

Chem-Ring Encapsulated Seals

VULCAN

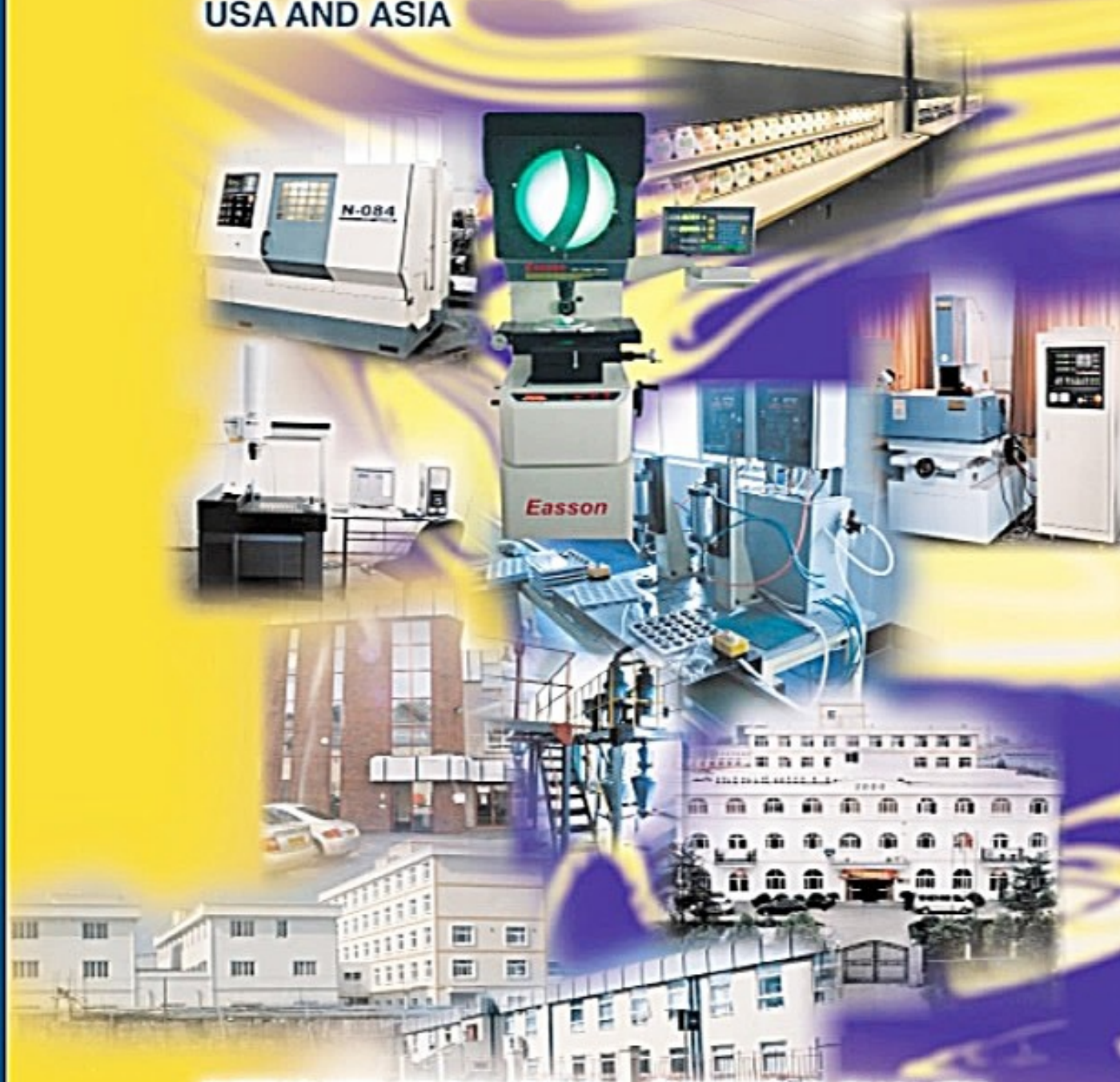




FOUR FACTORIES ON TWO CONTINENTS

**MODERN FACILITIES, AUTOMATED PRODUCTION
ELECTRONIC DISTRIBUTION**

**DISTRIBUTION CENTRES IN EUROPE,
USA AND ASIA**



**INTRICATE PRODUCTION, INTENSIVE QUALITY,
ELECTRONIC INSPECTION**

**THE MOST COMPETITIVE PRICES, QUALITY
MANUFACTURE AND LARGEST STOCKS**

**VULCAN CHEM-RINGS: QUALITY AND
RELIABILITY ASSURED**



"THE BEST ENCAPSULATED 'O' RING MANUFACTURER AND SUPPLIER".

INTRODUCTION

Vulcan, with some 200 staff, in our four mechanical seal and Encapsulated Seal factories and our worldwide distribution centre, are one of the world's leading Encapsulated 'O' Ring and Mechanical Seal manufacturers and suppliers.

Founded in 1987, Vulcan continues to rapidly grow through our exceptional investments in new product development, vertically integrated, advanced, modern factories with increasingly automated manufacturing machinery, and electronically controlled, extensive stock holding and distribution.

Vulcan have established new industry standards, with our product range, performance/quality, ex-stock service and price.

We are immensely motivated and dedicated to being the World's Best Encapsulated Seal Company. The key features of this policy goal and our company are:

- Advanced production facilities, automated wherever possible.
- Development of in-house component and material manufacture.
- The very best quality and inspection systems, CMM checked and electronically controlled.
- The widest range and stock of Encapsulated Seals, available from any company, accessible to our customers, via the internet.
- Well motivated and rewarded staff working in excellent facilities.
- Fully computer controlled, integrated and automated seal ordering, stocking and supply systems.
- To be **The Electronic Seal Warehouse to The Industry.**

VERTICALLY INTEGRATED MANUFACTURE

Vulcan's four modern production factories exceed 11,000 square metres of total floor space for production of our range of seals, with two production units dedicated to CHEM-RINGS. The factories were architecturally designed and built to create world-class facilities. We continue to heavily invest in our production processes, machinery, systems and people. This focus has naturally led to extraordinary annual rates of growth in our factories capacity and employment. Growth needed to meet the growth in our customers demands.

