2.62	+/- 0.09	**106**
5.23	0.13	2.62	+/- 0.09	**107**
6.02	0.13	2.62	+/- 0.09	**108**
7.59	0.13	2.62	+/- 0.09	**109**
9.19	0.13	2.62	+/- 0.09	**110**
10.77	0.13	2.62	+/- 0.09	**111**
12.37	0.13	2.62	+/- 0.09	**112**
13.94	0.18	2.62	+/- 0.09	**113**
15.54	0.23	2.62	+/- 0.09	**114**
17.12	0.23	2.62	+/- 0.09	**115**
18.72	0.23	2.62	+/- 0.09	**116**
20.29	0.25	2.62	+/- 0.09	**117**
21.89	0.25	2.62	+/- 0.09	**118**
23.47	0.25	2.62	+/- 0.09	**119**
25.07	0.25	2.62	+/- 0.09	**120**
26.64	0.25	2.62	+/- 0.09	**121**
28.24	0.25	2.62	+/- 0.09	**122**
29.82	0.3	2.62	+/- 0.09	**123**
31.42	0.3	2.62	+/- 0.09	**124**
32.99	0.3	2.62	+/- 0.09	**125**
34.59	0.3	2.62	+/- 0.09	**126**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
36.17	0.3	2.62	+/- 0.09	**127**
37.77	0.3	2.62	+/- 0.09	**128**
39.34	0.38	2.62	+/- 0.09	**129**
40.94	0.38	2.62	+/- 0.09	**130**
42.52	0.38	2.62	+/- 0.09	**131**
44.12	0.38	2.62	+/- 0.09	**132**
45.69	0.38	2.62	+/- 0.09	**133**
47.29	0.38	2.62	+/- 0.09	**134**
48.90	0.43	2.62	+/- 0.09	**135**
50.47	0.43	2.62	+/- 0.09	**136**
52.07	0.43	2.62	+/- 0.09	**137**
53.64	0.43	2.62	+/- 0.09	**138**
55.25	0.43	2.62	+/- 0.09	**139**
56.82	0.43	2.62	+/- 0.09	**140**
58.42	0.51	2.62	+/- 0.09	**141**
59.99	0.51	2.62	+/- 0.09	**142**
61.60	0.51	2.62	+/- 0.09	**143**
63.17	0.51	2.62	+/- 0.09	**144**
64.77	0.51	2.62	+/- 0.09	**145**
66.34	0.51	2.62	+/- 0.09	**146**
67.95	0.56	2.62	+/- 0.09	**147**
69.52	0.56	2.62	+/- 0.09	**148**
71.12	0.56	2.62	+/- 0.09	**149**
72.69	0.56	2.62	+/- 0.09	**150**
75.87	0.61	2.62	+/- 0.09	**151**
82.22	0.61	2.62	+/- 0.09	**152**
88.57	0.61	2.62	+/- 0.09	**153**
94.92	0.71	2.62	+/- 0.09	**154**
101.27	0.71	2.62	+/- 0.09	**155**
107.62	0.76	2.62	+/- 0.09	**156**
113.97	0.76	2.62	+/- 0.09	**157**
120.32	0.76	2.62	+/- 0.09	**158**
126.67	0.89	2.62	+/- 0.09	**159**
133.02	0.89	2.62	+/- 0.09	**160**
139.37	0.89	2.62	+/- 0.09	**161**
145.72	0.89	2.62	+/- 0.09	**162**
152.07	0.89	2.62	+/- 0.09	**163**
158.42	1.02	2.62	+/- 0.09	**164**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
164.77	1.02	2.62	+/- 0.09	**165**
171.12	1.02	2.62	+/- 0.09	**166**
177.47	1.02	2.62	+/- 0.09	**167**
183.82	1.14	2.62	+/- 0.09	**168**
190.17	1.14	2.62	+/- 0.09	**169**
196.52	1.14	2.62	+/- 0.09	**170**
202.87	1.14	2.62	+/- 0.09	**171**
209.22	1.27	2.62	+/- 0.09	**172**
215.57	1.27	2.62	+/- 0.09	**173**
221.92	1.27	2.62	+/- 0.09	**174**
228.27	1.27	2.62	+/- 0.09	**175**
234.62	1.4	2.62	+/- 0.09	**176**
240.97	1.4	2.62	+/- 0.09	**177**
247.32	1.4	2.62	+/- 0.09	**178**
3.53mm Cross section				
4.34	0.13	3.53	+/- 0.10	**201**
5.94	0.13	3.53	+/- 0.10	**202**
7.52	0.13	3.53	+/- 0.10	**203**
9.12	0.13	3.53	+/- 0.10	**204**
10.69	0.13	3.53	+/- 0.10	**205**
12.29	0.13	3.53	+/- 0.10	**206**
13.87	0.18	3.53	+/- 0.10	**207**
15.47	0.23	3.53	+/- 0.10	**208**
17.04	0.23	3.53	+/- 0.10	**209**
18.64	0.25	3.53	+/- 0.10	**210**
20.22	0.25	3.53	+/- 0.10	**211**
21.82	0.25	3.53	+/- 0.10	**212**
23.39	0.25	3.53	+/- 0.10	**213**
24.99	0.25	3.53	+/- 0.10	**214**
26.57	0.25	3.53	+/- 0.10	**215**
28.17	0.3	3.53	+/- 0.10	**216**
29.74	0.3	3.53	+/- 0.10	**217**
31.34	0.3	3.53	+/- 0.10	**218**
32.92	0.3	3.53	+/- 0.10	**219**
34.52	0.3	3.53	+/- 0.10	**220**
36.09	0.3	3.53	+/- 0.10	**221**
37.69	0.38	3.53	+/- 0.10	**222**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
40.87	0.38	3.53	+/- 0.10	**223**
44.04	0.38	3.53	+/- 0.10	**224**
47.22	0.46	3.53	+/- 0.10	**225**
50.39	0.46	3.53	+/- 0.10	**226**
53.57	0.46	3.53	+/- 0.10	**227**
56.74	0.51	3.53	+/- 0.10	**228**
59.92	0.51	3.53	+/- 0.10	**229**
63.09	0.51	3.53	+/- 0.10	**230**
66.27	0.51	3.53	+/- 0.10	**231**
