John Crane

515C

METAL BELLOWS CARTRIDGE SEAL

Applications

The Type 515C is a metal bellows cartridge seal with computer optimised asymmetric bellows.

- General industrial applications including chemical processing, mining, pulp and paper and wastewater treatment.
- Used in areas where hygiene and purity are essential such as food, beverage, biotechnology and pharmaceutical industries.
- The even stress distribution in the bellows and the smooth profile lead to greater reliability, whilst the cartridge arrangement makes pump conversion and maintenance procedures faster and more reliable.
- For easy installation and maintenance, the slotted gland plate has an integral throttle bush and connections for seal flush, quench and drain.
- Available in Metric and Inch sizes to suit popular DIN and ANSI pumps without modification.

Operating Conditions

- **Temperatures:** -40˚C to +200˚C/ -40˚F to +390˚F depending on materials used
- **Pressures:** Up to 20 bar g/ 290 psig
- **Speed:** Up to 25 m/s/ 5000 fpm

Fluids

Abrasives
Aqueous Solutions
Caustics
Lubricants
Slurries
Chemicals

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METRIC AND INCH RANGE

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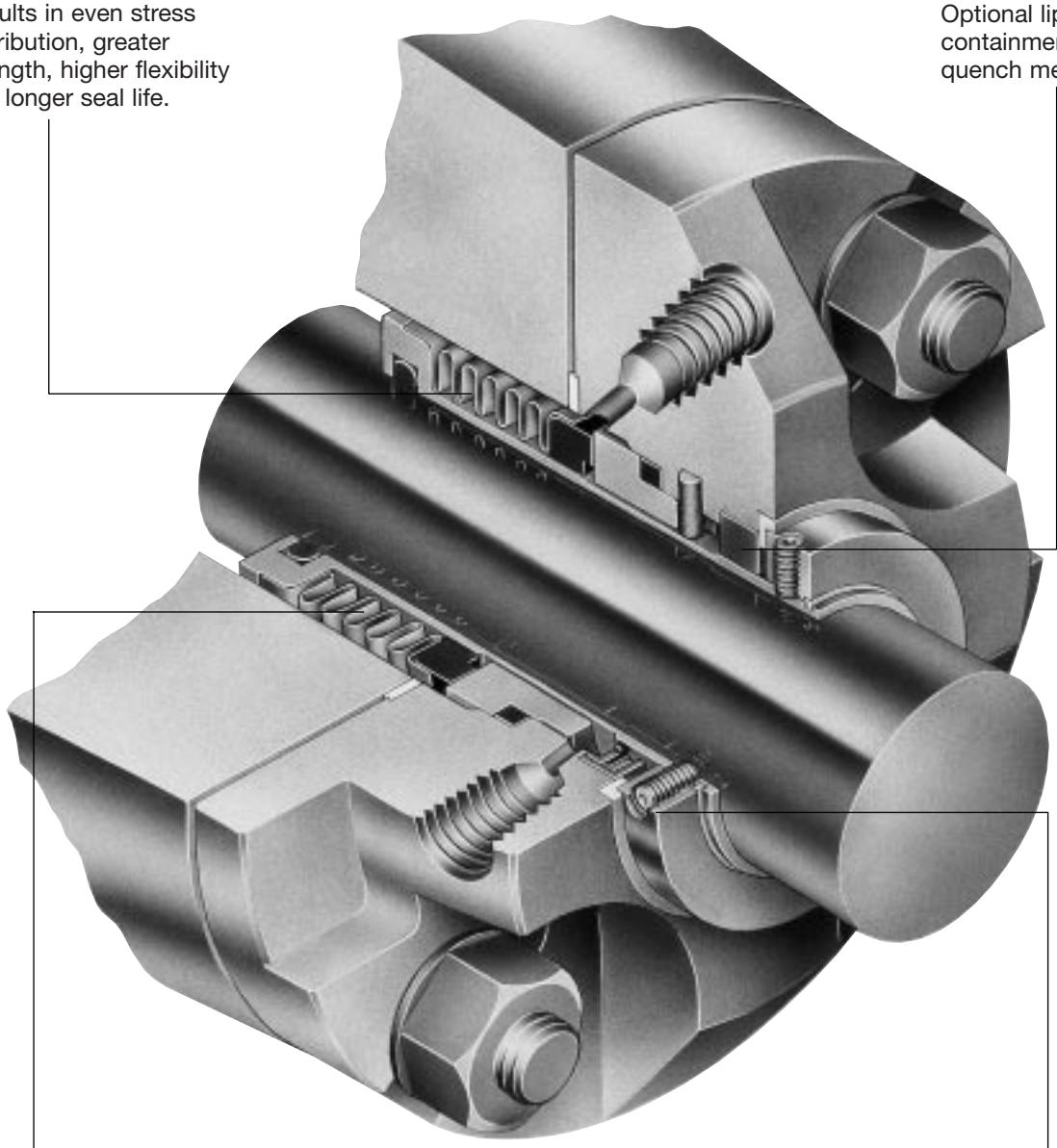
Design Features