This vertical integration allows us to absolutely Quality and Cost Control all parts of the Vulcan seal. With our Can Do Philosophy, this also allows us to produce many special designs of seals for customers, with quantities, costs and lead times lower than our competitors, because we primarily do it all in-house.

DESIGN, RANGE AND STOCK-HOLDING

All Vulcan seals are manufactured in-house to our own exacting production requirements. We have eliminated the faults common in some Encapsulated 'O' Ring manufacture, through close attention to production detail and material inspection.

Vulcan have the widest range of FEP/PFA Encapsulated Seals, available from stock, of any manufacturer in the world. We back this very extensive range with a guaranteed ex-stock holding, that is accessible to our customers to view on the internet. All seal types, in all sizes and materials, shown in this CHEM-RING Brochure, are available ex-stock, if previously sold three times. In total Vulcan stock over 100,000 FEP Encapsulated 'O' Rings alone. We can also manufacture practically any special and will even stock them for you, to agreement, for repeat requirements.

MATERIAL SPECIFICATION

Material quality is vital to the capability, performance and life of a seal. So Vulcan only use Du Pont genuine Viton®, and Grade 160 FEP Resin to ensure we start with the best quality materials.

Encapsulated 'O' Rings and KamLock® Gaskets are manufactured from extruded FEP/PFA tubes and Viton®/Silicone cords. Our material tolerance requirements, necessary to produce a close-tolerance finished ring, are extremely exacting and difficult to manufacture on a consistent basis. We set exacting standards and control them through tight specification and electronic material inspection.

QUALITY ASSURANCE

All Vulcan seals are solely produced in our own modern factories. Our manufacturing facilities have been audited and certified to ISO9001 and our distribution operations are examined and certified to ISO9002. ISO9001:2000 from 01/01/04! Vulcan have extremely extensive and intensive Quality, Inspection and Work Documentation Systems. In-depth, electronically integrated process documents and assessment systems govern all aspects of manufacture, assembly, inspection and supply.

We do not buy any standard Encapsulated Seals from anyone else. Every Vulcan component and seal is produced and processed via our Global Inspection System. This system incorporates all of the above controls culminating in 100% inspection of each and every CHEM-RING batch on both Esscon® computer controlled Shadow-Graph and Mitutoyo® CMC Co-ordinate Measuring Machines, prior to despatch from our factories.

Thus a Vulcan Seal Means Quality and Reliability Assured.

ELECTRONIC INVESTMENT

Vulcan are firmly focused on the future. Our philosophy is to heavily invest in IT, automation, technology and our people, in order to be the world leaders in Mechanical and Encapsulated Seals Manufacture and Supply.

As an example, our Investment Plan, for one year (2002) alone, included in the Capital Equipment Section; four internal automatic grinders, two external automatic grinders, one extra CNC machining centre, CNC controlled rubber moulding machine, automatic flash removal machine, two CNC Co-ordinate measuring inspection machines, extra SPC furnace, automated seal assembly track, five computer integrated and controlled carousel stock systems and company-wide IT core software upgrade, to Sage CS3.

SUPPLY PHILOSOPHY

Our ethos is to do extraordinarily well, whatever the customer reasonably requires. We have a can do mentality, backed by truly exceptional customer service. Vulcan's commercial policy is to focus on our products, manufacture, stock holding and supply to the seal trade.

It is not our intention to be diverted into becoming a sales organisation. Our strengths lie in our unrivalled product range, quality, service and prices. Vulcan will maintain its strong distributor and trade sale focus. Our vision is to be The Electronic Seal Warehouse to the trade and to continue to provide increasing levels of service, product and information to our customers in, already, over seventy countries.

CONCLUSION

People (customers and staff) are our premier concern. In order to see our commitment, facilities and processes in full, please visit us and experience the Vulcan difference.

VULCAN CHEM-RINGS



ADVANCED PRODUCTION INTENSE INSPECTION

UNBEATABLE PRODUCTION

All standard Vulcan "CHEM-RINGS" are produced in our own two modern, advanced factories. These two facilities are situated on separate continents, in order that we can produce volume, quality FEP/PSA Encapsulated 'O' Rings at the most competitive prices, whilst offering fast, special-sizes manufacture, to service our key markets and customers. We strongly complement these unrivalled production facilities with an industry leading, ex-stock service. Fully integrated, electronic, bar-coded, computerised stock control and supply management systems, are utilised to guarantee an ex-stock service. This is backed by a stock of over 100,000 Encapsulated 'O' Rings, viewable on our web-site, on all repeat sale sizes and types.

COMPREHENSIVE ENGINEERING STANDARDS

Vulcan's Engineering Department produces and documents, in our Engineering Standards Electronic System and Library, extensive and comprehensive detail on all the key technical features of our "CHEM-RING", Manufacture, Assembly, Moulding and Inspection. Please contact us for details on any aspect.

ELECTRONIC INSPECTION

The superb Quality of a Vulcan "CHEM-RING" starts with fully electronically documented, control and traceability, throughout the complete manufacturing process. Excellent staff training, management and motivation, tied to a stringent focus on Quality and Reliability Assured at every stage of the process, are the key foundations of our production of this intricate product. Computerised, automatic, electronic inspection machines (Easson® and Mitutoyo®) are utilised to inspect and control every batch of receipt of raw material and final inspection of a Vulcan "CHEM-RING".