69.44	0.61	3.53	+/- 0.10	**232**
72.62	0.61	3.53	+/- 0.10	**233**
75.79	0.61	3.53	+/- 0.10	**234**
78.97	0.61	3.53	+/- 0.10	**235**
82.14	0.61	3.53	+/- 0.10	**236**
85.32	0.61	3.53	+/- 0.10	**237**
88.49	0.61	3.53	+/- 0.10	**238**
91.67	0.71	3.53	+/- 0.10	**239**
94.84	0.71	3.53	+/- 0.10	**240**
98.02	0.71	3.53	+/- 0.10	**241**
101.19	0.71	3.53	+/- 0.10	**242**
104.37	0.71	3.53	+/- 0.10	**243**
107.54	0.76	3.53	+/- 0.10	**244**
110.72	0.76	3.53	+/- 0.10	**245**
113.89	0.76	3.53	+/- 0.10	**246**
117.07	0.76	3.53	+/- 0.10	**247**
120.24	0.76	3.53	+/- 0.10	**248**
123.42	0.89	3.53	+/- 0.10	**249**
126.59	0.89	3.53	+/- 0.10	**250**
129.77	0.89	3.53	+/- 0.10	**251**
132.94	0.89	3.53	+/- 0.10	**252**
136.12	0.89	3.53	+/- 0.10	**253**
139.29	0.89	3.53	+/- 0.10	**254**
142.47	0.89	3.53	+/- 0.10	**255**
145.64	0.89	3.53	+/- 0.10	**256**
148.82	0.89	3.53	+/- 0.10	**257**
151.99	0.89	3.53	+/- 0.10	**258**
158.34	1.02	3.53	+/- 0.10	**259**
164.69	1.02	3.53	+/- 0.10	**260**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
171.04	1.02	3.53	+/- 0.10	**261**
177.39	1.02	3.53	+/- 0.10	**262**
183.74	1.14	3.53	+/- 0.10	**263**
190.09	1.14	3.53	+/- 0.10	**264**
196.44	1.14	3.53	+/- 0.10	**265**
202.79	1.14	3.53	+/- 0.10	**266**
209.14	1.27	3.53	+/- 0.10	**267**
215.49	1.27	3.53	+/- 0.10	**268**
221.84	1.27	3.53	+/- 0.10	**269**
228.19	1.27	3.53	+/- 0.10	**270**
234.54	1.4	3.53	+/- 0.10	**271**
240.89	1.4	3.53	+/- 0.10	**272**
247.24	1.4	3.53	+/- 0.10	**273**
253.59	1.4	3.53	+/- 0.10	**274**
266.29	1.4	3.53	+/- 0.10	**275**
278.99	1.65	3.53	+/- 0.10	**276**
291.69	1.65	3.53	+/- 0.10	**277**
304.39	1.65	3.53	+/- 0.10	**278**
329.79	1.65	3.53	+/- 0.10	**279**
355.19	1.65	3.53	+/- 0.10	**280**
380.59	1.65	3.53	+/- 0.10	**281**
405.26	1.91	3.53	+/- 0.10	**282**
430.66	2.03	3.53	+/- 0.10	**283**
456.06	2.16	3.53	+/- 0.10	**284**
5.33mm Cross Section				
10.46	0.13	5.33	+/- 0.13	**309**
12.07	0.13	5.33	+/- 0.13	**310**
13.64	0.18	5.33	+/- 0.13	**311**
15.24	0.23	5.33	+/- 0.13	**312**
16.81	0.23	5.33	+/- 0.13	**313**
18.42	0.25	5.33	+/- 0.13	**314**
19.99	0.25	5.33	+/- 0.13	**315**
21.59	0.25	5.33	+/- 0.13	**316**
23.16	0.25	5.33	+/- 0.13	**317**
24.77	0.25	5.33	+/- 0.13	**318**
26.34	0.25	5.33	+/- 0.13	**319**
27.94	0.3	5.33	+/- 0.13	**320**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
29.51	0.3	5.33	+/- 0.13	**321**
31.12	0.3	5.33	+/- 0.13	**322**
32.69	0.3	5.33	+/- 0.13	**323**
34.29	0.3	5.33	+/- 0.13	**324**
37.47	0.38	5.33	+/- 0.13	**325**
40.64	0.38	5.33	+/- 0.13	**326**
43.82	0.38	5.33	+/- 0.13	**327**
46.99	0.38	5.33	+/- 0.13	**328**
50.17	0.46	5.33	+/- 0.13	**329**
53.34	0.46	5.33	+/- 0.13	**330**
56.52	0.46	5.33	+/- 0.13	**331**
59.69	0.46	5.33	+/- 0.13	**332**
62.87	0.51	5.33	+/- 0.13	**333**
66.04	0.51	5.33	+/- 0.13	**334**
69.22	0.51	5.33	+/- 0.13	**335**
72.39	0.51	5.33	+/- 0.13	**336**
75.57	0.61	5.33	+/- 0.13	**337**
78.74	0.61	5.33	+/- 0.13	**338**
81.92	0.61	5.33	+/- 0.13	**339**
85.09	0.61	5.33	+/- 0.13	**340**
88.27	0.61	5.33	+/- 0.13	**341**
91.44	0.71	5.33	+/- 0.13	**342**
94.62	0.71	5.33	+/- 0.13	**343**
97.79	0.71	5.33	+/- 0.13	**344**
100.97	0.71	5.33	+/- 0.13	**345**
104.14	0.71	5.33	+/- 0.13	**346**
107.32	0.76	5.33	+/- 0.13	**347**
110.49	0.76	5.33	+/- 0.13	**348**
113.67	0.76	5.33	+/- 0.13	**349**
116.84	0.76	5.33	+/- 0.13	**350**
120.02	0.76	5.33	+/- 0.13	**351**
123.19	0.76	5.33	+/- 0.13	**352**
126.37	0.94	5.33	+/- 0.13	**353**
129.54	0.94	5.33	+/- 0.13	**354**
132.72	0.94	5.33	+/- 0.13	**355**
135.89	0.94	5.33	+/- 0.13	**356**
139.07	0.94	5.33	+/- 0.13	**357**
142.24	0.94	5.33	+/- 0.13	**358**

