

CHENG MAO  
PRECISION SEALING 2016VER.

<http://www.tcsoilseal.com>



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## COMPANY

Taiwan TCS Seals, CHENG MAO PRECISION SEALING CO., LTD is one of leading oil seals manufacturers with 30 years experiences in oil seals design. Professional with high quality skills and experiences in the areas of oil seals, packings, u-cups, gaskets, rubber parts and o-rings. TCS is capable of producing sealing products from design, drawings, researching, development, testing, and making molds to finished products independently.

### CERTIFICATION

ISO / TS16949: 2009, design and manufacture of oil seals.  
ISO 9001

### BRAND

TCS

### INVESTMENT

5,000 square meters of the factory buildings.  
Invested US\$3,500,000 in hardware and software devices as for manufacturing facilities.



CNC Professional Mold Making

Automatic Rubber-Cutting Machine

5S Production Section



Rheometer Machine

Power Steering Tester

Micro-vu 2.5D Testing Equipment



## PRODUCT SPECIFICATIONS

### Oil Seals for Automotive Applications

- 1) Power Steering Seals
- 2) Heavy Duty Wheel Seals
- 3) A/C Compressor Seals
- 4) Crankshaft and Camshaft Seals
- 5) Shock Absorber Seals
- 6) Gas Spring Seals
- 7) Bellows and Dust Boots
- 8) Alternator Seals
- 9) Transmission Seals

### Oil Seals for Industrial Applications

- 1) Rotary Shaft Seals
- 2) High Pressure Seals
- 3) Gear Reducer Seals
- 4) Motor Seals
- 5) Pneumatic Tool Seals
- 6) V-Seals (VA, VS, VL, VE)
- 7) PTFE Seals
- 8) Axial Face Seals

- 9) Bonded Seals
- 10) End Caps
- 11) Oil Gauge Seals
- 12) Bearing Unit Seals

### Oil Seals for Agricultural, Constructional, Mining Applications

- 1) Oil Seals for agricultural equipments
- 2) Oil Seals for constructional equipments
- 3) Oil Seals for mining equipments

### Seals for Pneumatic or Hydraulic Applications

- 1) Pneumatic Seals
- 2) Hydraulic Seals
- 3) Rod Wipers
- 4) Fabric reinforced OD Seals
- 5) O-Rings, X-Rings, Wear Rings, O-Ring Kits, O-Ring Cords

### Oil Seals for Consumer Electronics Applications

- 1) Laundry Washer Seals
- 2) Squeezer Seals

## Repair Kit

Provide a Variety of Combinations of Vehicles Repair Kit Package  
(Ex: TOYOTA, MITSUBISHI, NISSAN... etc.)

## MATERIAL

NBR (Nitrile)  
HNBR (Hydrogenated NBR)  
EPDM (Ethylene Propylene Diene)  
VMQ (Silicone)  
FKM (Fluorocarbon)  
PTFE (Polytetrafluoro Ethylene)  
ACM (Polyacrylate)  
PU (Polyurethane)  
CR (Chloroprene Rubber)  
SBR (Styrene Butadiene Rubber)

## SIZE

Metric  
Inch

## STANDARD

JIS  
ASTM  
DIN  
BS  
SAE

## EQUIPMENTS

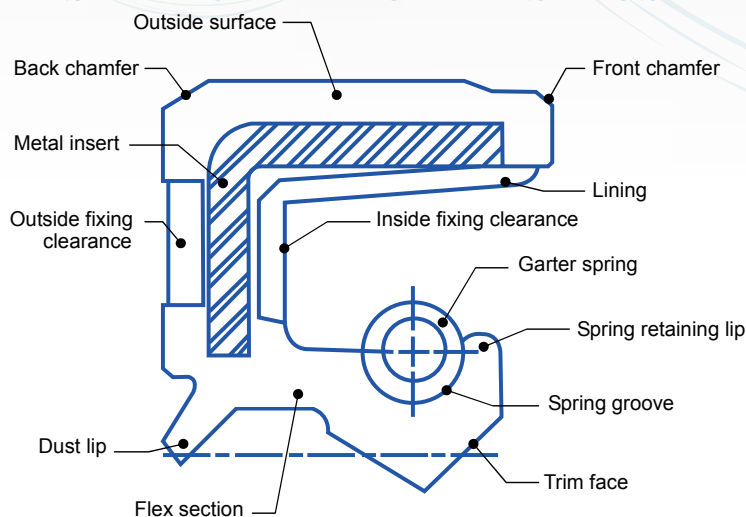
For material research: tensile testers, hardness testers, oscillating disc Rheometers, etc.

For design and R&D: seal life testers, radial load testers, etc.