IN-HOUSE QUALITY ASSURED

All Vulcan "CHEM-RINGS" are manufactured in Vulcan's high-spec factories, to our exacting Quality Requirements and Standards. NB Vulcan Mechanical Seals Manufacturing Company Limited is certified to ISO9001 and our world-wide distribution centre to ISO9002. (ISO9001:2000 from 01/01/04).

Modern, increasingly automated, machinery is utilised to produce and inspect our Encapsulated 'O' Rings, via carefully controlled, advanced management and production procedures. Each stage and final inspection, is governed by electronically documented and managed, extensive and intensive, Inspection Systems and Forms.

Copies of our SKIS inspection forms and procedures are available upon request.

Vulcan can provide Certification with supply to cover inspection, size/tolerance, EDA compliance, materials etc.



EXCEPTIONAL MATERIALS

We are one of the worlds highest volume manufacturers of Encapsulated 'O' Rings and Mechanical Seal products. Vulcan's policy is to produce superior quality of and stock the widest range of, all common Encapsulated 'O' Rings, manufactured extremely well and specified to contain high quality materials, especially on the critical tolerances.

We carefully specify these materials ourselves and details of the grades utilised/made are documented on the following pages. For a full listing of the grade of every material in each encapsulated seal, please contact our Technical Department.

VULCAN CHEM-RINGS



VULCAN

Vulcan Quality

In-house production, of all Vulcan Encapsulated Seals, gives us absolute Cost and Quality Control. This dedication to Quality, with in-house electronic inspection of materials and product, puts Vulcan ahead of our competitors.

Vulcan Production

Modern, often automated machinery, continually assessed and updated, ensure cost efficient, volume production and inspection.

Vulcan Materials

Exceptional materials, specified and utilised as standard, are a vital, integral part of our policy of solely producing high quality product.

Vulcan Inspection

Extensive and intensive electronic inspection systems, document and control all stages of material verification, production and final inspection.

Vulcan Means Quality and Reliability Assured.

Manufactured to ISO9001,
Electronically distributed to ISO9002,
with a quality comes first standard.

UNBEATABLE STOCKS

Vulcan have the worlds largest stock which is constantly available to view live on our web-site. We routinely despatch same-day, with over 100,000 Encapsulated 'O' Rings in stock, from our extensive stock policy range.

UNBEATABLE SERVICE

Standard delivery is ex-stock as any size/material, sold three times plus per annum, becomes stock policy. Normal "special size" production lead times are three weeks. Certain, few, exceptional sizes/profiles sections take four/five weeks. Urgent production can be supplied in seven to ten working days.

Vulcan Logistics

Product is stocked and despatched from our stock carousel machines in bar-coded screen-printed boxes, not just plastic bags. Vulcan can label and bar-code batches to your specification and also print your details on the core of the seal.

Vulcan Electronic Supply

Product is distributed to over seventy countries world-wide from our Sheffield Head Quarters, with electronic, computer assisted, automation on all stages from inspection to final supply

Vulcan: The Full Monty

Our philosophy is to be the Worlds Leading Encapsulated Seal Manufacturer, by continuing to offer an unbeatable combination of Product, Quality, Price and Service.

UNBEATABLE QUALITY

The most important factor affecting an Encapsulated 'O' Ring or Gasket's sealing capability, performance and life, in comparison to other supplier's Encapsulated Seals, is the quality and tolerance of manufacture and the final product. Uniquely in the Industry, Vulcan offer Three Grades;

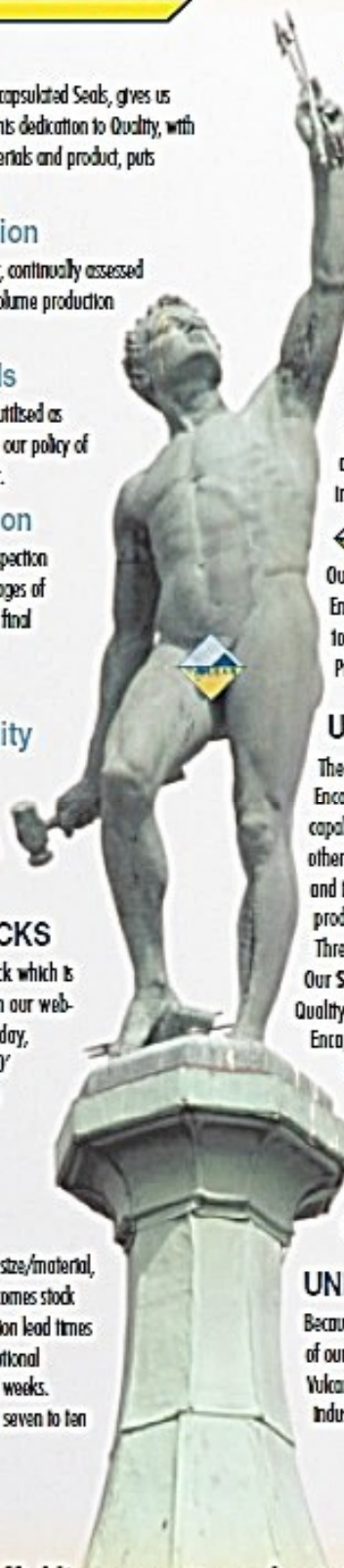
Our **Standard Ring** is already Upper Quartile Quality in comparison to like, other supplier, Encapsulated Seals.

Vulcan's **Q Grade** set a new standard, as we were the first supplier to offer Encapsulated 'O' Rings Inspected to BS 1806/AS 568 or DIN 3771 tolerances.

Blood Line Free Encapsulated 'O' Rings provide a quality alternative to our Q Grade.

