



# Vulcan Parallel Spring Balanced Diaphragm Type Seals



## Introduction

The A1 to A5 range are elastomeric bellows, bi-directional, parallel spring Mechanical Seals, offering superior design and performance compared to market alternatives. This has been achieved by superior face materials and innovative patented design features. As detailed on the next page.

## Applications

Suitable for Pumps, mixers, compressors and other rotary equipment. Often utilised for a diverse range of applications including; water, petrochemical, chemical, food processing, refrigeration and other arduous duties.

## Standard Vulcan Parallel Types

### Type A1

The A1 is a flexible Seal, suitable for the narrower Seal housing, due to the compact radial cross-sectional design and suiting common European Seal housing standards. The Type A1 has a long working length and is fitted with a Seal head retainer backing plate. The Type A1 is supplied as standard with a Type 20 Boot mounted stationary.

### Types A2 and A2H

The A2 Type coil fits over the Seal head, reducing the overall working length, making this Seal suitable for short gland depth applications, fitting to common European Seal housing standards. Type A2H has a Type 21 'O'-Ring stationary as standard, whilst the Type A2 comes with a Type 20 Boot mounted seat.

### Types A4 and A4J

As per the Type A2 Seal but designed to suit common American standard working length and housing dimensions. Type A4J has the Type 31 'O'-Ring mounted stationary as standard, whilst the Type A4 comes with a Type 11 Boot mounted seat.

### Types A5 and A5J

Spring profile as per the Type A1 Seal but designed to suit common American standards and supplied without the Seal head retainer backing plate, utilised on the Type A1. Type A5J has the Type 31 'O'-Ring mounted stationary as standard, whilst the Type A5 comes with a Type 11 Boot mounted seat.

## Section 6



## Vulcan Design Advantages

### Mechanical Drive

We refer to this family of Type A1 - A5 Seals as the Ax range.

The mechanical drive mechanism of the Ax range incorporates a patented design. This innovative solution eliminates the problem of Seal failure, due to excessive wear by the thin metal drive components cutting a groove into the retainer, common to competitors' Seals.



The drive area has been increased by over 250%, to greatly reduce the contact drive pressure and consequent wear. As a result, the drive ring does not cut nor groove into the Seal head retainer.

The unique Seal head design also retains the drive ring by a locking mechanism. This results

in security and ease of assembly, due to the unitised design of the entire Seal head assembly.

### Balanced

The Vulcan Ax range Seals are hydraulically balanced to a recognised industry standard, to reduce heat and friction at the Seal interface. This allows for higher operating parameters to be achieved and prolongs Seal life. Competitor's Seals are not balanced throughout this range and therefore do not offer the full benefits of a balanced Seal.

### Bellows Disk

The Vulcan Ax Seal family includes a bellows disk, as a standard design feature. This component provides radial support to the bellows, ensuring no bellows / shaft contact, which could result in Seal wear and possible hang-up. This component is routinely omitted in the Crane® USA designs but is included on UK / European Type 1A and 2. Without the disk, the bellows I.D.'s are very close to the shaft and can be problematic, due to bellows extrusion and shaft contact / stiction.

### Bellows Design

The flexible bellows compensates for primary Seal face wear and machinery misalignment, such as shaft end float. The Vulcan Ax bellows contains an additional drive ring supporting lip, to ensure that the drive ring is held in a positive position, away from the bellows. This feature is not included in many alternative designs, which can result in possible bellows interference, affecting Seal performance.

### Base Plate Retaining

Types A2 to A5 Seal retain the base plates on the coil as standard, providing support during Seal fitting.

### Seal Face Retaining

The Vulcan Seal face is retained by inert grease and NOT glue. Some Seal suppliers chose to utilise glue which can create a leakage path, and upon chemical attack, the glue can migrate into Seal components and product.

