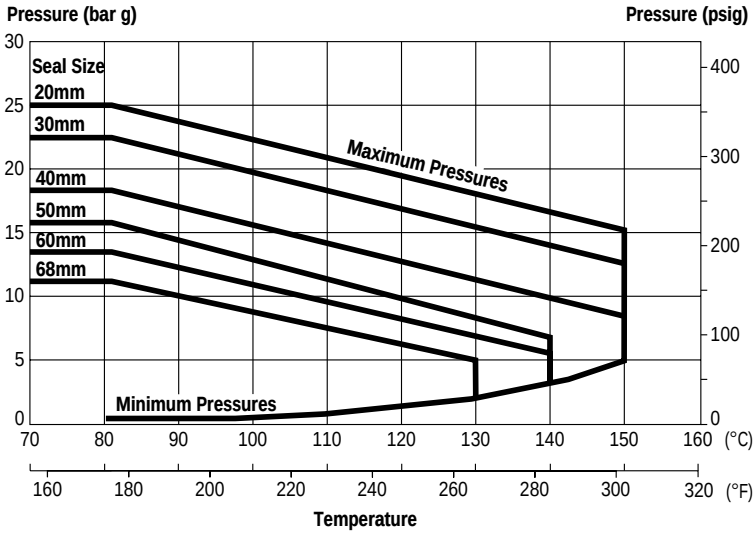
502

Elastomer Bellows Seal

Pressure/Temperature Limits for Hot Water



The graph shows maximum operating pressures/temperatures for seal sizes up to and including 68 mm when used with hot water above 80˚C/175˚F.

These pressure capabilities are based on the use of a carbon graphite face, a tungsten carbide seal and ethylene propylene elastomers. The limits are valid for shaft speeds of 3600 rpm maximum, with uncooled product recirculation.

PV Multiplier Factors

	Selection Considerations	Multiplier Factors
Sealed Fluid Lubricity	Petrol, Kerosene or better	x 1.00
	Water, Aqueous Solutions, Lighter Hydrocarbons (s.g. ≤0.65)	x 0.75
Face and Seat Materials	Carbon v. Sintered Silicon Carbide or Silicon Carbide Converted Graphite v. Sintered Silicon Carbide	x 0.80
	Tungsten Carbide v. Tungsten Carbide	x 0.60
	Carbon v. Aluminium Oxide or Austenitic Cast Iron	x 0.60
	Sintered Silicon Carbide v. Sintered Silicon Carbide	x 0.50
Sealed Fluid Temperature	up to 80°C /175°F	x 1.00
	Above 80°C to 120°C/175°F to 250°F	x 0.90
	Above 120°C to 180°C/250°F to 355°F	x 0.80
	Above 180°C to 230°C/355°F to 445°F	x 0.65
Speed	up to 1800rpm	x 1.00
	Above 1800 to 3600 rpm	x 0.85

Example for Determining PV Limits:

Seal: 45mm diameter Type 502

Product: Water

Face and seat material: Carbon graphite v. aluminium oxide

Operating temperature: +10°C/50°F

Operating speed: 1750 rpm

Using Pressure/Velocity (PV) Limits table, the maximum pressure would be 28 bar g/400 psig.

From PV Multiplier Factors table, apply the multiplier factors for the specific service requirements:

28 bar g/400 psig x 0.75 x 0.60 x 1.00 x 1.00 = 12.6 bar g/189 psig

Therefore for the example given the maximum operating pressure is 12.6 bar g/180 psig.