UNBEATABLE PRICES

Because we efficiently manufacture and distribute all of our Encapsulated Seals, on three continents, Vulcan offer the greatest true cost savings in the industry.



Vulcan, the symbol of Sheffield's prowess in mechanical engineering, is a four metre, bronze statue that stands sixty metres high atop Sheffield's City Hall.

VULCAN CHEM-RINGS



PRODUCT INFORMATION

Vulcan Chem-Ring Seals combine the resilience and sealing force of an elastomer with the chemical resistance of Teflon®. They consist of an elastomeric core of Silicone or Viton® with a relatively thin, moulded encapsulation of PTFE, FEP or PFA polymer. This produces an elastomeric PTFE seal with maximum sealing capability. Elastomeric, rubber 'O' Rings suffer from high friction and limited resistance to aggressive chemicals and gas permeation. Solid Teflon® 'O' Rings are rigid with no effective memory and high compression set.

FEP Encapsulated 'O' Rings are solvent resistant and chemically inert (except for attack by alkaline metals, fluorine and some halogenated compounds at high temperatures) yet have a elastomeric memory near that of rubber 'O' Rings. FEP polymer, also, has an extremely low coefficient of friction (1 to .2) and very low permeability to gases, making Chem-Rings a virtually universal seal for use in hostile environments.

FUNCTION

The seamless, uniform PTFE/PFA polymer encapsulation provides the CHEM-RINGS near universal sealing capability, whilst the continuous reset, and the constant pressure of the encapsulation onto the sealing point, is performed by the elastomeric core.

The result is an overall sealing compression that increases with media pressure. The CHEM-RING behaves like a highly viscous fluid, any pressure exerted on the seal is transmitted practically undiminished in all directions.

MANUFACTURING STANDARDS

The CHEM-RING is an 'O' Ring, consisting of a seamless and uniform PTFE/PFA encapsulation, which completely encloses the core material of Silicone or Viton®. In brief, the seal is manufactured by pressure injecting the rubber core material into this wall PTFE/PFA tubing. This eliminates any potential gap between the core and the tube wall.

The PTFE/PFA tubing is joined by a special heat moulding process to give a true, seamless encapsulation. On our Vulcan CHEM-RING, the mould area exhibits no discernible different characteristics to the rest of the circumference of the seal. There are no joints nor ridges to affect the seal's performance nor life.

The nature of the moulding process is critical to the quality of the Ring. Standards for the manufacture of moulded rubber 'O' Rings call for close tolerances on the I.D.'s and, particularly, the cross sections of the rings. Outside these tolerances, any step in the cross section can severely affect the 'O' Rings ability to seal.

FEP Encapsulated 'O' Rings are hand moulded in a very precise and skilled operation. Traditional production processes have been previously unable to guarantee absolutely the tolerances in the join area.



Reject Weld Area; High-lighted on Vulcan's Esscon® Profile projector.

VULCAN CHEM-RINGS

Vulcan offer three different standards of FEP/PFA Encapsulated 'O' Rings;



Standard Quality

This product is routinely supplied unless Q Standard or Bleed Line Free is specified. Vulcan's advanced processes result in our Standard Quality being in the Upper Quartile of that available world-wide.



Q Standard

Manufactured as above but specified, controlled and inspected to BS 1806/AS 568 tolerances and supplied with a Q suffix on the stock-code.



Bleed Line Free Standard

Produced by a special moulding process, with a moulding cycle time of three times the above, to produce an exact tolerance weld. Certified to within BS 1806/AS 568 tolerances and identified by the letter W in the stock-code.

Recognising the importance of Quality Assured product, certified to conform to recognised rubber moulded 'O' Ring standards, we have thus developed our Q and Bleed Line Free Standard processes. All aspects of manufacture of a Q/B.L.F Standard ring go through an extra rigid Quality Control procedure, from specification and size tolerancing of the rubber cord and FEP tubing, via utilisation of an advanced new precision moulding technique in production, to final inspection.

A ring specified and produced via our Q/Bleed line Free Standard, is certified and guaranteed to be within the tolerances of the relevant size British, or International Standard, moulded rubber 'O' Ring. These seals are offered as exceptional quality for difficult applications.

MATERIALS

Vulcan CHEM-RINGS are available with FEP or PFA PTFE Polymer encapsulation. The capabilities of these two polymers are essentially similar, except that PFA exhibits better heat resistance once above 200°C. FEP Encapsulation is the preferred standard for all applications below 205°C. continuous temperature.

**Core materials are either Viton® or Silicone.
Vulcan specify and utilise solely;**

VITON® Grade E-60C

SILICONE Grade ZZR 765B

Solid core seals are preferred and are standard for static and dynamic applications. Hollow Silicone cores are available in most cross-sections for preferred higher compression seals.

The quality of the material is of paramount importance for close-tolerance manufacture and seal performance. Vulcan, therefore, solely utilise the best quality materials and specify "Genuine Viton®" rather than lower cost/quality Viton® or alternative compounds, for our FEP/PFA Encapsulated Viton® Seals.

SIZE AND TECHNICAL DETAILS

MINIMUM I.D. SIZES

Virtually any size of I.D. or cross section of CHEM-RING can be made using existing stocks of material. The only possible normal limitation is the minimum size of I.D. that can be physically encapsulated without kinking. This varies with the cross section of the ring and developments in manufacturing methods.

The table below shows our Minimum Possible I.D.'s at the time of printing this brochure. Those dimensions shown in the Special Production columns have increased lead-times and prices, compared to the standard production sizes, due to the increased complexity of manufacture.