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O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
145.42	0.94	5.33	+/- 0.13	**359**
148.59	0.94	5.33	+/- 0.13	**360**
151.77	0.94	5.33	+/- 0.13	**361**
158.12	1.02	5.33	+/- 0.13	**362**
164.47	1.02	5.33	+/- 0.13	**363**
170.82	1.02	5.33	+/- 0.13	**364**
177.17	1.02	5.33	+/- 0.13	**365**
183.52	1.14	5.33	+/- 0.13	**366**
189.87	1.14	5.33	+/- 0.13	**367**
196.22	1.14	5.33	+/- 0.13	**368**
202.57	1.14	5.33	+/- 0.13	**369**
208.92	1.27	5.33	+/- 0.13	**370**
215.27	1.27	5.33	+/- 0.13	**371**
221.62	1.27	5.33	+/- 0.13	**372**
227.97	1.27	5.33	+/- 0.13	**373**
234.32	1.4	5.33	+/- 0.13	**374**
240.67	1.4	5.33	+/- 0.13	**375**
247.02	1.4	5.33	+/- 0.13	**376**
253.37	1.4	5.33	+/- 0.13	**377**
266.07	1.52	5.33	+/- 0.13	**378**
278.77	1.52	5.33	+/- 0.13	**379**
291.47	1.65	5.33	+/- 0.13	**380**
304.17	1.65	5.33	+/- 0.13	**381**
329.57	1.65	5.33	+/- 0.13	**382**
354.97	1.78	5.33	+/- 0.13	**383**
380.37	1.78	5.33	+/- 0.13	**384**
405.26	1.91	5.33	+/- 0.13	**385**
430.66	2.03	5.33	+/- 0.13	**386**
456.06	2.16	5.33	+/- 0.13	**387**
481.46	2.29	5.33	+/- 0.13	**388**
506.86	2.41	5.33	+/- 0.13	**389**
532.26	2.41	5.33	+/- 0.13	**390**
557.66	2.54	5.33	+/- 0.13	**391**
582.68	2.67	5.33	+/- 0.13	**392**
608.08	2.79	5.33	+/- 0.13	**393**
633.48	2.92	5.33	+/- 0.13	**394**
658.88	3.05	5.33	+/- 0.13	**395**