Asymmetric Formed Metal Bellows

Results in even stress distribution, greater strength, higher flexibility and longer seal life.

Throttle Bush Fitted as Standard

Optional lipseal for containment of liquid quench media.



Smooth Profile

Smooth, open bellows profile is ideal for slurries and fibrous liquids.

Simple Setting and Drive Mechanism

Setting ring eliminates requirement for removable setting clips. Easily converted to indirect drive when grubscrew contact on the shaft/sleeve is unacceptable.

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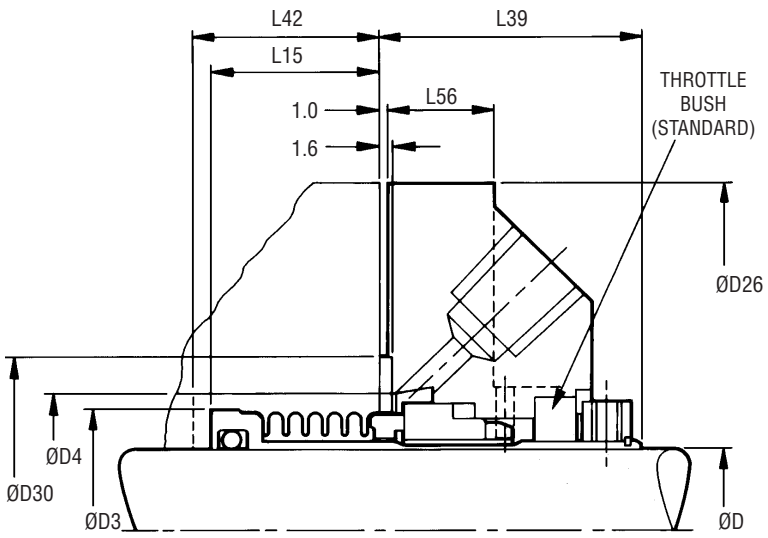
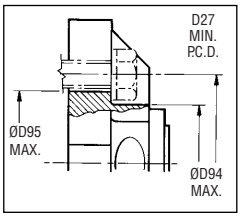
Type 515C Typical Arrangement/Dimensional Data





Minimum fixing bolt P.C.D. D27 and slot width D28 are sized to suit stud or bolt diameters according to the seal size code, as shown below:

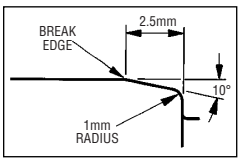
0240 to 0320 – M10 or 3/8in.

0330 to 0480 – M12 or 1/2in.

0500 to 0800 – M16 or 5/8in.

0825 to 1016 – M20 or 3/4in.

D95 is the maximum distance between the bottom of opposing slots.



For ease of installation, the lead-in edge of the shaft or sleeve should be chamfered as shown.

Chart 1. Type 515C Metric Range (mm)