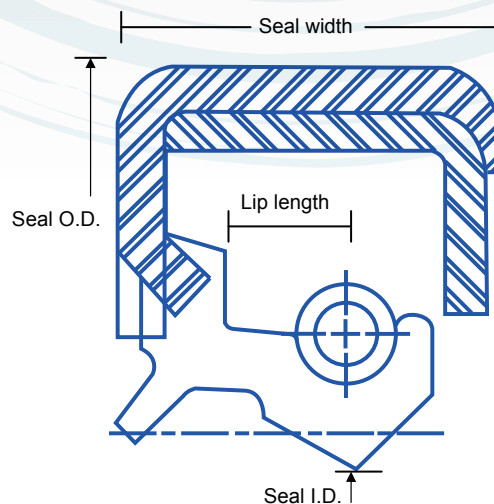
For production: automatic CNC lathes, rubber compound kneaders, rubber cutters, rubber slicers, low temperature storage, sanding machines, bonding machines, rubber compression molding machines, trimming machines, etc.

For QC: Micro-Vu, hardness testers, etc.

## OIL SEAL CHARACTERISTICS



TC Type



TA Type

## Seal I.D. Tolerance Chart - Inch

SHAFT	I.D.	Tolerance	Spring loaded	Tolerance
up to 0.500	-0.027	+0.004/-0.008	-0.039	±0.008
0.501~1.000	-0.032		-0.044	
1.001~2.000	-0.035	+0.006/-0.012	-0.053	±0.012
2.001~3.000	-0.040		-0.060	
3.001~4.000	-0.048		-0.068	
4.001~6.000	-0.056		-0.076	
6.001~10.000	-0.062	+0.008/-0.016	-0.086	±0.016
10.001~13.000	-0.070		-0.094	
13.001~16.000	-0.078		-0.102	
16.001~20.000	-0.086		-0.110	
20.001~40.000	-0.120		+0.010/-0.020	
40.001~	-0.140	+0.012/-0.020	-0.178	±0.024

## Seal O.D. Tolerances Chart - Inch

Bore Diameter	Metal case	Tolerance	Rubber covered case	Tolerance	G type	Tolerance	
up to 1.000	+0.004	±0.002	+0.006	±0.003	+0.010	±0.003	
1.001~2.000			+0.007		+0.012	±0.004	
2.001~3.000			+0.008		+0.014		
3.001~4.000	+0.005	±0.003/-0.002	+0.010	±0.004	+0.016	±0.006/-0.004	
4.001~6.000			+0.012		+0.016		
6.001~8.000	+0.006	±0.004/-0.002	+0.012	±0.004	+0.018	±0.006/-0.004	
8.001~10.000	+0.006				+0.014		+0.020
10.001~20.000	+0.008	±0.003/-0.002	+0.012	±0.005	+0.022	±0.008/-0.004	
20.001~40.000					+0.018		+0.024
40.001~60.000					+0.020		+0.026

## Seal Width Tolerances Chart - Inch

Width	Tolerance
All width	+0.015/-0.015

### Seal I.D. Tolerance Chart - Metric

SHAFT	I.D.	Tolerance	Spring loaded	Tolerance
<10.00	-0.60	+0.10/-0.20	-0.90	±0.20
10.01~18.00	-0.70		-1.00	
18.01~30.00	-0.80		-1.10	
30.01~50.00	-0.90	+0.15/-0.30	-1.40	±0.30
50.01~80.00	-1.10		-1.60	
80.01~120.00	-1.30		-1.80	
120.01~180.00	-1.50		-2.00	
180.01~250.00	-1.60		-2.20	
250.01~300.00	-1.80	+0.20/-0.40	-2.40	±0.40
300.01~400.00	-2.00		-2.60	
400.01~500.00	-2.20		-2.80	

### Seal O.D. Tolerances Chart – Metric

Bore Diameter	Metal case Tolerance	Rubber covered case Tolerance	G type Tolerance
<10.00	+0.20/+0.10	+0.30/+0.15	+0.40/+0.20
10.01~18.00			
18.01~30.00			
30.01~50.00	+0.23/+0.13	+0.35/+0.20	+0.45/+0.25
50.01~80.00			+0.50/+0.30
80.01~120.00	+0.25/+0.15	+0.45/+0.25	+0.55/+0.35
120.01~180.00	+0.28/+0.18		+0.70/+0.40
180.01~250.00	+0.30/+0.20		+0.75/+0.45
250.01~300.00	+0.35/+0.23	+0.55/+0.30	+0.75/+0.45
300.01~400.00			
400.01~500.00			