Ceetak

O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
6.99mm Cross Section				
113.67	0.84	6.99	+/- 0.15	**425**
116.84	0.84	6.99	+/- 0.15	**426**
120.02	0.84	6.99	+/- 0.15	**427**
123.19	0.84	6.99	+/- 0.15	**428**
126.37	0.94	6.99	+/- 0.15	**429**
129.54	0.94	6.99	+/- 0.15	**430**
132.72	0.94	6.99	+/- 0.15	**431**
135.89	0.94	6.99	+/- 0.15	**432**
139.07	0.94	6.99	+/- 0.15	**433**
142.24	0.94	6.99	+/- 0.15	**434**
145.42	0.94	6.99	+/- 0.15	**435**
148.59	0.94	6.99	+/- 0.15	**436**
151.77	0.94	6.99	+/- 0.15	**437**
158.12	1.02	6.99	+/- 0.15	**438**
164.47	1.02	6.99	+/- 0.15	**439**
170.82	1.02	6.99	+/- 0.15	**440**
177.17	1.02	6.99	+/- 0.15	**441**
183.52	1.14	6.99	+/- 0.15	**442**
189.87	1.14	6.99	+/- 0.15	**443**
196.22	1.14	6.99	+/- 0.15	**444**
202.57	1.14	6.99	+/- 0.15	**445**
215.27	1.4	6.99	+/- 0.15	**446**
227.97	1.4	6.99	+/- 0.15	**447**
240.67	1.4	6.99	+/- 0.15	**448**
253.57	1.4	6.99	+/- 0.15	**449**
266.07	1.52	6.99	+/- 0.15	**450**
278.77	1.52	6.99	+/- 0.15	**451**
291.47	1.52	6.99	+/- 0.15	**452**
304.17	1.52	6.99	+/- 0.15	**453**
316.87	1.52	6.99	+/- 0.15	**454**
329.57	1.52	6.99	+/- 0.15	**455**
342.27	1.78	6.99	+/- 0.15	**456**
354.97	1.78	6.99	+/- 0.15	**457**
367.67	1.78	6.99	+/- 0.15	**458**
380.37	1.78	6.99	+/- 0.15	**459**
393.07	1.78	6.99	+/- 0.15	**460**
405.26	1.91	6.99	+/- 0.15	**461**