Seal Type	Crane® Equivalent
A1	1A (UK / EUROPEAN)
A2	Type 2 (UK / EUROPEAN)
A4	Type 2 (american DIMENSIONS)
A5	Type 1 (american DIMENSIONS)

### Vulcan® Type A1 - A5 Seals PV Chart

Please refer to the PV Chart shown on page 49.

### Seal Face Drive

Vulcan's designs include improved Seal face / retainer engagement. The Seal face slot is designed to achieve a positive drive from the retainer crimps and to eliminate chipping of the face.

It can be demonstrated, from the Seal comparison diagram below, that the Vulcan Seal has a superior drive location area and doesn't drive at the weakest point, as per the standard competitors design; which will be prone to chipping and spinning leading to Seal failure

#### Vulcan Type A4



#### Common Competitor

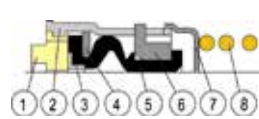


### Mechanical Face Loading

Face loading on the Vulcan Ax Seal ranges has been designed to enhance Seal life, whilst not affecting performance capabilities. The linear progressive, Vulcan design, utilises proven values within the Seal industry, which will result in less heat generation, less power consumption, less wear and therefore, increased Seal performance, capability and life. Common competitor designs have wide variances in face loading, between shaft sizes.

### Material Quality and Reliability

A wide selection of first-class face materials and elastomers are readily available as standard. These ensure excellent performance and have been verified through extensive testing.



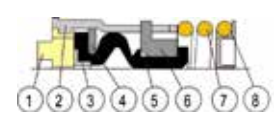
Type A1



Type A2



Type A4

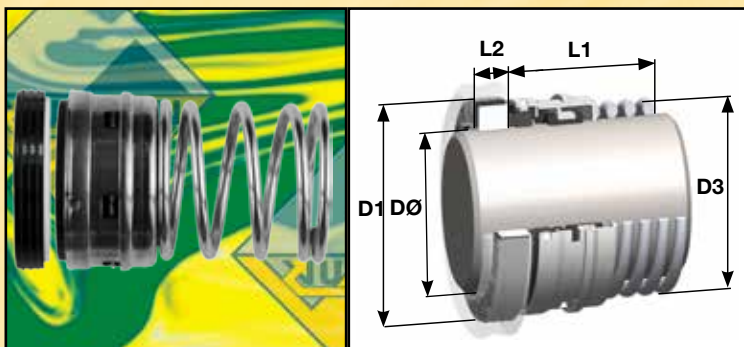


Type A5

No	Description
1	Face
2	Retainer
3	Bellows Disk
4	Plate
5	Bellows
6	Drive Ring
7	Coil
8	Backing Plate
9	Sleeve



## Type A1



Robust, long working length, highly accommodating and reliable, rubber diaphragm balanced Seal, which provides enhanced Seal capability, performance and life. The Type A1 has a retainer backing plate, a narrow profile and a no spring base plate. Also now available for metric shafts.

Improved design features further enhance this popular Seal. Available with a Type 20 Boot-mounted seat as standard, suitable for originally common UK housing dimensions.