Cross Section	Standard Production		Special Production	
	FEP Silicon	FEP Viton®	FEP Silicon	FEP Viton®
1.50	-	-	12.00	12.00
1.60	-	-	7.20	7.20
1.78	11.00	11.00	7.20	7.20
2.00	11.00	11.00	7.20	7.20
2.40	12.00	12.00	9.30	9.30
2.50	12.00	12.00	9.30	9.30
2.62	13.50	13.50	9.30	9.30
3.00	13.50	13.50	10.00	12.00
3.15	13.50	13.50	10.00	12.00
3.53	16.50	16.50	12.00	12.00
3.80	-	-	18.00	18.00
4.00	23.00	23.00	18.00	18.00
4.30	-	-	18.00	22.00
4.50	23.00	23.00	18.00	22.00
4.75	-	-	19.00	22.00
5.00	25.00	25.00	19.00	22.00
5.33	25.00	25.00	20.00	20.00
5.50	27.00	27.00	25.00	27.00
5.70	27.00	27.00	25.00	27.00
6.00	28.00	28.00	25.00	27.00
6.30	28.00	28.00	27.00	28.00
6.44	-	-	28.00	35.00
6.99	32.00	39.00	32.00	39.00
7.50	-	-	50.80	60.00
8.00	65.00	65.00	50.80	60.00
8.40	98.00	98.00	50.80	70.00
9.00	70.00	70.00	50.80	70.00
9.50	75.00	75.00	50.80	73.00
10.00	85.00	85.00	57.00	74.00
11.00	98.00	98.00	70.00	98.00
12.00	100.00	100.00	70.00	100.00
12.70	150.00	150.00	70.00	102.00
14.00	-	-	130.00	130.00
15.00	-	-	177.80	177.80
16.00	203.20	-	177.80	177.80
18.00	-	-	177.80	177.80
19.00	-	-	203.20	203.20
20.00	-	-	203.20	203.20
25.40	-	-	228.00	-
31.75	-	-	232.00	-

THICKNESS OF ENCAPSULATION

Cross Section	FEP/PFA Encapsulation Thickness	Cross Section	FEP/PFA Encapsulation Thickness
0.070"/1.78mm	0.008"/0.203mm	0.225"/5.70mm	0.020"/0.508mm
0.078"/2.00mm	0.008"/0.203mm	0.275"/6.99mm	0.020"/0.508mm
0.095"/2.40mm	0.010"/0.254mm	0.312"/8.00mm	0.020"/0.508mm
0.103"/2.62mm	0.010"/0.254mm	0.330"/8.40mm	0.020"/0.508mm
0.118"/3.00mm	0.010"/0.254mm	0.375"/9.50mm	0.020"/0.508mm
0.139"/3.53mm	0.012"/0.305mm	0.393"/10.00mm	0.020"/0.508mm
0.157"/4.00mm	0.012"/0.305mm	0.472"/12.00mm	0.030"/0.762mm
0.196"/5.00mm	0.015"/0.381mm	0.708"/18.00mm	0.030"/0.762mm
0.210"/5.33mm	0.020"/0.508mm	0.787"/20.00mm	0.030"/0.762mm

The above chart shows the variance in thickness of FEP or PFA Encapsulation with different BS 1806/AS 568, BS 4518 and British Metric Standard 'O' Ring cross sections. For square sections, please contact our Technical Department.

SECTION

Sections available are standard round cross section ('O' Ring), square section and rectangular section. Round 'O' Ring sections are specified as standard and are utilised for practically all sealing applications. Square section seals are available for certain applications where a larger sealing surface is necessary to effect a more positive seal. These square section CHEM-RINGS utilise the same size 'O' Ring groove as 'O' Rings but require less squeeze to seal.

Round section seals, once energised, present a flat face to the groove and housing surfaces to seal. The necessary use of square section seals to achieve additional performance benefits is limited to very few, particular situations. Please consult Vulcan, or our distributors, for advice before specifying a square section.

Rectangular section seals are manufactured primarily for use in quick release hose couplings. Designed to suit all standard nominal bore sizes, they are available ex-stock as our KAMLOCK® seals. A limited range of Fep/Silicone rectangular cross sections are also available for manufacture into any size I.D. seals.

TEMPERATURE RANGE

FEP ENCAP

-60°C. to +205°C. (-75°F to +400°F)
Short durations to +260°C. (+500°F)

PFA ENCAP

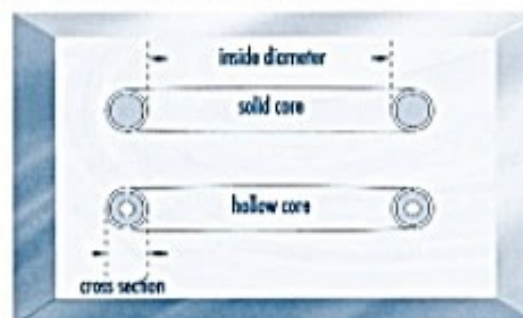
-60°C. to +260°C. (-75°F to +500°F)
Short durations to +300°C. (+575°F)

HARDNESS

Shore Hardness of the seals as an average overall is:

85-90 Shore A for solid core Silicone
90-95 Shore A for solid core Viton®
75-80 Shore A for hollow core Silicone

This applies for round, square and rectangular sections.



WARRANTY

Vulcan CHEM-RINGS are produced under stringent Quality Controlled conditions. Vulcan CHEM-RINGS are warranted to be free of all defects in material and workmanship. Vulcan's liability there under is limited to the purchase price on any seals proved defective, or at our option, their replacement.

All information in this brochure is given in good faith, but without warranty, and is based on our functional evaluations, experience and published technical data. The purchaser should, however, thoroughly test any application and independently conclude satisfactory performance of the product for his intended use.

