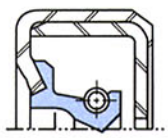
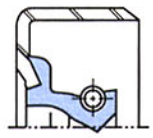
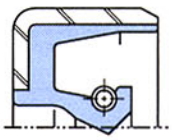
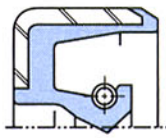
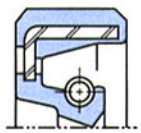
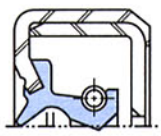
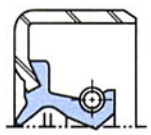
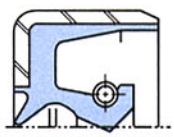
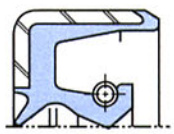
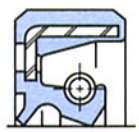
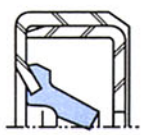
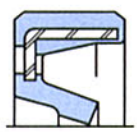
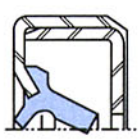
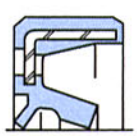
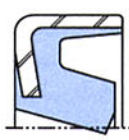
FREUDENBERG-NOK STANDARD SEAL TYPES

TABLE 1

LIP SYMBOLS \ BODY SYMBOLS		A2 Metal O.D. design with an inner case for greater structural rigidity.	B2 Most standardized and economical metal O.D. design.	B Metal O.D. design with fluid side rubber covered.	BR Part rubber/part metal O.D. design for greater O.D. sealing ability.	C Rubber O.D. design for excellent O.D. sealing ability.
S	General nonpressure fluid sealing applications and severe grease sealing conditions.	SA2 	SB2 	SB 	SBR 	SC 
T	General nonpressure fluid sealing applications and severe grease sealing conditions with light duty exclusion of foreign materials.	TA2 	TB2 	TB 	TBR 	TC 
V	Economical design for grease retention or sealing viscous fluid.	VA2 	VB2 	VB 	VBR 	VC 
K	Economical design for grease retention or sealing viscous fluid with light duty exclusion of foreign materials.	KA2 	KB2 	KB 	KBR 	KC 
WP	Dust wiper or scraper for hydraulic or pneumatic cylinder applications			WPB 		WPC 

NOTE:

Metal O.D. seals are most suitable for steel or cast iron housing materials.

Rubber covered O.D. seals are preferred for soft alloy or plastic housing materials and are suitable as well for steel or cast iron housings. Also, this design category is best for rough bore finishes or for materials with a high coefficient of thermal expansion.

OPERATING CONDITIONS ("S" & "T" CONFIGURATIONS)

TABLE 2 **DESIGN LIMITATIONS**

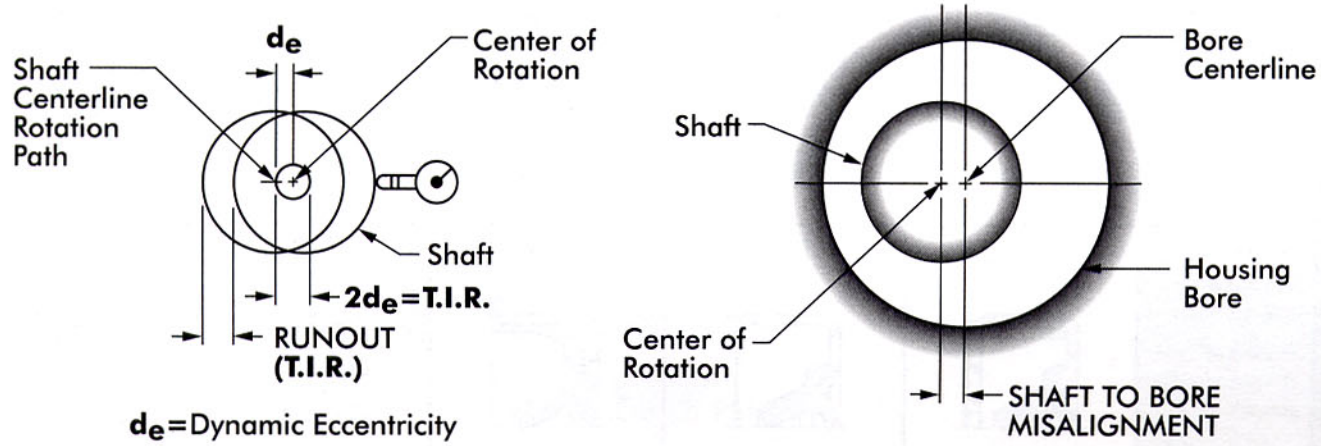
SHAFT DIAMETER	NITRILE LIP MAXIMUM CONTINUOUS SHAFT SPEED	MAXIMUM CONTINUOUS PRESSURE	MAXIMUM TOTAL ECCENTRICITY
General	3,500 rpm	5 psi	.020"
.500	8,000 rpm	5 psi	.004"
1.500	7,000 rpm	5 psi	.006"
2.500	4,500 rpm	5 psi	.010"
3.500	3,800 rpm	5 psi	.013"
4.500	2,750 rpm	5 psi	.017"

NOTE:
Higher shaft speeds possible using higher temperature materials such as polyacrylate, fluoroelastomer or silicone.

Slightly higher continuous pressure is possible for shaft speeds below 200 fpm.