### Vulcan Standard Sizes

Imperial Shaft Size DØ	Metric Shaft Size DØ	Size Code	D1 (mm)	D3 (mm)	L1 (mm)	L2 (mm)
	12*	0120	27.79	23.90	43.66	8.74
0.500		0127	27.79	23.90	43.66	8.74
	14*	0140	30.95	27.07	43.66	10.32
0.625		0158	30.95	27.07	43.66	10.32
	16	0160	30.95	27.07	43.66	10.32
	18*	0180	34.15	30.25	43.66	10.32
0.750		0191	34.15	30.25	43.66	10.32
	20*	0200	35.70	33.42	43.66	10.32
	22	0220	37.30	33.42	43.66	10.32
0.875		0222	37.30	33.42	43.66	10.32
	24*	0240	40.50	38.10	43.66	10.32
	25*	0250	40.50	38.10	43.66	10.32
1.000		0254	40.50	38.10	43.66	10.32
	28*	0280	47.63	41.28	60.33	11.99
1.125		0286	47.63	41.28	60.33	11.99
	30*	0300	50.80	46.00	60.33	11.99
1.250		0317	50.80	46.00	60.33	11.99
	32	0320	50.80	46.00	60.33	11.99
	33*	0330	53.98	48.68	60.33	11.99
1.375		0349	53.98	48.68	60.33	11.99
	35	0350	53.98	48.68	60.33	11.99
	38	0380	57.15	51.85	60.33	11.99
1.500		0381	57.15	51.85	60.33	11.99
	40*	0400	60.33	58.10	60.33	11.99
1.625		0412	60.33	58.10	60.33	11.99
	43*	0430	63.50	61.67	70.64	11.99
1.750		0444	63.50	61.67	70.64	11.99
	45*	0450	63.50	61.67	70.64	11.99
1.875		0476	66.68	64.84	70.64	11.99
	48*	0480	66.68	64.84	70.64	11.99
	50*	0500	69.85	68.01	70.64	13.50
2.000		0508	69.85	68.01	70.64	13.50
	53*	0530	73.03	72.02	70.64	13.50
2.125		0539	73.03	72.02	70.64	13.50
	55*	0550	76.20	75.30	70.64	13.50
2.250		0571	76.20	75.30	70.64	13.50
	60	0600	79.38	78.37	70.64	13.50
2.375		0603	79.38	78.37	70.64	13.50
	63*	0630	82.55	81.54	70.64	13.50
2.500		0635	82.55	81.54	70.64	13.50
	65*	0650	92.08	86.22	69.85	15.88
2.625		0666	92.08	86.22	69.85	15.88
2.750		0698	95.25	89.40	69.85	15.88
	70	0700	95.25	89.40	69.85	15.88
2.875		0730	98.43	92.57	73.03	15.88
	75*	0750	101.60	95.75	73.03	15.88
3.000		0762	101.60	95.75	73.03	15.88

All Types, sizes and materials shown are part of Vulcan's Guaranteed Ex-Stock Range, unless marked with an asterisk\*. However, most asterisked sizes are stocked in some, but not all, materials. And the asterisked materials in many sizes.

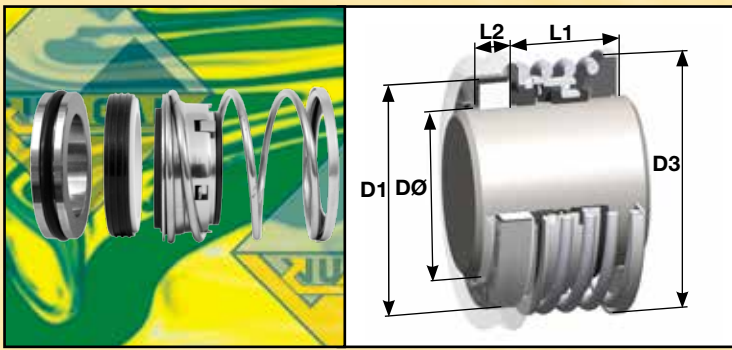
Guaranteed Stock Materials and Face Material Code					
Seal And Seat Assembly		Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material	Code
Soft	C	M106K Carbon	C	99% Ceramic	A
Soft vs Hard	D	M106K Carbon	C	VES2 RB SIC	S
Hard vs Soft	G	VES2 RB SIC	S	99% Ceramic	A
Hard	S	VES2 RB SIC	S	VES2 RB SIC	S
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*	H
Guaranteed Stock Elastomers: Viton™, E.P. and Nitrile			Guaranteed Stock Metallurgy: 304SS		

### Suggested Operating Limits

Maximum Operating Pressure Limits primarily depend upon Face Materials, Shaft Size, Speed and Media. Please refer to the Seal Type Specific PV Chart, found at the front of this Brochure Section, in combination with the Vulcan Multiplying Factors found in Technical and Material Standards Section 2.