VULCAN CHEM-RINGS

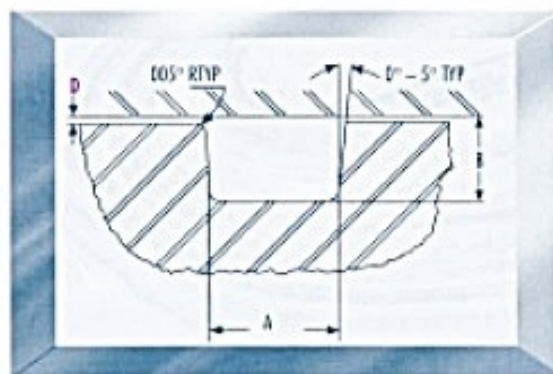


APPLICATION DETAILS

'O' RING GROOVE SIZE

Vulcan CHEM-RINGS are designed to be used in all standard 'O' Ring grooves with the same housing dimensions and clearances as for standard elastomeric seals. Our recommendations for BS 1806/AS 568 Imperial Standard 'O' Ring grooves are tabulated below for the standard groove design show below.

Cross Section	A (Inches)	B (Inches)		
		Static	Dynamic	Pneumatic
0.070"	0.093"/0.098"	0.056"/0.060"	0.061"/0.063"	0.064"/0.065"
0.103"	0.140"/0.145"	0.082"/0.087"	0.090"/0.093"	0.094"/0.096"
0.139"	0.187"/0.192"	0.111"/0.118"	0.122"/0.125"	0.127"/0.129"
0.210"	0.281"/0.286"	0.168"/0.178"	0.184"/0.189"	0.193"/0.195"
0.275"	0.375"/0.380"	0.220"/0.232"	0.242"/0.247"	0.253"/0.255"



SEAL EXTRUSION RADIAL CLEARANCE GAPS (D on above diagram)

If the radial clearance gap (D) between the sealing surface and the groove corners are too large and the pressure exceeds the deformation limit of the 'O' Ring, extrusion of the ring material can occur.

When this happens, the extruded material wears or frays with cycling and can cause seal failure.

There are two possible options to minimise the potential for 'O' Ring Extrusion;

Preferably, close the clearance gap (D) by modifying the shaft or housing dimensions, or use backup washers or other anti-extrusion devices.

Alternatively, use the harder, higher modulus Viton® core, at the possible expense of higher friction and greater tendency to leak at lower pressure ranges.

Recommended Maximum Design Radial Clearance Gap To Prevent Extrusions			
Maximum Pressure PSI	Encapsulated 'O' Ring Type		
	Hollow Core	FEP/PFA Silicone	FEP/PFA Viton®
100	0.011"	0.015"	0.018"
250	0.010"	0.014"	0.016"
500	0.009"	0.012"	0.014"
750	0.008"	0.010"	0.012"
1000	0.006"	0.009"	0.011"
1500	0.004"	0.006"	0.009"
2000	0.003"	0.005"	0.006"
3000	0.001"	0.003"	0.004"

INSTRUCTIONS FOR INSTALLING CHEM-RINGS

1. All surfaces that the 'O' Ring will contact in operation should be smooth and free from sharp edges, burrs and deep scratches. A 30 micro-inch finish is best recommended on the bore, 15 micro-inch finish on the shaft.
2. Lubricate the 'O' Ring and all contact surfaces with a clean light oil or grease.
3. If it is difficult to install the 'O' Ring over a shaft, it may be 'stretched' by first immersing the 'O' Ring in boiling water for a few minutes. This softens and enlarges the 'O' Ring and allows it to be fitted more easily. Install the 'O' Ring when it is still hot and it will return to its original size when cooled. Elongation at Break is 108 to 150% but it is strongly preferable not to stretch the 'O' Ring more than 20% for Silicone core and 7% for Viton® core 'O' Rings.
4. Do not bend the 'O' Ring too sharply as the PTFE/PFA will tend to kink under the strain. If it does become kinked however, it will not effect the operation in most applications.

The degree of squeeze best recommended is;

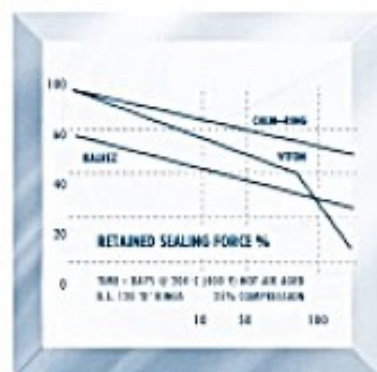
- 15/22% for static applications
- 10/15% for dynamic applications
- 8/10% for pneumatic applications

The amount of squeeze required varies with many factors, most critically, the pressure to be sealed.

COMPRESSION SET

Vulcan CHEM-RINGS resist hardening and embrittlement due to the PTFE/PFA FEP encapsulation. The 'O' Seals retained elasticity and recovery properties at temperatures up to 205°C, is due to the Silicone or Viton® core material. The results of compression set tests, which compare the retained sealing force of perfluoroelastomers, fluoroelastomers and FEP Encapsulated 'O' Rings can be observed in the following diagram.

The results of these tests demonstrate that, by combining the mechanical properties of Viton® or Silicone elastomers and the chemical resistance of PTFE FEP/PFA resins, the CHEM-RING possesses the ability to resist compression set and retain its mechanical properties.



VULCAN CHEM-RINGS



CHEMICAL RESISTANCE, RESTRICTED PERMEABILITY AND ABSORPTION

The PTFE/PFA encapsulation is the essential component of the CHEM-RING and it is resistant to practically all chemicals. Within normal use temperatures, PTFE/PFA resins are attacked by so few chemicals that it is more practical to describe the exceptions rather than to tabulate the chemicals with which they are compatible. Molten alkali metals, fluorine and several complex halogen compounds (chlorine trifluoride) are incompatible with PTFE/PFA resins.

