DELCO

MECHANICAL SEALS

For Centrifugal and Chemical Pumps, Agitators, Compressors, Refineries, Supply Systems and Similar Applications

world WP pump

integrity and improved efficiency

THE MAIN FOCUS OF DELCO GROUP IS DELIVERING MAXIMUM VALUE AND HIGH QUALITY LEVEL PRODUCTS

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ELASTOMERIC BELLOWS AND MULTI SPRINGS MECHANICAL SEALS

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MATERIALS

TYPE DM

TYPE DL

TYPE DU

SEATS

QUALITY ASSURED

ELASTOMERIC BELLOWS AND MULTI SPRINGS MECHANICAL SEALS

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Materials

Material Identification and Coding

Bellows Material

E - EPDM Ethylene propylene Diene M-class rubber
P - NBR Nitrile Butadiene Rubber
V - VITON® flourocarbon rubber
K - KALREZ® preflourocarbon rubber
T - PTFE (TEFLON®)
G - Compressed graphite
X - FLUORAZ ®
A - AFLAS®

Spring(s)

M - Hastelloy C4 DIN 2.4610
G - AISI 316 DIN 2.4571
F - AISI 304 DIN 1.4301
M5 - Hastelloy C276 DIN 2.4819
T6 - AM 350 special alloy
S - Chromum-molybden steel

Stationary rings

Q1 - SIC sintered silicon carbide
Q2 - SIC reaction bonded silicon carbide
U3 - Tungsten carbide
V - Aluminum oxide (ceramic 95%)
V2 - Aluminum oxide (ceramic 97%)

Rotary rings

A - Antimony-impregnated carbon graphite
B - Carbon graphite
Q1 - Sintered silicon carbide
Q2 - Reaction bonded silicon carbide
U3 - Tungsten carbide

Construction material(s)

G - AISI 316
F - AISI 304
M5 - Hastelloy C276
T4 - Carpenter 42
T6 - AM 350 special alloy
S - Chromum-Molybden steel

Elastomeric Mechanical Seals

ELASTOMERIC BELLOWS AND MULTI SPRINGS MECHANICAL SEALS

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Operating principles and Fundamentals Behind Elastomeric Rotary Mechanical Seal

Centrifugal and rotary positive displacement pumps require controlling of the pumped fluids desire to exit through the stuffing box, the area where the pump shaft enters the pump fluid end.

When operating the pumped fluid within the stuffing box sees a pressure higher than the surrounding atmospheric pressure, and on static lift applications; during the priming cycle, the stuffing box will see a pressure below atmospheric pressure i.e., a vacuum. In either operating condition a mechanical seal will virtually eliminate the release of the pump age to atmosphere and the entrance of air into a stuffing box when under vacuum.

A basic mechanical seal is not a complex device. It consists primarily of a rotary seal face with a driving mechanism which rotates at the same speed as the pump shaft. a stationary seal face which mates with the rotary and is retained using a gland or in some pump models an integral stuffing box cover, a tension assembly which keeps the rotary face firmly positioned against the stationary face to avoid leakage when the pump is not in operation, and static sealing gasket(s) and elastomeric strategically located to complete the seal assembly.

The rotating and stationary sealing faces commonly referred to as primary seal members, are materials selected for their low coefficient of heat and are compatible with the fluid being pumped. Their extremely flat; lapped mating surfaces, make it extremely difficult for the fluid to escape between them. The fluid does however, forms a thin layer or film between the faces and migrates toward the low pressure side of the faces. It is this boundary layer of fluid which is used and required to cool and lubricate the seal faces.

To prohibit leakage along the pump shaft through the inside diameter of the rotary and stationary seal faces the mechanical seal assembly uses o-rings, v-rings, wedges and packing. Commonly referred to as secondary sealing members these components of the seal are selected based on fluid compatibility, temperature, elastomeric quality, and depending on the type and design of the seal they may perform in either a dynamic or static state.

Mechanical seal hardware represents the components required to apply mechanical tension to the rotating and stationary seal faces. This hardware; depending on seal design, can include springs, bellows, retaining rings, and pins. Not to be overlooked hardware materials must be constructed of suitable metallurgy compatible with the fluid. An appreciation of seal driving hardware is also extremely important when sealing viscous products as ample torque to rotate the seal must be made available when the fluid is at its standing viscosity when starting a pump, and effective viscosity at operating conditions.