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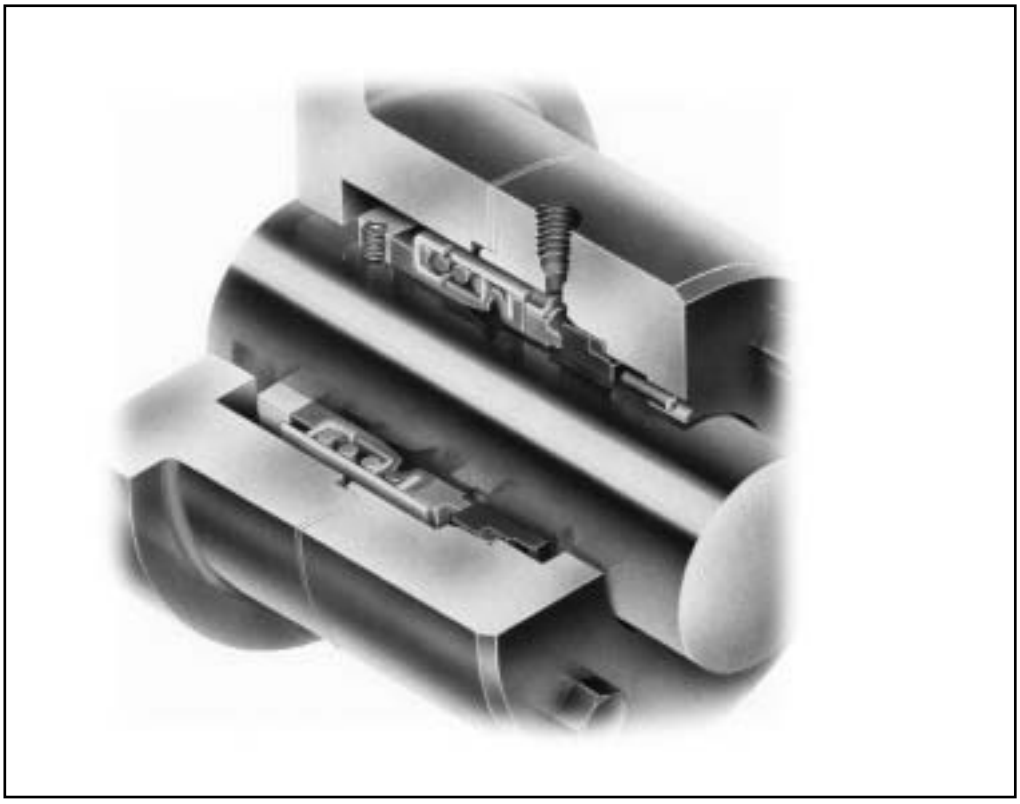
Industries Served

Chemical Processing
Conveyor and Industrial Equipment
Cryogenics
Food Processing
Gas Compression
Industrial Blowers and Fans
Marine
Mixers and Agitators
Nuclear Service
Offshore
Oil and Refinery
Paint and Ink
Petrochemical Processing
Pharmaceutical
Pipeline
Power Generation
Pulp and Paper
Water Systems
Wastewater Treatment
Water Desalination



Applications

The Type 502 is a full convolution elastomeric bellows seal designed for confined spaces and limited gland depths. Self-aligning feature compensates for excessive shaft end play and run-out.

- Industries include chemical processing, food processing, gas compression, marine, nuclear service, offshore, oil & refinery, paint & ink, petrochemical processing, pharmaceutical, pipeline, power generation, pulp and paper, wastewater, water desalination, water systems.
- All types of rotary equipment, pumps, marine, mixers, agitators, blowers, fans and compressors in a variety of service applications.
- Supplied completely assembled for fast installation and field repairable.
- Complies with DIN 24960, ISO 3069, and BS.5257:1975.

Operating conditions

Temperature: -40°C to +205°C/
-40°F to +400°F
depending on materials used

Pressures: up to 40 bar g/580 psig

Speed: up to 13 m/s/2500 fpm

Fluids

Paints and Inks
Water
Weak Acids

Design Features/Benefits

- **Fast Installation**
  Completely assembled one-piece design for fast installation.
- **Unitised Design**
  Unitised design incorporates positive retainer/key drive from bellows.
- **Non-Clogging, Single Coil Spring**
  Provides greater dependability than multiple spring designs. Will not be affected by build-up of solids.
- **Compact Design**
  Full convolution elastomeric bellows seal designed for confined spaces and limited gland depths. Self-aligning feature compensates for excessive shaft end play and run-out.