# Types A2 / A2H



Robust, short working length, highly accommodating and reliable, rubber diaphragm balanced Seal, which provides enhanced Seal capability, performance and life. The A2 Type coil fits over the Seal head, reducing the overall working length, making this Seal suitable for short gland depth applications. Improved design features further enhance this popular Seal. Available with a Type 20 Boot-mtd seat as standard Type A2, or with a Type 21 'O'-Ring mounted stationary as Type A2H, both Types suitable for imperial dimensions.

## Vulcan Standard Sizes

Imperial Shaft Size DØ	Metric Shaft Size DØ	Size Code	D1 (mm)	D3 (mm)	L1 (mm)	L2 (mm)
	12*	0120	27.79	30.20	25.40	8.74
0.500		0127	27.79	30.20	25.40	8.74
	13*	0130	27.79	30.20	25.40	8.74
	14*	0140	30.95	33.37	25.40	10.32
	15*	0150	30.95	33.37	25.40	10.32
0.625		0158	30.95	33.37	25.40	10.32
	16	0160	30.95	33.37	25.40	10.32
	18*	0180	34.15	36.55	25.40	10.32
0.750		0191	34.15	36.55	25.40	10.32
	20*	0200	35.70	39.72	25.40	10.32
	22	0220	37.30	39.72	25.40	10.32
0.875		0222	37.30	39.72	25.40	10.32
	24*	0240	40.50	44.30	25.40	10.32
	25*	0250	40.50	44.30	25.40	10.32
1.000		0254	40.50	44.30	25.40	10.32
	28*	0280	47.63	49.07	33.34	11.99
1.125		0286	47.63	49.07	33.34	11.99
	30*	0300	50.80	53.40	33.34	11.99
1.250		0317	50.80	53.40	33.34	11.99
	32	0320	50.80	53.40	33.34	11.99
	33*	0330	53.98	57.58	33.34	11.99
1.375		0349	53.98	57.58	33.34	11.99
	35	0350	53.98	57.58	33.34	11.99
	38	0380	57.15	60.75	33.34	11.99
1.500		0381	57.15	60.75	33.34	11.99
	40*	0400	60.33	67.40	33.34	11.99
1.625		0412	60.33	67.40	33.34	11.99
	43*	0430	63.50	71.97	40.48	11.99
1.750		0444	63.50	71.97	40.48	11.99
	45*	0450	63.50	71.97	40.48	11.99
1.875		0476	66.68	75.14	40.48	11.99
	48*	0480	66.68	75.14	40.48	11.99
	50*	0500	69.85	78.31	40.48	13.50
2.000		0508	69.85	78.31	40.48	13.50
	53*	0530	73.03	82.72	40.48	13.50
2.125		0539	73.03	82.72	40.48	13.50
	55*	0550	76.20	86.00	40.48	13.50
2.250		0571	76.20	86.00	40.48	13.50
	60	0600	79.38	89.00	40.48	13.50
2.375		0603	79.38	89.00	40.48	13.50
	63*	0630	82.55	92.24	40.48	13.50
2.500		0635	82.55	92.24	40.48	13.50
	65*	0650	92.08	97.92	49.21	15.88
2.625		0666	92.08	97.92	49.21	15.88
2.750		0698	95.25	101.10	49.21	15.88
	70	0700	95.25	101.60	49.21	15.88
2.875		0730	98.43	105.27	52.39	15.88
	75*	0750	101.60	108.45	52.39	15.88
3.000		0762	101.60	108.45	52.39	15.88