Mechanical seal selection should never be addressed as simple, easy or standard, as it is this approach which results in inadequate performance. A mechanical seal will only perform as well as all the sealing components combined and any options and auxiliary systems which may be required. Failure to properly address any portion of the mechanical seal chain could result in catastrophic failure, down time, considerable damage and expense, and most importantly personal injury and possible damage to the environment.

Specific pumping application requirements will determine the complexity of the seal design to achieve optimum performance. Mechanical seal configurations and options are as vast as pump models and designs. Addressing all the application parameters and fluid behavior characteristics will result in long trouble free mechanical seal service and enhanced pump and process performance.

Materials

ELASTOMERIC BELLOWS AND MULTI SPRINGS MECHANICAL SEALS

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Elastomers and Rubber Identification

KALREZ®

Perfluoroelastomer
Kalrez is a registered trademark of DuPont Performance Elastomers L.L.C. These parts are based on perfluoroelastomeric material which is compounded and molded into O-rings, gaskets, mechanical seals and specialty parts. Kalrez has excellent resistance towards temperature and chemicals, some grades have a maximum continuous service temperature of 346°C.
perfluoroelastomeric (FFKM) O-rings and gaskets are generally used in applications of aromatic hydrocarbons and in highly corrosive fluids and can generally withstand to a temperature of -7 degree Celsius to maximum of 480 degree Celsius, at which point the material decomposes.

VITON®

Viton is a registered trademark of DuPont Performance Elastomers L.L.C.
and is an excellent elastomeric for use in high temperature applications. Also exhibits excellent chemical resistance to use in harsh environments such as phosphate esters. Widely used in applications dealing with extreme temperature and/or extreme chemicals. It is suitable to use with most chemicals. Makes it a popular elastomeric in chemical processing, paper / pulp mills, various chemical, acid and solvent applications. Use in tough sealing applications requiring extreme chemical resistance such as O-Rings, Hydraulic seals, Pneumatic seals and mechanical seals.

TEFLON®

Teflon is a registered trademark of E.I. DuPont de Nemours and Company (DuPont).
The molecular structure of PTFE consists of long chains of carbon atoms fully saturated by fluorine atoms. PTFE component parts for applications that require the high purity, chemical resistance, and thermal & electrical properties of performance and display exceptionally low coefficients of friction. Teflon fluoropolymer resins have exceptional resistance to high temperatures, chemical reaction, corrosion, and stress-cracking and can be used to fabricate o-rings, gaskets, mechanical seals and mechanical parts.

AFLAS®

Aflas is the trademark of AGC Chemicals, Asahi Glass Co. Ltd.
Aflas is resistant to highly reactive organic and inorganic chemicals. Aflas is highly resistant to automotive oils heavily formulated with amine additives. Aflas is suitable even in dirty environments, such as gear seals, mechanical seal and can be used to fabricate o-rings, gaskets, seals, packing where PTFE resin seals are not suitable.

FLUORAZ®

By Greene, Tweed & Co.
Fluoraz delivers an excellent performance in a variety of harsh environments, including the deep-well drilling, chemical, petrochemical, aerospace, automotive and refining industries. This versatile compound outperforms fluorocarbon and other conventional elastomers, even in the most severe circumstances. Fluoraz is derived from a modified structure of tetrafluoroethylene and propylene copolymers, providing significantly longer and more reliable service in a broad range of fluids, especially at elevated temperatures. Standard and customized. Its excellent performance in steam, hot water and nearly all caustics allows it to be the elastomer of choice in sterile water-for-injection, clean steam, and steam-in-place and clean-in-place systems.