In some instances, at or near the suggested service limit temperatures of PTFE - FEP (204°C/400°F) and PTFE - PFA (260°C/500°F), a few chemicals at high concentrations have been reported to be reactive. Attack has been produced at such high temperatures by 80% NaOH or KOH, metal hydrides such as boranes (e.g. - B₂H₆), aluminium chloride, ammonia (NH₃), and certain amines (R - NH₂) and imines (R = NH). Also, slow oxidative attack has been observed, by 70% nitric acid under pressure at 250°C/480°F.

Special testing is required when such extremes of reducing or oxidizing conditions are approached. Except for the chemicals under the conditions mentioned, it can be said that the VULCAN CHEM-RING, is chemically inert.

TYPICAL CHEMICALS WITH WHICH PTFE/PFA RESINS ARE COMPATIBLE

Abietic acid	Bromine	Diethyl carbonate
Acetic acid	n-Butyl amine	Dimethyl ether
Acetic anhydride	Butyl acetate	Dimethyl formamide
Acetone	Butyl methacrylate	Di-isobutyl adipate
Acetophenone	Calcium chloride	Dimethylformamide
Acrylic anhydride	Carbon disulfide	Dimethyl hydrazine
Alkyl methacrylate	Cetane	Unsymmetrical
Ammonia, liquid	Chlorine	Dioxane
Ammonium chloride	Chloroacetic Acid	Ethyl acetate
Aniline	Chloroform	Ethyl alcohol
Aqua Regia	Chlorosulfonic acid	Ethyl ether
Benzoyl chloride	Chromic acid	Ethyl hexoate
Benzyl alcohol	Cyclohexane	Ethylene bromide
Benzoyl Peroxide	Cyclohexanone	Ethylene glycol
Borax	Dibutyl phthalate	Ferric chloride
Boric acid	Dibutyl sebacate	Freons
Ferric phosphate	2-Nitro-butanol	Potassium permanganate
Fluoronitrobenzene	Nitramethane	Pyridine
Formaldehyde	Nitrogen tetroxide	Soap and detergents
Formic acid	2-nitro-2-methyl propanol	Sodium Fluoride
Furane	n-Octadecyl alcohol	Sodium hydroxide < 80%

Gasoline	Diesel	Sodium hypochlorite
Hexachloroethane	Nitric acid	Sodium peroxide
Hexane	Nitrobenzene	Solvents, aliphatic and aromatic ²
Hydrazine	Oils, animal and vegetable	Stannous chloride
Hydrochloric acid	Oleum	Sulfur
Hydrocyanic acid	Ozone	Sulfuric acid
Hydrofluoric acid concentrate	Perchloroethylene	Tetrabromoethane
Hydrogen peroxide	Pentachlorobenzamide	Tetrachloroethylene
Isopropyl alcohol	Perfluorooxylene	Trichloroacetic acid
Isocyanates	Phenol	Trichloroethylene
Lead compounds	Phosphoric acid	Triacetyl phosphate
Magnesium chloride	Phosphorus	Triethanolamine
Mercury	pentachloride	Turpentine
Methyl ethyl ketone	Phthalic acid	Unleaded fuel
Methacrylic acid	Pinene	Vinyl methacrylate
Methanol	Piperidine	Water
Methyl methacrylate	Polyacrylonitrile	Xylene
Naphthalene	Potassium acetate	
Naphthals	Potassium hydroxide < 50%	Zinc chloride

Based on experiments conducted up to the boiling points of the liquids listed.

GAS PERMEABILITY

All thermoplastics have some permeability to gases primarily through intermolecular migration. In the case of our FEP or PFA encapsulation, any gas permeation is at a substantially lower rate than most other plastics.

Whilst highly corrosive gases do not normally chemically successfully attack, the PTFE/PFA encapsulation, they may eventually permeate through and damage the elastomer core, and hence affect the seal's mechanical properties. Thus in addition to chemical resistance, permeability effects may have to be considered in some aggressive gas sealing systems.

ABSORPTION

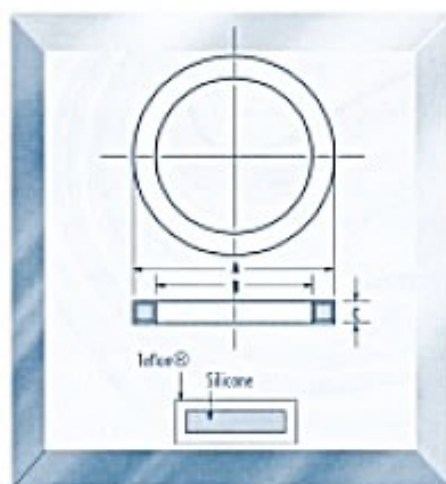
CHEM-RINGS are immune and absorb near zero acid or alkalis, even at elevated temperatures as high as 200°C. with exposure up to one year.

Absorption of solvents is also small, with weight increases of generally less than 1%, even at elevated temperatures over long exposure periods. The encapsulation of PTFE/PFA means that the effects of volume swell, which is one of the principal causes of 'O' Ring failure, can be virtually ignored.



VULCAN KAMLOCK® SEALS

Vulcan Encapsulated Gaskets for KAMLOCK® Couplings are designed as universal, non-contaminating hose coupling seals. They eliminate the need to specify different elastomers for differing applications and eliminate coupling leakage through seal gasket failure, due to chemical attack or creep of solid Teflon® gasket seals. Vulcan KAMLOCK® seals provide a superior seal for any bulk liquid transfer in manufacturing, distribution or storage.



VULCAN CHEM-RINGS



Universal Gasket:

Extreme chemical resistance and wide temperature range.



Leak Free Service:

Low compression set and elastomer core energiser avoids cold flow leakage of solid PTFE.