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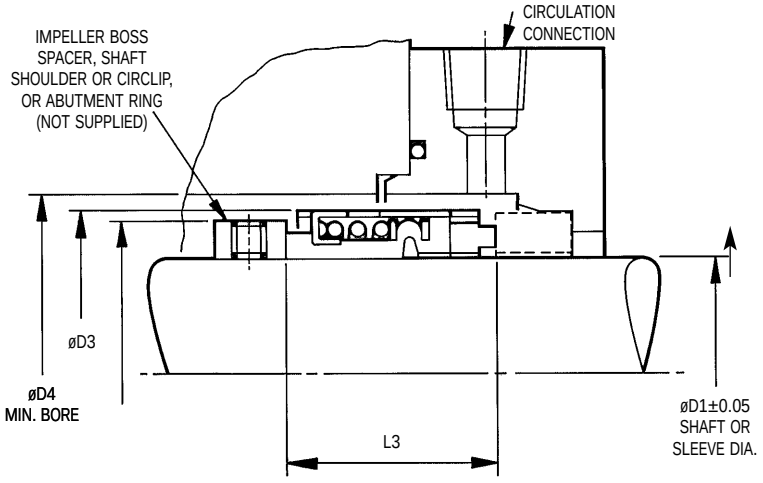
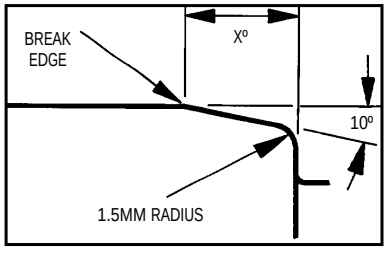
Type 502 Typical Arrangement/Dimensional Data (mm)





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

*Recommended chamfer lengths:

Seal Sizes	Dim. X
14 to 68 mm	3 mm
70 to 100 mm	8 mm

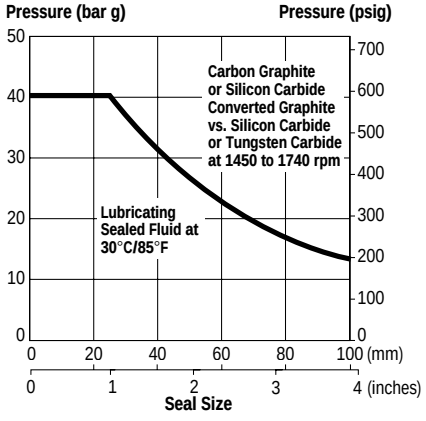
The working length for both single, L1K, and double, 2 x L1K, Type 502 seals conforms to DIN 24960 without special spacer pieces being needed.

Type 502 Dimensional Data (mm)

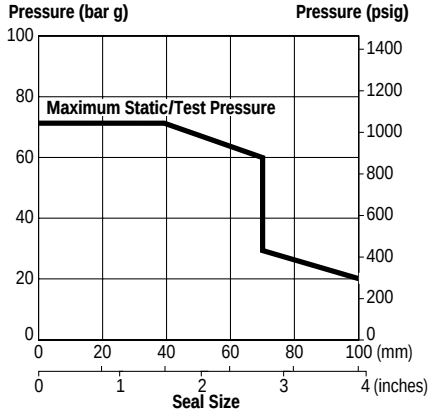
Seal Size (mm)	Seal Size Code	D1	D3	D4	D20 Min.	D20 Max.	L3
14	0140	14	24	26	16.0	22.5	23.0
16	0160	16	26	28	18.0	24.5	23.0
18	0180	18	32	34	20.0	29.0	24.0
20	0200	20	34	36	22.0	31.0	24.0
22	0220	22	36	38	24.0	33.0	24.0
24	0240	24	38	40	26.0	35.2	26.7
25	0250	25	39	41	27.0	36.3	27.0
28	0280	28	42	44	30.0	39.5	30.0
30	0300	30	44	46	32.0	41.5	30.5
32	0320	32	46	48	34.0	43.5	30.5
33	0330	33	47	49	35.0	44.5	30.5
35	0350	35	49	51	37.0	46.5	30.5
38	0380	38	54	58	40.0	51.0	32.0
40	0400	40	56	60	42.0	53.0	32.0
43	0430	43	59	63	45.0	56.0	32.0
45	0450	45	61	65	47.0	58.0	32.0