Ceetak

O-Ring Catalogue

BS ISO 3601-1 standard reference table

Inside ø (mm)	Inside ø Tolerance (mm) ±	Cross Section (mm)	Cross Section Tolerance (mm)	ISO 3601 Size Ref
417.96	1.91	6.99	+/- 0.15	**462**
430.66	2.03	6.99	+/- 0.15	**463**
443.36	2.16	6.99	+/- 0.15	**464**
456.06	2.16	6.99	+/- 0.15	**465**
468.76	2.16	6.99	+/- 0.15	**466**
481.46	2.29	6.99	+/- 0.15	**467**
494.16	2.29	6.99	+/- 0.15	**468**
506.86	2.41	6.99	+/- 0.15	**469**
532.26	2.41	6.99	+/- 0.15	**470**
557.66	2.54	6.99	+/- 0.15	**471**
582.68	2.67	6.99	+/- 0.15	**472**
608.08	2.79	6.99	+/- 0.15	**473**
633.48	2.92	6.99	+/- 0.15	**474**
658.88	3.05	6.99	+/- 0.15	**475**

Common Failure Modes

Elastomeric o-ring seals are known to fail from time to time for a number of reasons, which may include poor installation consideration, chemical incompatibility, harsh operating conditions or a combination of the above. Using best practise when designing and specifying elastomeric seal installations can help to reduce the likelihood of failure.

The following highlights a number of the more common failure modes witnessed to help users understand the reasons for failure. Ceetak engineers are available to discuss individual product failures and possible remedies to prolong and preserve the life and performance of your application.

Compression Set

Compression set is likely the most common failure mode found in o section seals. Compression set, or stress relaxation results in a loss of sealing pressure, or squeeze, on the hardware, allowing the sealed media to bypass the seal.

Compression set is characterised by significant permanent deformation of the sealing faces, with the seal taking flat sections at the contact faces.

Compression set can be worsened through the environment, the gland design, the compound and the fluid media. Compression set resistance can be optimised through appropriate design and compound selection matched to the operating environment.

Extrusion

Extrusion is the result of the seal becoming forced, usually by high pressure, into a clearance gap at the seal interface. This is often caused where the o-ring hardness is insufficient to withstand the combination of system pressure, temperature and size of clearance gap. The temperature and hardness may be affected by dynamic friction, chemical attach and thermal swell.

Extrusion is identified by the existence of frayed material adhering to, or removed from the edges of the seal.

Nibbling

Nibbling is usually found in dynamic applications, and can follow extrusion damage. Nibbling can occur as a result of extruded material being removed from the seal due to alternating direction of pressure or reciprocation of the seal interface.

Nibbling can also occur due to poorly finished edges of groove hardware which can cause mechanical damage without presence of extrusion.

Signs of nibbling damage are typically a rough edge on the seal profile, appearing with chunks of material removed. These failures can lead to sudden seal rupture failure.

Spiralling

Spiral failure is often caused through dynamic reciprocation of the seal, where forces, compression, fluid flow and friction are not always uniform, part of the seal can “hang up” on the reciprocating surface, and begin to rotate part of the seal within the groove. The resultant stresses can cause a spiralled rupture around the o-ring.

Explosive Decompression

Explosive Decompression is created from small amounts of gas entering the polymer structure under high pressure, which expand quickly when pressure is removed. If the pressure is reduced rapidly, the gas expansion occurs within the polymer bursting the structure and creating a number of ruptures within the material. Often, ruptures are retained within the material section, exhibiting as small blisters, in extreme cases the seal section can be torn visibly at the surface.

Chemical Attack

Chemical attack due to incompatible material selection is often difficult to identify and confirm visually. Chemical attack can cause erosion, swelling and in some cases blistering of the seal materials. Ceetak recommend, where suspected chemical attack has occurred, that the seal materials are checked for compatibility from existing test data, with further material testing, available through your Ceetak representative available should further laboratory testing be required to identify the root cause of the concern.

Abrasion

Abrasion is caused in rotary and reciprocating hardware, where the seal material is abraded by the hardware. This is often due to the surface finish of the interface being too rough, the lubricity being too poor, or the temperature being too high. Materials with low friction or wear resistant additives are available to reduce the effects.

This failure mode is identified through the presence usually of one flat seal interface, and a loss of seal mass.