Seal Size (mm)	Seal Size Code	D	D3	D4 Min.	D4 Max.	D26	D27	D28	D30	D94	D95	L15	L39	L42	L56
24	0240	24	39.0	41.0	50.4	114	79.4	12	59	54.3	61.4	28.5	46.0	31.5	18
25	0250	25	39.0	41.0	50.4	114	79.4	12	59	54.3	61.4	28.5	46.0	31.5	18
28	0280	28	42.0	44.0	50.4	114	79.4	12	59	54.3	61.4	27.5	46.0	30.5	18
30	0300	30	45.8	47.8	50.4	114	79.4	12	59	54.3	61.4	32.5	48.0	35.5	18
32	0320	32	45.8	47.8	50.4	114	79.4	12	59	54.3	61.4	32.5	48.0	35.5	18
33	0330	33	48.3	50.3	52.4	120	82.4	14	62	54.3	64.4	32.5	48.0	35.5	18
35	0350	35	48.3	50.3	52.4	120	82.4	14	62	54.3	64.4	32.5	48.0	35.5	18
38	0380	38	54.0	57.0	60.4	125	88.9	14	69	60.9	71.4	31.5	51.0	34.5	18
40	0400	40	58.3	61.3	65.4	140	97.0	14	74	68.9	76.5	36.5	49.5	39.5	18
43	0430	43	58.3	61.3	65.4	140	97.0	14	74	68.9	76.5	36.5	49.5	39.5	18
45	0450	45	63.7	66.7	72.4	140	102.0	14	81	74.0	83.5	36.0	49.5	39.0	19
48	0480	48	63.7	66.7	72.4	140	102.0	14	81	74.0	83.5	36.0	49.5	39.0	19
50	0500	50	69.0	72.0	77.4	145	112.0	18	86	78.0	88.5	42.3	49.5	45.3	19
53	0530	53	71.0	74.0	77.4	145	112.0	18	86	78.0	88.5	42.3	51.5	45.3	19
55	0550	55	73.3	76.3	82.4	150	117.1	18	92	83.1	94.6	42.3	49.5	45.3	19
58	0580	58	76.7	79.7	82.4	150	117.1	18	92	83.1	94.6	42.3	51.5	45.3	19
60	0600	60	76.7	79.7	82.4	150	117.1	18	92	83.1	94.6	42.3	52.0	45.3	19
63	0630	63	79.4	82.4	87.4	160	122.1	18	96	88.1	98.6	42.3	52.0	45.3	19
65	0650	65	83.0	86.0	87.4	160	122.1	18	96	88.1	98.6	52.3	54.0	55.3	19
68	0680	68	87.8	90.8	96.4	170	131.2	18	106	97.2	108.6	51.3	54.0	54.3	19
70	0700	70	94.0	97.0	101.4	180	136.2	18	111	102.2	113.7	51.3	54.0	54.3	19
75	0750	75	94.0	97.0	101.4	180	136.2	18	111	102.2	113.7	51.3	54.0	54.3	19
80	0800	80	100.6	103.6	109.4	195	141.3	18	121	107.3	123.7	60.8	54.0	63.8	20
85	0850	85	106.0	109.0	114.4	200	158.4	22	125	117.3	127.8	60.8	54.0	63.8	20
90	0900	90	114.9	117.9	124.4	210	168.4	22	136	127.4	138.8	60.8	54.0	63.8	20
95	0950	95	121.3	124.3	128.4	215	168.4	22	140	127.4	142.9	60.8	54.0	63.8	20
100	1000	100	121.3	124.3	128.4	215	168.4	22	140	127.4	142.9	60.8	54.0	63.8	20

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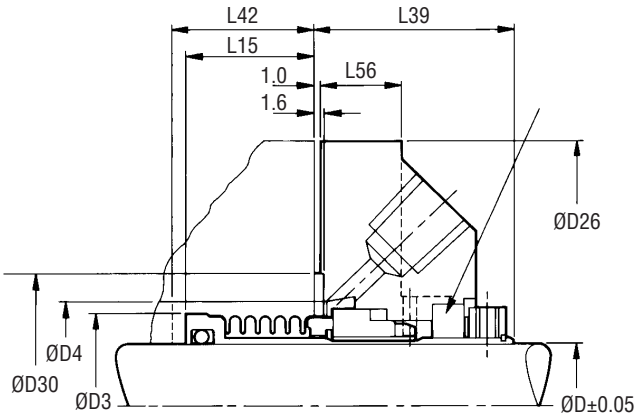
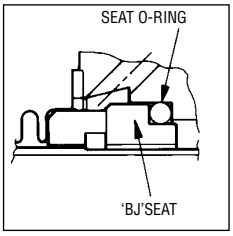
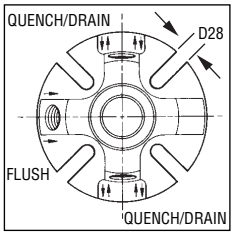
Type 515C Typical Arrangement/Dimensional Data





Alternative seat arrangement.