ELASTOMERIC BELLOWS AND MULTI SPRINGS MECHANICAL SEALS

Material Applications

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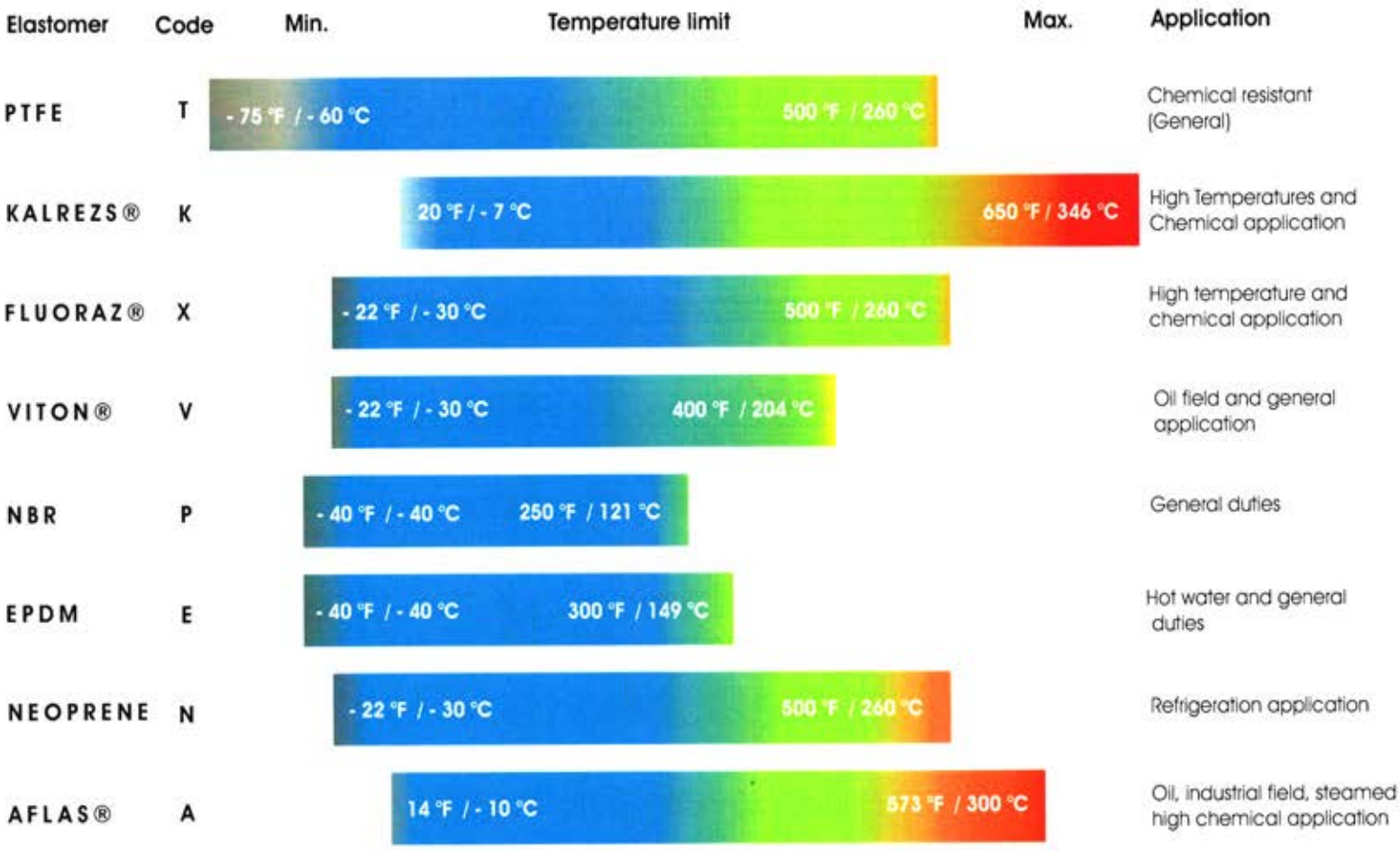
Elastomeric Temeprature and Application Limit



Best Performance and Working Temperature Condition For Seals Ring

Material	Max. Temperature	
Solid Tungsten Carbide	750°F	400°C
Solid Carbon-graphite	525°F	275°C
Solid Reaction Bonded Silicon Carbide	800°F	430°C
Solid Sintered Silicon Carbide	800°F	430°C
Solid Antimony Impregnated Carbon Graphite	700°F	370°C
Solid Pure Ceramic (Al2O3)	350°F	180°C