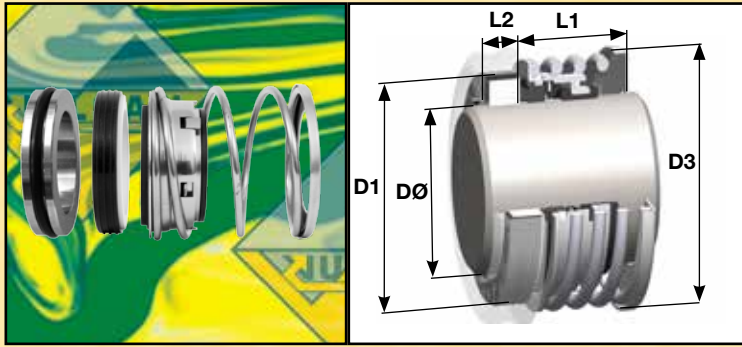
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Type A2					
Guaranteed Stock Materials and Face Material Code					
Seal And Seat Assembly		Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material	Code
Soft	C	M106K Carbon	C	99% Ceramic	A
Soft vs Metal	X	Non-standard: Please use alternative shown here or enquire			
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC	S
Hard vs Soft	G	VES2 RB SiC	S	99% Ceramic	A
Soft vs 1ST alt	X	Non-standard: Please use alternative shown here or enquire			
Hard	S	VES2 RB SiC	S	VES2 RB SiC	S
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*	H
Guaranteed Stock Elastomers: Viton™, E.P. and Nitrile			Guaranteed Stock Metallurgy: 304SS		

Type A2H					
Guaranteed Stock Materials and Face Material Code					
Seal And Seat Assembly		Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material	Code
Soft	C	M106K Carbon	C	99% Ceramic	A
Soft vs Metal	Q	M106K Carbon	C	304 Stainless Steel	Q
Soft vs Metal	F	M106K Carbon	C	Ni-Resist*	F
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC	S
Soft vs 1ST alt	E	M106K Carbon	C	Tungsten Carbide*	H
Hard	S	VES2 RB SiC	S	VES2 RB SiC	S
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*	H
Guaranteed Stock Elastomers: Viton™, E.P. and Nitrile			Guaranteed Stock Metallurgy: 304SS		



## Types A4 / A4J



Robust, short working length, highly accommodating and reliable, rubber diaphragm balanced Seal which provides enhanced Seal capability, performance and life. Improved design features further enhance this popular Seal.

Suitable for common originally American standard housing and working length dimensions. Available with a Type 11 Boot-mounted seat as Type A4, or with a Type 31 'O'-Ring mounted stationary as Type A4J.

### Vulcan Standard Sizes

Imperial Shaft Size DØ	Size Code	D1		D3		L1		L2	
		in	mm	in	mm	in	mm	in	mm
0.500	0127	1.000	25.40	1.187	30.14	0.813	20.64	0.312	7.93
0.625	0158	1.250	31.75	1.312	33.32	0.875	22.23	0.405	10.28
0.750	0191	1.375	34.93	1.438	36.52	0.875	22.23	0.405	10.28
0.875	0222	1.500	38.10	1.564	39.72	0.937	23.80	0.405	10.28
1.000	0254	1.625	41.28	1.783	45.30	1.000	25.40	0.437	11.10
1.125	0286	1.750	44.44	1.908	48.47	1.062	26.97	0.437	11.10
1.250	0317	1.875	47.63	2.079	52.80	1.062	26.97	0.437	11.10
1.375	0349	2.000	50.80	2.204	55.98	1.125	28.58	0.437	11.10
1.500	0381	2.125	53.98	2.329	59.15	1.125	28.58	0.437	11.10
1.625	0412	2.375	60.33	2.636	66.96	1.375	34.93	0.500	12.70
1.750	0444	2.500	63.50	2.761	70.12	1.375	34.93	0.500	12.70
1.875	0476	2.625	66.68	2.880	73.16	1.500	38.10	0.500	12.70
2.000	0508	2.750	69.85	3.011	76.48	1.500	38.10	0.500	12.70
2.125	0539	3.000	76.20	3.256	82.71	1.687	42.85	0.562	14.28
2.250	0571	3.125	79.38	3.381	85.89	1.687	42.85	0.562	14.28
2.375	0603	3.250	82.55	3.506	89.06	1.812	46.02	0.562	14.28
2.500	0635	3.375	85.73	3.631	92.24	1.812	46.02	0.562	14.28
2.625	0666	3.375	85.73	3.875	98.43	1.937	49.20	0.625	15.88
2.750	0698	3.500	88.90	4.000	101.60	1.937	49.20	0.625	15.88
2.875	0730	3.750	95.25	4.125	104.78	2.062	52.37	0.625	15.88
3.000	0762	3.875	98.43	4.250	107.95	2.062	52.37	0.625	15.88