Higher eccentricity is allowable if shaft speed is reduced.

ECCENTRICITY



Eccentricity is determined by measuring the shaft runout, TIR, and the shaft-to-bore misalignment. Combine the two results for the total eccentricity the seal lip must follow to function effectively. As eccentricity increases, and/or shaft speed increases, it becomes more difficult for the lip to follow the shaft.

OPERATING CONDITIONS ("V" & "K" CONFIGURATIONS)

TABLE 3 **DESIGN LIMITATIONS**

SHAFT DIAMETER	MAXIMUM SHAFT SPEED	MAXIMUM CONTINUOUS PRESSURE	MAXIMUM TOTAL ECCENTRICITY
General	2,000 rpm	4 psi	.005"
.500	4,000 rpm	4 psi	.003"
1.500	3,000 rpm	4 psi	.005"
2.500	2,300 rpm	4 psi	.006"
3.500	1,700 rpm	4 psi	.008"
4.500	1,400 rpm	4 psi	.010"

NOTE:
Higher eccentricity is allowable if maximum shaft speed is reduced.

A nonsprung seal design offers a cost effective way to seal high viscosity grease applications. Because the design does not benefit from the constant load of a garter spring, the allowable eccentricity is decreased and the fluids to be sealed are limited.

OPERATING CONDITIONS ("WP" CONFIGURATIONS)

TABLE 4 **DESIGN LIMITATIONS**

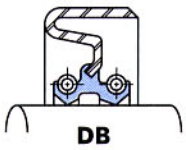
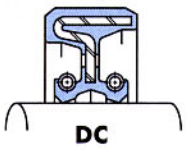
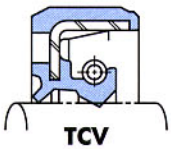
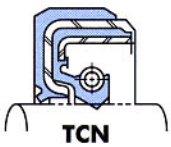
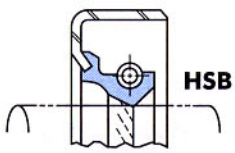
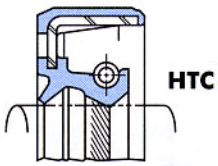
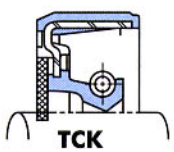
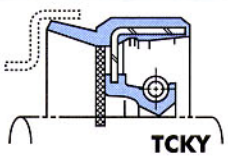
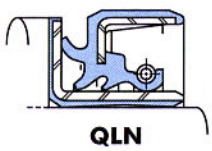
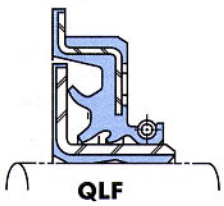
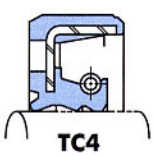
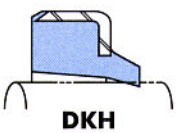
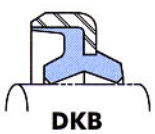
Maximum Shaft Linear Velocity	200 fpm (1 m/sec.)
Maximum Pressure Capability	4 psig (.28 kg/cm^2)
Maximum Stroke Length	78 inches (1.98 m)
Maximum Shaft-To-Bore Misalignment	0.004 inches (0.1 mm) TIR

The "WP" design was developed as a dust wiper (scraper) for reciprocating applications, such as hydraulic cylinder rods. As a result, the operating limits are different from the "V" & "K" type provided above.

NONSTANDARD DESIGNS

TABLE 5

Special applications which cannot be adequately satisfied by standard designs are illustrated on the next two pages.

FREUDENBERG-NOK DESIGN		DESIGN CHARACTERISTICS
"D" Style	 DB  DC	Applications which require separating two fluids from each other should use two garter spring loaded lips. The "D" style seal incorporates the two lips into one design. Note: The bore depth must be increased to accommodate the two seal lips.
"TCV" (Medium Pressure)	 TCV	For applications up to 50 psi (3.5 kg/cm²), the "TVC" design is recommended. Pressure limit is dependent on shaft speed. Available for shaft diameters less than 2.500" (65 mm).
"TCN" (High Pressure)	 TCN	Type "TCN" is designed for high pressure applications where continuous pressure may reach 150 psi (10.6 kg/cm²). Maximum pressure limit is dependent on shaft speed.
"H" Style	 HSB  HTC	Hydrodynamic sealing lips are available with most designs. Both unidirectional and bidirectional helical ribs are available. The helical ribs help "pump" the fluid back under the seal lip. Basic lip design is same as standard seal.
"K" (Fabric Auxiliary Lip)	 TCK  TCKY	Where dirt or dust ingestion is a problem, the "TCK" design provides superior exclusion. Where dust or dirt and moisture (small quantities of water) mixture are evident, combination with a slinger provides excellent results (TCKY).
"QL" (Sleeve Oil Seals)	 QLN  QLF	The "QL" seal is specially designed for mud or very dirty applications. Maximum shaft speed is limited to 10 ft/sec. (3 m/sec.).
"T4" (Reciprocating)	 TB4  TC4	Severe reciprocating shaft applications can be effectively sealed by the "T4" design. Pressure up to 100 psi (7 kg/cm²) can be sealed, such as in shock absorbers.
"DK" (Reciprocating)	 DKH  DKB	Dust wiper for hydraulic cylinders. Not recommended for pressures above 5 psi (.35 kg/cm²).