TYPE DM - 502

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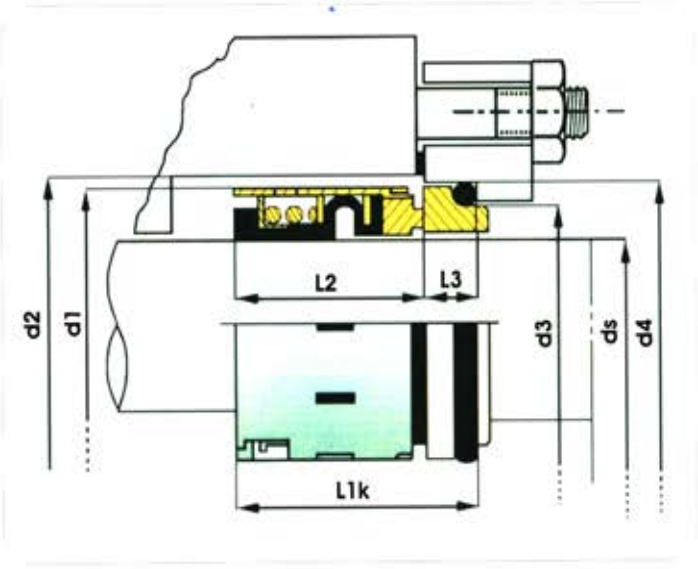
PROTECTED ELASTOMERIC BELLOWS ROTARY MECHANICAL SEAL FOR PLAIN SHAFT, SPRING ROTATING



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. Unitized for ease of installation and tolerance of shaft play & run-out. Bi-directional and robust drive to the seal face eliminates stresses on the bellows. The rubber bellows is supported by a metal body, enabling the seal to operate in particular difficult heavy duty fluid application with excessive run-out.
Available in metric sizes from 14mm to 100mm.

TYPE DM - 502 Dimensional Data

Code	ds	d1	d2	d3	d4	*L1K	*L2	L3
0140	14	24	25	20.6	25.1	33.0	23.0	10.0
0160	16	26	27	22.6	27.1	33.0	23.0	10.0
0180	18	32	34	26.6	33.1	35.5	24.0	11.5
0200	20	34	36	28.1	35.1	35.5	24.0	11.5
0220	22	36	38	30.6	37.1	35.0	24.0	11.5
0240	24	38	40	32.6	39.1	38.2	26.7	11.5
0250	25	39	41	33.6	40.1	38.5	27.0	11.5
0280	28	42	44	36.7	43.1	41.5	30.0	11.5
0300	30	44	46	38.6	45.1	41.5	30.0	11.5
0320	32	46	48	41.6	48.1	42.0	30.5	11.5
0330	33	47	49	41.6	48.1	42.0	30.5	11.5
0350	35	49	51	43.6	50.1	42.0	30.5	11.5
0380	38	54	56	48.6	56.1	46.0	32.0	14.0
0400	40	56	59	50.6	58.1	46.0	32.0	14.0
0430	43	43	62	53.6	61.1	46.0	32.0	14.0
0450	45	61	64	55.6	63.1	46.0	32.0	14.0

Code	ds	d1	d2	d3	d4	L1K	*L2	L3
0480	48	64	67	58.6	66.1	46.0	32.0	14.0
0500	50	66	69	61.6	70.1	49.0	34.0	15.0
0530	53	69	74	64.6	73.1	49.0	34.0	15.0
0550	55	71	74	66.6	75.1	49.0	34.0	15.0
0580	58	78	81	69.6	78.1	54.0	39.0	15.0
0600	60	80	84	71.6	80.1	54.0	39.0	15.0
0630	63	83	87	74.6	83.1	-	39.0	-
0650	65	85	88	76.6	85.1	54.0	39.0	15.0
0680	68	88	92	80.6	90.1	57.0	39.0	18.0
0700	70	90	94	82.5	92.1	63.5	45.5	18.0
0750	75	95	99	87.5	97.1	63.5	45.5	18.0
0800	80	104	109	94.6	105.1	63.7	45.0	18.2
0850	85	109	114	99.6	110.1	63.7	45.0	18.2
0900	90	114	119	104.6	115.1	63.7	50.0	18.2
0950	95	119	124	109.6	120.1	67.2	50.0	17.2
01000	100	124	129	114.6	125.1	67.2	50.0	17.2

Metric sizes. From 14 .....100 mm

Fitting length tolerance: ds 14 .. 22 mm ±1.0; ds 24 .. 30 mm ±1.5; ds 32 .. 100 mm ± 2.0

Design and featuring : Complying with DIN24960

*L2 = Standard seal working length.

*L1K = Based on Stationary Seat G9.