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### Suggested Operating Limits

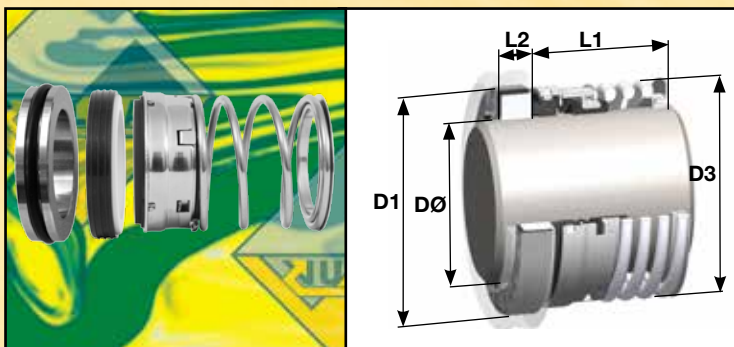
Maximum Operating Pressure Limits primarily depend upon Face Materials, Shaft Size, Speed and Media. Please refer to the Seal Type Specific PV Chart, found at the front of this Brochure Section, in combination with the Vulcan Multiplying Factors found in Technical and Material Standards Section 2.

Type A4				
Guaranteed Stock Materials and Face Material Code				
Seal And Seat Assembly	Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material
Soft	C	M106K Carbon	C	99% Ceramic
Soft vs Metal	X	Non-standard: Please use alternative shown here or enquire		
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC
Hard vs Soft	G	VES2 RB SiC	S	99% Ceramic
Soft vs 1ST alt	X	Non-standard: Please use alternative shown here or enquire		
Hard	S	VES2 RB SiC	S	VES2 RB SiC
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*
Guaranteed Stock Elastomers: Viton*, E.P. and Nitrile		Guaranteed Stock Metallurgy: 304SS		

Type A4J				
Guaranteed Stock Materials and Face Material Code				
Seal And Seat Assembly	Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material
Soft	C	M106K Carbon	C	99% Ceramic*
Soft vs Metal	Q	M106K Carbon	C	304 Stainless Steel*
Soft vs Metal	F	M106K Carbon	C	Ni-Resist
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC
Soft vs 1ST alt	E	M106K Carbon	C	Tungsten Carbide*
Hard	S	VES2 RB SiC	S	VES2 RB SiC
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*
Guaranteed Stock Elastomers: Viton*, E.P. and Nitrile		Guaranteed Stock Metallurgy: 304SS		



## Types A5 / A5J



Robust, long working length, highly accommodating and reliable, rubber diaphragm balanced Seal which provides enhanced Seal capability, performance and life. Improved design features enhance this popular Seal. Suitable for common US standard housing and working length dimensions. Available with Type 11 Boot-mounted seat as Type A5, or with Type 31 'O'-Ring mounted stationary as Type A5J.