Seal Size (mm)	Seal Size Code	D1	D3	D4	D20 Min.	D20 Max.	L3
48	0480	48	64	68	50.0	61.0	32.0
50	0500	50	66	70	52.0	63.2	34.0
53	0530	53	69	73	55.0	66.2	34.0
55	0550	55	71	75	57.0	68.2	34.0
58	0580	58	78	83	60.0	74.0	39.0
60	0600	60	80	85	62.0	76.0	39.0
63	0630	63	83	88	65.0	79.0	39.0
65	0650	65	85	90	67.0	81.0	39.0
68	0680	68	88	93	70.0	84.0	39.0
70	0700	70	89	95	†	†	45.5
75	0750	75	96	104	†	†	45.5
80	0800	80	104	109	†	†	45.0
85	0850	85	108	114	†	†	45.0
90	0900	90	114	119	†	†	50.0
95	0950	95	118	124	†	†	50.0
100	1000	100	124	129	†	†	50.0

Pressure/Velocity (PV) Limits



Hydrostatic Pressure Limits



To determine the maximum pressure for the size of Type 502 seal required, multiply the pressure obtained from this table by the appropriate factors given in PV Multiplier Factors table. The maximum operating pressures shown apply under the following conditions: carbon graphite face/primary ring running against a silicon carbide or tungsten carbide seat/mating ring up to 1800 rpm, with a lubricating sealed fluid up to 80°C/175°F.

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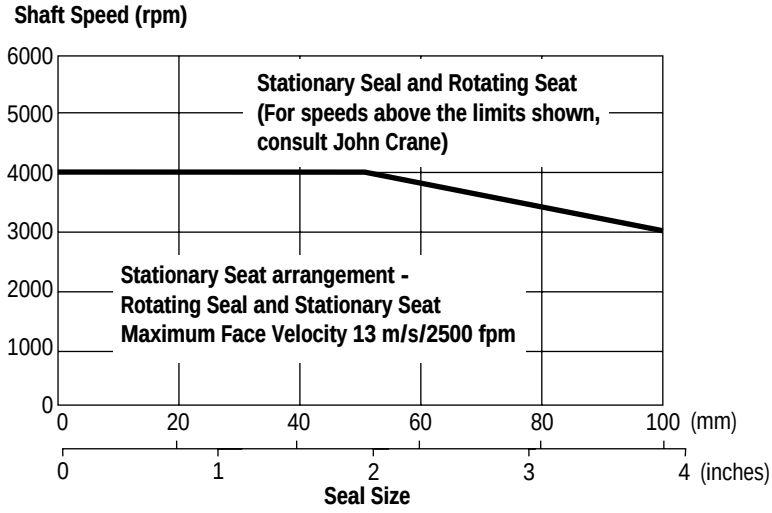
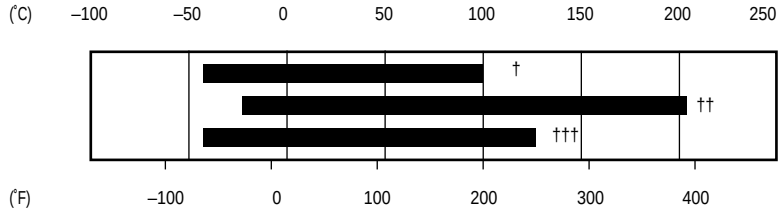
Speed Limits



Rotating seals may be used at speeds up to 4000 rpm according to seal size. Above the limit shown, it is necessary to stationary mount the seal unit and use a rotating seat. This would necessitate a special arrangement and would not conform to DIN 24960.

Elastomer Temperature Limits

Compound	Temperature
Nitrile	–40°C to +100°C/–40°F to +210°F
Fluorocarbon	–30°C to +205°C/–20°F to +400°F
Ethylene Propylene*	–40°C to +135°C/–40°F to +275°F



*Not to be used for hydrocarbons or mineral oils.