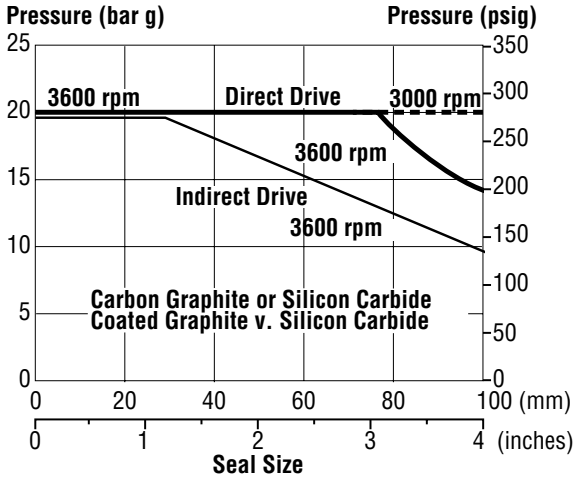
Positions of quench or drain connections (indicated by double arrows), and flush connection (indicated by single arrows). Thread sizes are related to seal size codes, as follows:

0240 to 0650 – 3/8in. NPT
0666 to 1016 – 1/2in. NPT

Chart 2. Type 515C Inch Range (mm)

Seal Size (Inches)	Seal Size Code	D	D3	D4 Min.	D4 Max.	D26	D27	D28	D30	D94	D95	L15	L39	L42	L56
1.000	0254	25.40	39.0	41.0	50.4	114	77.5	12	59	54.3	61.4	28.5	46.0	31.5	18
1.125	0285	28.58	42.0	44.0	50.4	114	77.5	12	59	54.3	61.4	27.5	46.0	30.5	18
1.250	0317	31.75	45.8	47.8	50.4	114	77.5	12	59	54.3	61.4	32.5	48.0	35.5	18
1.375	0349	34.93	48.3	50.3	52.4	120	83.8	14	62	54.3	64.4	32.5	48.0	35.5	18
1.500	0381	38.10	54.0	57.0	60.4	125	90.3	14	69	60.9	71.4	31.5	51.0	34.5	18
1.625	0412	41.28	58.3	61.3	65.4	140	98.4	14	74	68.9	76.5	36.5	49.5	39.5	18
1.750	0444	44.45	58.3	61.3	65.4	140	98.4	14	74	68.9	76.5	36.5	51.5	39.5	18
1.875	0476	47.63	63.7	66.7	72.4	140	103.4	14	81	74.0	83.5	36.0	49.5	39.0	19
2.000	0508	50.80	69.0	72.0	77.4	145	113.8	18	86	78.0	88.5	42.3	49.5	45.3	19
2.125	0539	53.98	71.0	74.0	77.4	145	113.8	18	86	78.0	88.5	42.3	51.5	45.3	19
2.250	0571	57.15	73.3	76.3	82.4	150	118.9	18	92	83.1	94.6	42.3	49.5	45.3	19
2.375	0603	60.33	76.7	79.7	82.4	150	118.9	18	92	83.1	94.6	42.3	52.0	45.3	19
2.500	0635	63.50	79.4	82.4	87.4	160	123.9	18	96	88.1	98.6	42.3	54.0	45.3	19
2.625	0666	66.68	87.8	90.8	96.4	170	133.0	18	106	97.2	108.6	51.3	54.0	54.3	19
2.750	0698	69.85	94.0	97.0	101.4	180	138.0	18	111	102.2	113.7	51.3	54.0	54.3	19
2.875	0730	73.02	94.0	97.0	101.4	180	138.0	18	111	102.2	113.7	51.3	54.0	54.3	19
3.000	0762	76.20	100.6	103.6	109.4	195	143.1	18	121	107.3	123.7	60.8	54.0	63.8	20
3.125	0793	79.37	100.6	103.6	109.4	195	143.1	18	121	107.3	123.7	60.8	54.0	63.8	20
3.250	0825	82.55	106.0	109.0	114.4	200	159.5	22	125	117.3	127.8	60.8	54.0	63.8	20
3.375	0857	85.72	110.3	113.3	120.4	205	159.5	22	130	117.3	132.8	60.8	54.0	63.8	20
3.500	0889	88.90	110.3	113.3	120.4	205	159.5	22	130	117.3	132.8	60.8	54.0	63.8	20
3.625	0920	92.07	114.9	117.9	124.4	210	169.5	22	136	127.4	138.8	60.8	54.0	63.8	20
3.750	0952	95.25	121.3	124.3	128.4	215	169.5	22	140	127.4	142.9	60.8	54.0	63.8	20
3.875	0984	98.42	121.3	124.3	128.4	215	169.5	22	140	127.4	142.9	60.8	54.0	63.8	20
4.000	1016	101.60	121.3	124.3	128.4	215	169.5	22	140	127.4	142.9	60.8	54.0	63.8	20

Chart 3. Pressure/Velocity (PV) Limits



Direct drive or indirect drive are inherent options on all Type 515C cartridge seals, and the seals may be fitted using either method of drive: refer to the Type 515C Instruction Manual, I-515C-E.