PROTECTED ELASTOMERIC BELLOWS ROTARY MECHANICAL SEAL FOR PLAIN SHAFT, SPRING ROTATING

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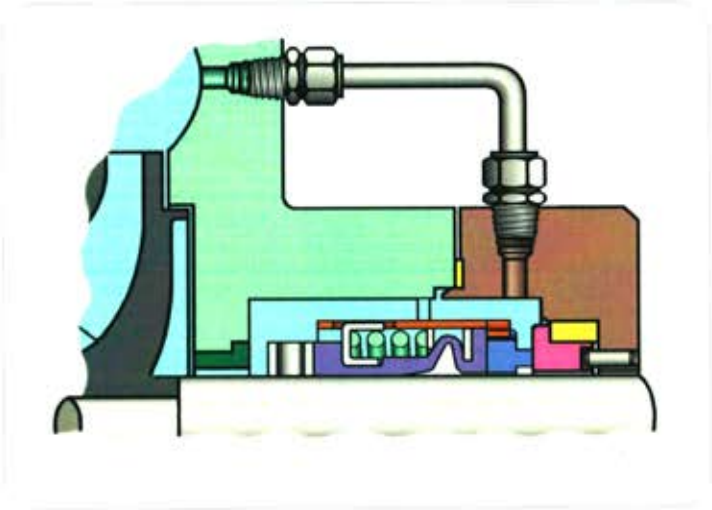
TYPE DM - 502

TYPE DM - 502 Mechanical View

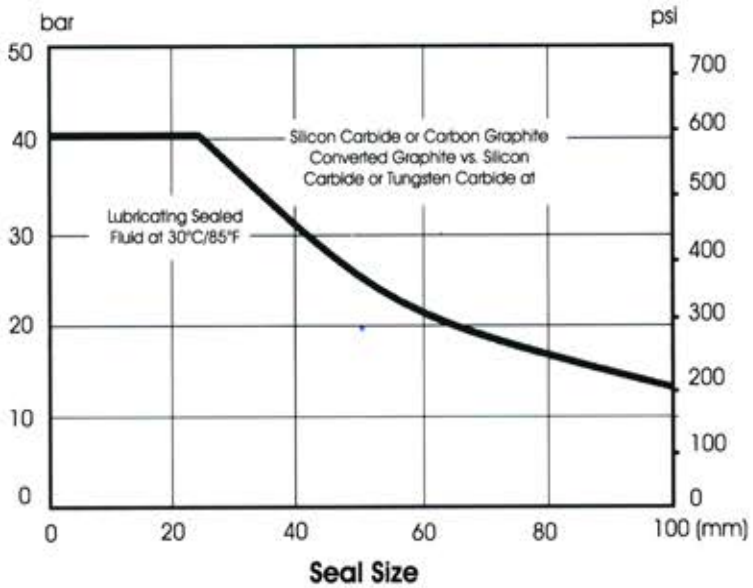


Material Availability and Technical Data

Bellows	P - E - V - A
Rotary Face	A - B - Q1 - Q2 - U3
Stationary Face	U3 - V - V2 - Q1 - Q2
Spring	G - M - F
Metal parts set	G - F
Max. Pressure	Up to 40 bar / 580 psi (Table 1 and Table 2)
Max. Speed	Speed up to 13 m/s - 2500 fpm (Table 3)
Available Sizes	9/16" to 4.00" / 14 mm to 100 mm
Temperature Limit: (Upon Elastomer)	-40°C to +205°C / -40°F to +400°F

Pressure and Velocity

Table 1



Example

Examples for Determining Pressure and Velocity Multiplier factors limits (Table 1 and 2):

Seal: 50mm diameter
Product: Kerosene
Face and seat material: Tungsten Carbide vs. Tungsten Carbide
Operating temperature: +85°C/185°F
Operating speed: 3600 rpm

Using Pressure/Velocity Limits (Table 1), the maximum pressure would be 23 bars/330psi.
From (Table 2) Multiplier Factors tables, apply the multiplier factors for the specific service requirements:
23 bar (330 psi) x 1.00 x 0.60 x 0.90x 0.85 = 10.6 bar /154 psi
Therefore, for the example given the maximum operating pressure is 10.6 bar /154 psi.