### Vulcan Standard Sizes

Imperial Shaft Size DØ	Size Code	D1		D3		L1		L2	
		in	mm	in	mm	in	mm	in	mm
0.500	0127	1.000	25.40	0.937	23.80	1.187	30.16	0.312	7.93
0.625	0158	1.250	31.75	1.093	27.76	1.312	33.32	0.405	10.28
0.750	0191	1.375	34.93	1.218	30.94	1.312	33.32	0.405	10.28
0.875	0222	1.500	38.10	1.343	34.11	1.375	34.93	0.405	10.28
1.000	0254	1.625	41.28	1.500	38.10	1.562	39.67	0.437	11.10
1.125	0286	1.750	44.44	1.625	41.28	1.625	41.28	0.437	11.10
1.250	0317	1.875	47.63	1.812	46.02	1.625	41.28	0.437	11.10
1.375	0349	2.000	50.80	1.917	48.68	1.687	42.85	0.437	11.10
1.500	0381	2.125	53.98	2.041	51.85	1.687	42.85	0.437	11.10
1.625	0412	2.375	60.33	2.287	58.10	2.000	50.80	0.500	12.70
1.750	0444	2.500	63.50	2.412	61.27	2.000	50.80	0.500	12.70
1.875	0476	2.625	66.68	2.537	64.44	2.125	53.98	0.500	12.70
2.000	0508	2.750	69.85	2.646	67.21	2.125	53.98	0.500	12.70
2.125	0539	3.000	76.20	2.835	72.02	2.375	60.33	0.562	14.28
2.250	0571	3.125	79.38	2.965	75.30	2.375	60.33	0.562	14.28
2.375	0603	3.250	82.55	3.083	78.30	2.500	63.50	0.562	14.28
2.500	0635	3.375	85.73	3.210	81.54	2.500	63.50	0.562	14.28
2.625	0666	3.375	85.73	3.394	86.22	2.750	69.85	0.625	15.88
2.750	0698	3.500	88.90	3.520	89.40	2.875	73.03	0.625	15.88
2.875	0730	3.750	95.25	3.644	92.57	2.875	73.03	0.625	15.88
3.000	0762	3.875	98.43	3.770	95.75	2.875	73.03	0.625	15.88

All Types, sizes and materials shown are part of Vulcan's Guaranteed Ex-Stock Range, unless marked with an asterisk\*.

However, the asterisked Seal and / or seat face materials are stocked in many, but not all, sizes.

### Suggested Operating Limits

Maximum Operating Pressure Limits primarily depend upon Face Materials, Shaft Size, Speed and Media. Please refer to the Seal Type Specific PV Chart, found at the front of this Brochure Section, in combination with the Vulcan Multiplying Factors found in Technical and Material Standards Section 2.

Type A5					
Guaranteed Stock Materials and Face Material Code					
Seal And Seat Assembly		Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material	Code
Soft	C	M106K Carbon	C	99% Ceramic	A
Soft vs Metal	X	Non-standard: Please use alternative shown here or enquire			
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC	S
Hard vs Soft	G	VES2 RB SiC	S	99% Ceramic	A
Soft vs 1ST alt	X	Non-standard: Please use alternative shown here or enquire			
Hard	S	VES2 RB SiC	S	VES2 RB SiC	S
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*	H
Guaranteed Stock Elastomers: Viton™, E.P. and Nitrile			Guaranteed Stock Metallurgy: 304SS		

Type A5J					
Guaranteed Stock Materials and Face Material Code					
Seal And Seat Assembly		Rotary Face		Stationary Face	
Face Reference Term	Code	Material	Code	Material	Code
Soft	C	M106K Carbon	C	99% Ceramic*	A
Soft vs Metal	Q	M106K Carbon	C	304 Stainless Steel*	Q
Soft vs Metal	F	M106K Carbon	C	Ni-Resist	F
Soft vs Hard	D	M106K Carbon	C	VES2 RB SiC	S
Soft vs 1ST alt	E	M106K Carbon	C	Tungsten Carbide*	H
Hard	S	VES2 RB SiC	S	VES2 RB SiC	S
Hard 1st alt	H	Tungsten Carbide*	H	Tungsten Carbide*	H
Guaranteed Stock Elastomers: Viton™, E.P. and Nitrile			Guaranteed Stock Metallurgy: 304SS		