To determine the maximum pressure for the size of Type 515C seal required for indirect drive applications, use the thin graph line of Chart 3 to find the limit, and then check the appropriate multiplier factors given in Chart 5. If any factors of less than 1.00 are involved, the normal direct drive PV limit must be calculated and the lower of the two limits used.

To determine the maximum pressure for the size of Type 515C seal required for direct applications, multiply the pressure obtained from the upper graph line of this chart by the appropriate factors given in Chart 5 – refer to the example.

Chart 4. Multiplier Factors

	Selection Considerations	Multiplier Factor
Sealed Fluid Lubricity	Petrol, Kerosene or better Water, Aqueous Solutions, Lighter Hydrocarbons (s.g. ≤ 0.65), etc.	x 1.00 x 1.00* x 0.75**
Face and Seat Materials	Carbon Graphite or Silicon Carbide Coated Graphite v. Silicon Carbide Carbon Graphite v. Aluminium Oxide	x 1.00 x 0.60
Sealed Fluid Temperature	200°C/390°F and below	x 1.00
Speed	3600 rpm and below	x 1.00

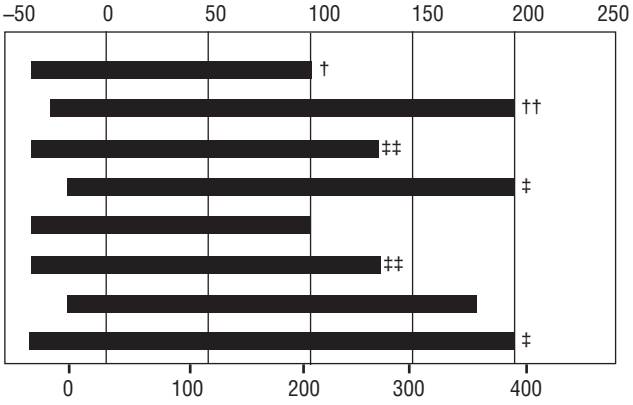
* Seal size codes up to and including 65mm/2.625in.
** Seal size codes above 65mm/2.625in.

Example for Determining PV Limits:

Seal: 80mm diameter Type 515C
Product: Water
Face and seat material: Carbon graphite v. silicon carbide
Operating temperature: 30°C/85°F
Operating speed: 3600 rpm
Using Chart 3, the maximum pressure would be 19.0 bar g/276 psig.
From Chart 5, apply the multiplier factors for the specific service requirements:
19.0 bar g/276 psig x 0.75 x 1.00 x 1.00 x 1.00 = 14.25 bar g/207 psig.
Therefore, for the example given, the maximum operating pressure is 14.25 bar g/207 psig.

Chart 5. Secondary Seal/Seat Ring Temperature Limits

Material	Temperature
Medium Nitrile	–40°C to +100°C/–40°F to +210°F
Fluorocarbon	–30°C to +200°C/–20°F to +390°F
Ethylene Propylene*	–40°C to +135°C/–40°F to +275°F
Perfluoroelastomer	–20°C to +200°C/–5°F to +390°F
Medium Nitrile (F.D.A.)**	–40°C to +100°C/–40°F to +210°F
Ethylene Propylene (F.D.A.)*	–40°C to +135°C/–40°F to +275°F
Pure PTFE	–20°C to +180°C/–5°F to +355°F
Glass Filled PTFE	–40°C to +200°C/–40°F to +390°F



* Not to be used for hydrocarbons or mineral oils.
** Can withstand repeated steam sterilisation at +120°C/250°F without adverse effect.
*** Although rated for lower temperatures, material should be limited to -40°C/-40°F in this seal.

† For hydrocarbon duties the limit is +120°C/250°F.
†† For water duties the temperature should not exceed +135°C/275°F.
‡ Although rated to a higher temperature, material should be limited to +200°C/390°F in this seal.
‡‡ For water/steam duties the limit is +150°C/300°F.

Chart 6. Criteria for Installation

Shaft/Sleeve	Limits
Surface Finish	0.2 to 1.2 µm Ra Fine Machined
Ovality/ Out of Roundness	0.05 mm/ 0.002 in.
End Play/ Axial Float Allowance	0.08 mm/ 0.003 in. F.I.M.
Housing Squareness to Shaft	See Chart 10.