PROTECTED ELASTOMERIC BELLOWS ROTARY MECHANICAL SEAL FOR PLAIN SHAFT, SPRING ROTATING

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TYPE DM - 502

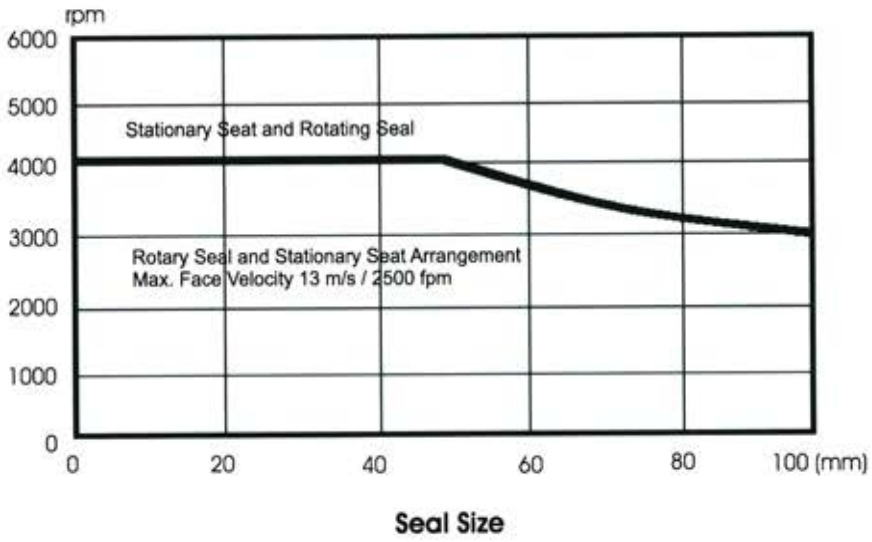
Installation

Assemble under extra-clean condition.
Make sure all edges, The lead-in edge of the shaft or sleeve, shoulders and transitions which come in to contact with the sealing parts during installation are sufficiently chamfered or round off (Table 5). wet the clean shaft with some low-surface tension water (add detergent) or lubricate with silicon grease, then feed the bellows with a slight twist in clock wise direction on to the shaft.

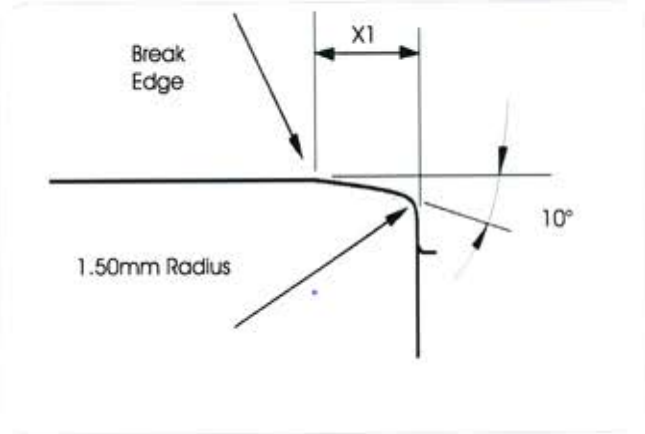
Important Note:
No tightening, No force!
Never place rotary and stationary seals onto their seal faces; Rotary and stationary seals with seal face defects & worn out face or damaged secondary seals should not be installed.

Speed Limits

Table 4

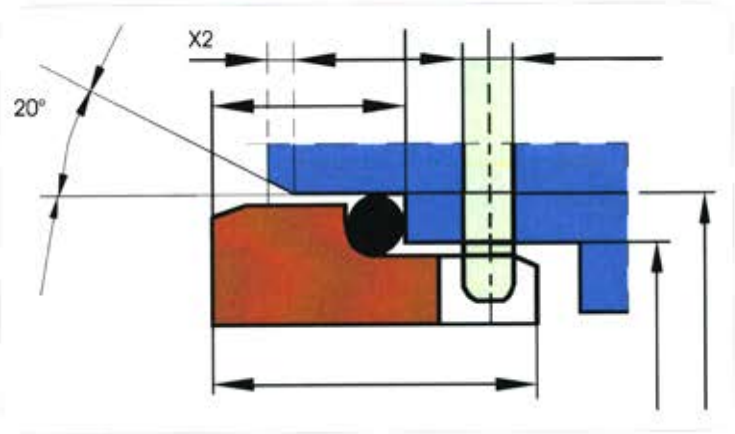


Recommended Chamfered Lengths Shaft



(X1) Seal Sizes:
3 mm chamfered length for size14 to 68 mm
8 mm chamfered length for size 70 to 100 mm

Recommended Chamfered Lengths Seat



(X2) Seat Sizes:
1.5 mm chamfered length for size 10 to 18 mm
2.0 mm chamfered length for size 19 to 48 mm
2.5 mm chamfered length for size 50 to 75 mm