† For hydrocarbon duties the limit is +120°C/250°F.
†† For water duties the temperature should not exceed +135°C/275°F.
††† For water or steam duties the limit is +150°C/300°F.

Material Availability

SEAL COMPONENTS	MATERIALS	
Description	**Standard**	**Options**
Bellows Seat 0-Ring	Nitrile Fluorocarbon Ethylene Propylene	
Face	Silicon Carbide Converted Graphite Resin Impregnated Carbon Graphite	Antimony Impregnated Carbon Graphite
Retainer/Spring/Drive Ring Assembly (Metal Parts Set) Securing Ring ('BC' Seat)	316 Stainless Steel	
'BO' Seat* 'BC' Seat*	Austenitic Cast Iron (Ni-Resist) Aluminium Oxide Ceramic	Cobalt Bonded Tungsten Carbide Sintered Silicon Carbide
Abutment Ring† Setscrews†	316 Stainless Steel	

*Seat types 'BP' or 'BD' can be used for applications requiring a secured and/or pinned seat, with PTFE, exfoliated graphite or elastomer seat ring.
†Optional parts: not supplied unless specially ordered.

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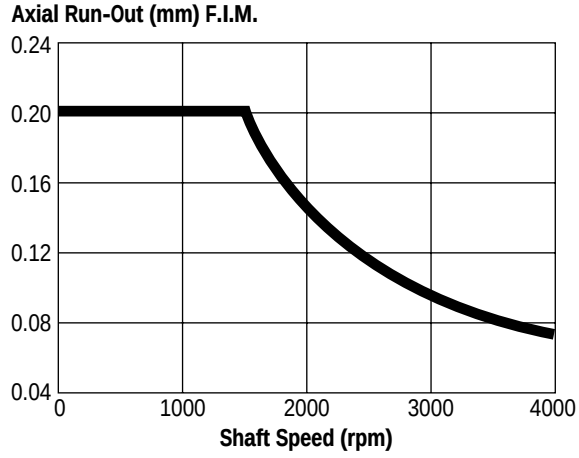
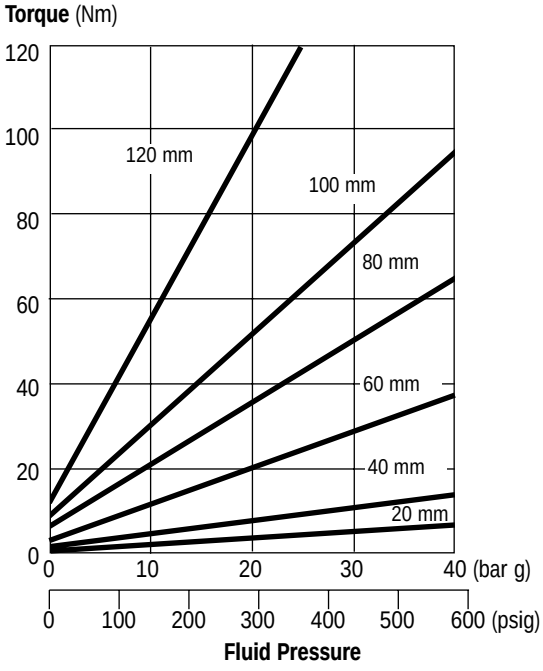
Criteria for Installation

Shaft/Sleeve	Limits
Surface Finish	0.8 to 1.2 µm Ra Fine Machined
Ovality/Out-of-Roundness	0.1mm/ 0.004 in.
End Play/ Axial Float Allowance	0.08mm/ 0.003 in.
Housing Squareness to Shaft	See Housing Squarness to Shaft table

Housing Squareness to Shaft



Breakout (Starting) Torque



The above specifications are given for general guidance only, and cannot be exact for every installation. The operating parameters shown are the recommended limits for continuous operation, and can be exceeded by a reasonable amount for limited periods. If the required performance for continuous operation is outside the specified limits, contact your John Crane Sales/Service Engineer.