Non-Stick Surface:

Low co-efficient of friction (0.1 to 0.2) allows easy installation and removal.



Sanitary:

Sterilizable and FDA Approved Encapsulation eliminates contamination.

RECTANGULAR FEP/SILICONE GASKETS FOR KAMLOCK® COUPLINGS

Coupling Nominal Size		Dimensions					
		Inches			mm		
Inches	mm	A	B	C	A	B	C
0.500"	12.70	1.024"	0.669"	0.157"	26.0	17.0	4.00
0.750"	19.00	1.375"	0.875"	0.218"	35.0	22.2	5.54
1.000"	25.40	1.563"	1.063"	0.250"	39.5	27.0	6.35
1.250"	31.70	1.938"	1.359"	0.250"	49.2	34.5	6.35
1.500"	38.00	2.188"	1.625"	0.250"	55.6	41.3	6.35
2.000"	50.80	2.625"	2.000"	0.250"	66.7	50.8	6.35
2.500"	63.50	3.125"	2.375"	0.250"	79.4	60.3	6.35
3.000"	76.30	3.719"	3.000"	0.250"	94.5	76.2	6.35
4.000"	101.60	4.875"	4.000"	0.250"	123.6	101.6	6.35
6.000"	152.40	7.063"	6.000"	0.250"	179.4	152.4	6.35

E.E.P. Encapsulation Thickness = 0.020" / 0.508mm

Tolerances: A/B = +/- 0.030" / 0.762mm

C = +/- 0.010" / 0.254mm

ROUND SECTION KAMLOCK® GASKETS

Round Section Nominal Size		Dimensions			
		Inches		mm	
		D	E	D	E
0.500"	12.70	0.738"	0.187"	18.75	4.75
0.750"	19.00	0.972"	0.224"	24.70	5.70
1.000"	25.40	1.000"	0.224"	25.40	5.70
1.250"	31.70	1.433"	0.224"	36.40	5.70
1.500"	38.00	1.724"	0.275"	43.81	6.99
2.000"	50.80	2.145"	0.275"	54.48	6.99
2.500"	63.50	2.675"	0.275"	67.95	6.99
3.000"	76.30	3.225"	0.275"	81.92	6.99

Vulcan Round Section Encapsulated Seals for KAMLOCK® Type Couplings offer distinct further advantages compared to our popular Rectangular Section Encapsulated Gaskets.



Easier Installation and Removal:

Reduced risk of cutting or tearing the encapsulation.



Easily Compressed:

Needs less force to create a seal.



Superior Seal:

Manufactured to closer tolerances, with the option of a Silicone or a Viton® core.



More Economical:

Production costs and prices are lower.



CHEM-RING BENEFITS

Vulcan CHEM-RINGS seal stronger and last longer than any other fluoroelastomer, rubber or solid Teflon® 'O' Rings especially in tough applications.

The Principal advantages are;



Outstanding chemical resistance



Wide temperature range



High pressure capability



Non-stick/low-friction resistance



High compression set retention



Performs as an elastomeric PTFE



Economical, assured seal

This combination of the best qualities of the PTFE encapsulation with the Silicone or Viton® rubber core creates an inexpensive, high performance solution to many critical sealing problems.

Example Applications

- Pumps and Valves
- Reactor Vessels
- Mechanical Seals
- Autoclaves
- Hose Coupling Seals
- Gas Compressors
- Pressure Relief Valves
- Filters
- Pressure Vessels
- Heat Exchangers
- Cryogenics
- Pipelines
- Access Covers
- Tank Lids

Example Industries

- Chemical Process
- Oil Refineries
- Photochemical
- Food Stuff Industries
- Dye Manufacture
- Pharmaceutical Production
- Aircraft and Aerospace
- Semi-Conductor Manufacture
- Refrigeration Engineering
- Polymer Production
- Paint and Coating Operations
- Petroleum and Chemical Transport

Utilise Vulcan CHEM-RINGS to replace standard material 'O' Rings when they suffer from;

- Chemical Attack
- 'O' Ring swell
- 'O' Ring compression set
- Gas permeation
- or where sterility is needed (Food, Pharmaceutical, Chemical Manufacturing Industries).
- or where standard materials cause problems related to surface friction (Eg. Reciprocating Movement).
- Provide an alternative to Kalrez® and similar Perfluoroelastomers - where Kalrez® may be not necessary ie. vastly reducing the seal's cost.
- Replace solid PTFE rings - these hard, unforgiving seals suffer from cold flow and creep and should not be used, given the superior capabilities and performance of Chem-Rings.
- Replace envelope gaskets in vessel lid seals to provide full seal integrity - avoiding possible product contamination or seal failure.

FDA APPROVED

The clear FEP/PTFE Encapsulation of the Vulcan CHEM-RING Encapsulated 'O' Ring complies with Part 177 of Title 21 of the F.D.A. Regulations, for safe use as articles (or components of articles) for producing, manufacturing, processing, preparing, treating, packaging, transport or holding food in accordance with F.D.A. Regulation 21 CFR 177.1550.

ALFAS® 'O' RINGS

Vulcan also manufacture moulded ALFAS® 'O' Rings and Components. These Vulcan Alfas® Seals exhibit exceptional chemical and temperature resistance, with significantly superior properties to FKM-type fluoroelastomers.

Benefits include;



Exceptional Heat Resistance: up to 260°C continuous.



Excellent Chemical Resistance to solvents, oils, steam and many acids and alkalis.



Very economical with product costs similar to Viton®.

BRAND NAMES®

All brand names and product names used in this catalogue are trade names, service marks, trade marks or registration trade marks of their respected owners. Use of other brand names is for informational purposes only.

VULCAN CHEM-RINGS



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