Elastomer Products: Shelf Life and Storage Limits

The properties of most rubber and elastomeric materials may change as a result of ageing. Prolonged storage prior to use is common, and Ceetak offer the following guidance to help minimise and control aging effects.

The effect of aging varies with time, environmental conditions and mechanical stress.
It is important therefore that the goods are stored within a controlled environment and in a relaxed state.
Improper storage may cause premature aging, manifesting in the parts as cracking, hardening or softening and excessive bloom.

The environmental conditions in which the goods are to be stored ideally includes ambient temperature and humidity controls, and the amount of light and oxygen or ozone to which the materials are exposed to during their time in storage should be limited.
The items should not be stored near sources of heat, or electronic equipment capable of generating ozone.

Ceetak ensure that elastomer products are securely packed in sealed opaque bags to assist the user in achieving the desired storage condition. It is recommended that the items are stored securely with the outer box, or laid flat where possible to avoid excessive deformation.

The shelf life of each polymer family as practiced by Ceetak Ltd is as per the British Standard BS ISO 2230 :2002: Guidelines for storage.

At the end of each extension period, the goods must be again inspected prior to use. Further extension periods can be used if the parts remain in good mechanical and visual condition at the end of the preceding extension period.

Storage of the goods may be extended if, upon inspection, the goods show none of the following conditional flaws:

- Changes in surface condition, softening, hardening or change in texture.
- Surface Crazing when viewed beneath a microscope of at least 10x magnification
- Permanent distortion, bends, kinks or set.
- Tears, abrasions or nicks.

Ceetak provide all elastomer products against a known cure date. The cure date listed on the Ceetak labelling refers to the quarter and year of the cure as the time of manufacture.

A copy of the British Standard BS ISO 2230 :2002: Guidelines for Storage:
listing full storage conditions can be purchased online.

Group A Elastomers	Natural Rubber, Polyurethane,
Group B Elastomers	Nitrile, Neoprene, HNBR, Polyacrylate (ACM)
Group C Elastomers	Fluorocarbon (FKM), Ethylene Propylene Rubber (EPDM), Silicone, Fluorosilicone

The initial and extension storage periods for unassembled components of the material groups are as per listed below:

Classification of group	Initial storage period	Extension storage period (after testing and inspection)
Group A Elastomers	5 Years	2 Years
Group B Elastomers	7 Years	3 Years
Group C Elastomers	10 Years	5 Years

O-Ring Assembly/Extraction kit

A tool every engineer should have to assist in the assembly and removal of o-rings.

These handy assembly kits consist of two pieces, and are designed to make assembly and removal of o-rings easier and less time consuming, whilst minimising potential damage to the seals.

Each kit is contained in a protective plastic holder and is easily stored in any engineer's tool kit.

Engineering request form

Contact

Company Name: ..... Date.....

Contact Name: .....

Tel: .....

Email: .....

Location: .....

Application sketch / notes

Specifications

Application: .....

Static ☐ Dynamic ☐

Reciprocating ☐ Rotary ☐ Oscillating ☐ Other: .....

Piston ☐ Rod ☐ Face ☐

Hydraulic ☐ Pneumatic ☐

Fluid Medium: .....

Surface speed: ..... Cycle rate: .....

Pressure

Minimum..... Maximum..... Normal operating .....

Single acting ☐ Double acting ☐

Temperature

Minimum..... Maximum..... Normal operating .....

Hardware

Mating hardware material: ..... Housing Type: Split ☐ Solid ☐ Open ☐ Stepped ☐

Nominal groove size .....

Mating hardware surface finish ..... Coating/ Treatment .....

Shaft surface hardness (Rockwell) .....

Part selection

Seal Type: ..... Existing part no: .....

Materials: .....

Additional Comments

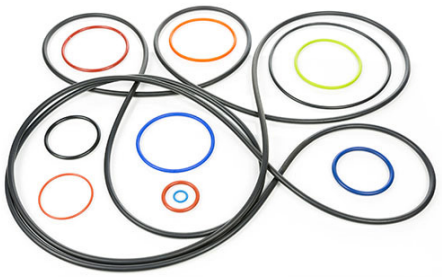
.....

.....

Our Seals

Metal Seals

Mouldings & Gaskets



O-Rings

Rotary Seals

PTFE Seals

2-Shot Mouldings

Diaphragms

Engineered Materials

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