Chart 7. Recommendation for Viscous Fluids

	Standard Seal and Seat	Standard Seal and Pinned or Clamped Seat	Standard Seat, with Hard Face and Pinned or Clamped Hard Seat					Refer to John Crane*
Fluid Viscosity (cSt)	0 to 750	750 to 1000	1000 to 3500					Above 3500
Max. Shaft Velocity (m/s)	25		10	8	6	4	3	*
Min. Radial Seal Clearance (mm)	Std.	5	10					
Heating at Start Up	Optional		Recommended					

cSt = Kinematic Viscosity Centistokes (cSt x 4.62 = SSU)
SSU = Saybolt Seconds Universal

METAL BELLOWS CARTRIDGE SEAL

Chart 8. Hydrostatic Pressure Limits

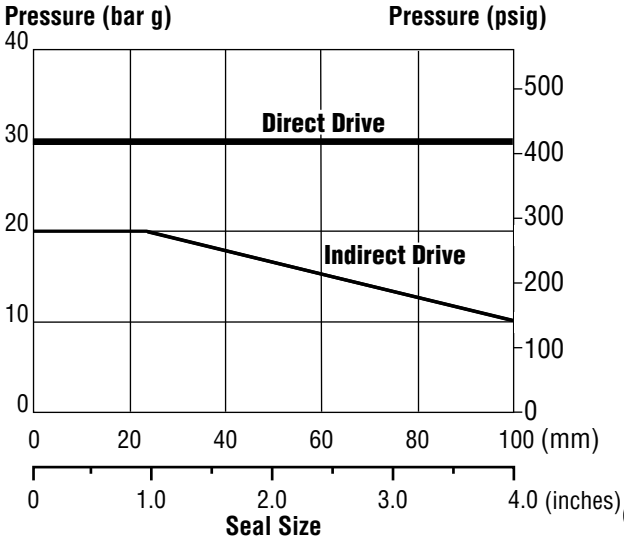
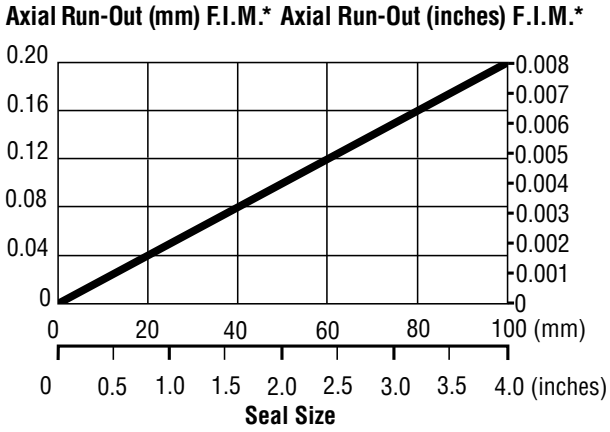


Chart 9. Housing Squareness to Shaft



*F.I.M. = Full Indicator Movement

Chart 10. Material Availability

SEAL COMPONENTS		MATERIALS	
Description		Standard	Optional
Seal Unit Assembly	Bellows	Inconel™ Alloy 718 †††	–
	Support Ring/Sleeve	FV 520BPH Stainless Steel	–
	Primary Ring/Face	Resin Impregnated Carbon Graphite	Silicon Carbide Coated Graphite
Secondary Seal O-Ring Seat O-Ring – 'BJ' Seat		Nitrile Ethylene Propylene Fluorocarbon	Perfluoroelastomer Nitrile† Ethylene Propylene†
Seat Ring – 'BK' Seat		Pure PTFE Glass Filled PTFE	–
Gasket		Compressed Fibre	–
Centralising Ring		Pure PTFE	–
Gland Plate Assembly Drive Collar Snap Ring Set Screws Blanking Plugs		316 Stainless Steel	–
'BK' Seat (Standard)		Sintered Silicon Carbide	–
'BJ' Seat (Optional)		99.5% Aluminium Oxide Ceramic	–
Throttle Bush (Standard)		Phosphor Bronze	–
Lip Seal (Optional)		Elastomer - Based †† PTFE - Based ††	–

† Material complies with The USA Federal Drug Administration (F.D.A.) Title 21 Paragraph 177.2600.
†† Use material according to quench medium: elastomer-based for grease or oil; PTFE-based for water. Lip seals will withstand internal pressure up to 1 bar g/15 psig.
††† Inconel is the trademark of Cabot Corp.

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