

## ROD AND ROD GROOVE DIAMETERS

ROD DIAM RANGE, IN.	ROD DIAM. TOLERANCE	GROOVE DIAM TOLERANCE	MAX DIAMETRICAL CLEARANCE		
			1000 PSI	3000 PSI	5000 PSI
.125 - .687	+ .0 / -.002	+ .004 / -.0	.008	.006	.004
.750 - 2.875	+ .0 / -.003	+ .008 / -.0	.012	.008	.004
3.000 - 7.000	+ .0 / -.004	+ .010 / -.0	.014	.010	-
7.000 - 7.750	+ .0 / -.005	+ .011 / -.0	.016	.010	-
8.000 - 9.500	+ .0 / -.005	+ .012 / -.0	.016	-	-
10.000 - 15.000	+ .0 / -.006	+ .015 / -.0	.016	-	-


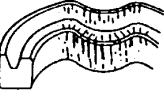



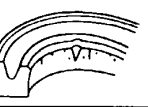






## BORE AND PISTON GROOVE DIAMETERS


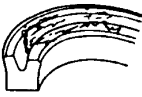
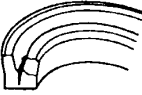

BORE DIAM RANGE, IN.	BORE DIAM. TOLERANCE	GROOVE DIAM TOLERANCE	MAX DIAMETRICAL CLEARANCE		
			1000 PSI	3000 PSI	5000 PSI
.750 - 1.062	+ .003 / -.0	+ .0 / -.004	.010	.008	.004
1.125 - 1.625	+ .003 / -.0	+ .0 / -.005	.010	.008	.004
1.750 - 2.500	+ .003 / -.0	+ .0 / -.007	.012	.008	.004
2.625 - 2.875	+ .003 / -.0	+ .0 / -.008	.012	.008	.005
3.000 - 3.500	+ .004 / -.0	+ .0 / -.008	.014	.010	-
3.625 - 5.625	+ .004 / -.0	+ .0 / -.009	.014	.010	-
5.750 - 6.750	+ .004 / -.0	+ .0 / -.010	.014	.010	-
7.000 - 8.500	+ .005 / -.0	+ .0 / -.011	.016	.010	-
9.000 - 11.000	+ .005 / -.0	+ .0 / -.011	.016	-	-
12.000 - 16.000	+ .006 / -.0	+ .0 / -.012	.018	-	-

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TYPE OF FAILURE	VISIBLE CONDITION	PROBABLE CAUSE	POSSIBLE CURE
HARDENING	Hardening of the dynamic face causing glazing and cracks 	Heat generated by high speed	Slow stroke speed Use alternative seal device
	Hardening of the whole seal. Loss of elasticity. 	High fluid temperature. Deterioration of fluid. Compatibility of seal to fluid	Lower oil temperature. Renew Fluid Change to different seal compound
WEAR	Dynamic face is worn to glossy mirror-like finish 	Insufficient lubrication	Check oil viscosity Use alternative seal device
	Wear on dynamic lip is egg-shaped 	Rod or piston bore not concentric	Hone to within seal specs Replace worn rod or cylinder tube
	Abnormal wear on one side of the dynamic lip 	Worn bearing or wear ring. Excessive lateral load	Replace bearings Increase bearing area
SCARRING	Cut or dent on the lip 	Storage on a nail or peg. Improper installation tool	Store flat in a plastic bag in a closed cardboard box Installation tools should not have sharp edges
	Scratches on the dynamic side 	Scars on the rod or bore. Foreign material in fluid	Hone, polish, and de-burr metal parts Flush system
SWELLING	Material soft and misshaped 	Absorption of fluid. Fluid and seal are incompatible. Water in system	Change seal compound or system fluid Flush system
DETERIORATION	Cracks and loss of elasticity. Material easily crumbles 	High fluid temperature. Exposure to ozone or sunlight	Lower oil temperature Store seals away from sunlight and arc welding area.
GROOVING	Axial cuts on the dynamic side 	Metal chips or other foreign material in system. Imploded air bubbles	Flush system Bleed air from system
EXTRUSION	Extruded material on dynamic side of heel 	Gap between mating surfaces too wide. Worn bearings. Pressure extreme	Employ back-up ring. Replace bearings. Use alternative seal
	Extruded material on static side of seal 	Uneven support surface. Undersize back-up ring	Machine surface. Correct back-up size

TYPE OF FAILURE	VISIBLE CONDITION	PROBABLE CAUSE	POSSIBLE CURE
FRACTURING	Chunks of material torn from dynamic side 	Excessive back pressure	Check relief valves
	Pressure side of seal burned and broken 	Explosion of residual air at high pressure. "Dieseling"	Check maximum pressure. Bleed air from system
	Long cracks in the "V" portion of the seal 	Frequent high pressure shocks or spikes. Low temperature start-up	Use alternative style seal. Warm system before applying pressure
	Breaking off of entire dynamic side 	Deterioration of material and/or fluid	Use alternative material or seal. Flush system

*For a professional analysis of seal failure, send your damaged seals to our Engineering Department.*