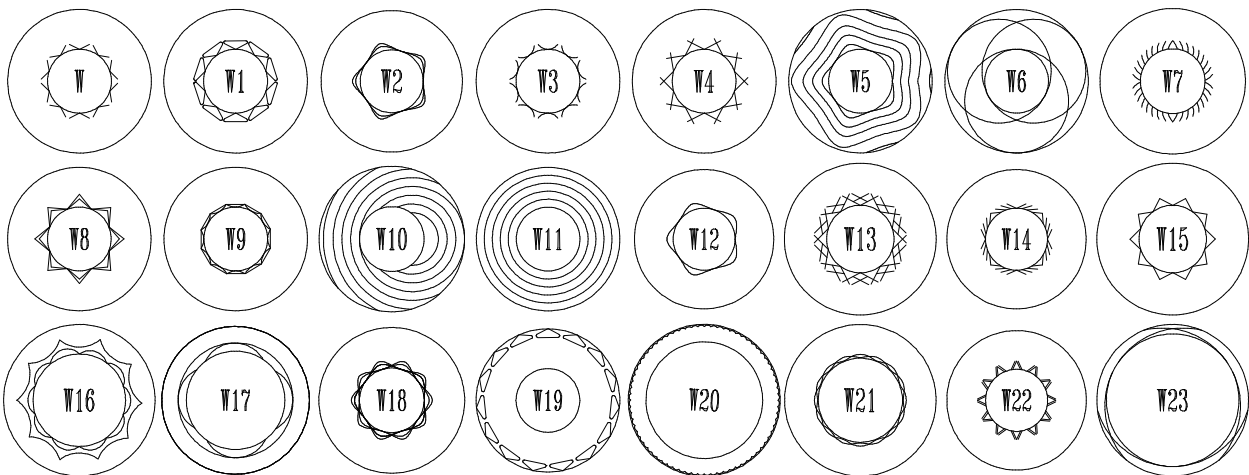
### Seal Width Tolerances Chart – Metric

Width	Tolerance
<10.00	+/-0.20
10.00	+/-0.30

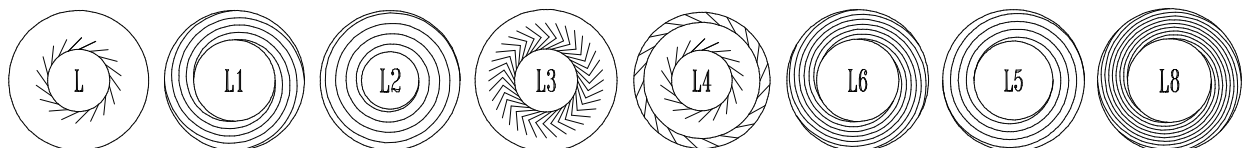
## HYDRODYNAMIC FEATURES – HELIX DESIGNS

The helix can improve the performance of sealing lip by pushing the medium back into the fluid reservoir. The helix applies to all rotary seals. There are three types available: Bi-directional (W Type) and Single direction (R Type and L Type):

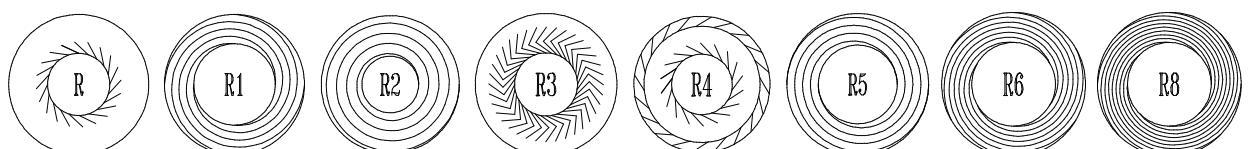
#### W type



#### L type



#### R Type





# RUBBER CHARACTERISTICS

## Common used rubbers:

Type	Name	ASTM
NBR	Nitrile rubber	BF,BG,BK,CH
FPM (VITON/FKM)	Fluorocarbon rubber	HK
ACM	Polyacrylate rubber	DF,DH
SIL	Silicone rubber	FC,FE,GE
EPDM	Ethylene propylene rubber	BA,CA,DA
PTFE	Polytetrafluoro ethylene	
PU	Urethane rubber	BG
AEM	Ethylene/Acrylic rubber (VAMAC)	EE,EF,EG
CR	Chloroprene rubber	BC,BE
HNBR	Hydrogenated NBR rubber	DH
SBR	Styrene Butadiene Rubber	AA

## Rubber properties:

Type	Advantages	Limitations
NBR	<ul style="list-style-type: none"> <li>•Cost efficient &amp; prevalent</li> <li>•Abrasion &amp; tear resistant</li> <li>•Water &amp; oil resistant</li> </ul>	<ul style="list-style-type: none"> <li>•Poor weather and ozone resistance</li> </ul>
FPM (VITON)	<ul style="list-style-type: none"> <li>•Applicable for most grease/oil</li> <li>•Excellent under high temp.</li> <li>•Long usage life</li> </ul>	<ul style="list-style-type: none"> <li>•Expensive</li> <li>•Moderate performance under low temp.</li> </ul>
ACM	<ul style="list-style-type: none"> <li>•Mineral &amp; gear oil</li> <li>•Aging &amp; tear resistant</li> <li>•Applicable for high-speed rotation</li> </ul>	<ul style="list-style-type: none"> <li>•Moderate under low temp.</li> <li>•Not for dry-running</li> <li>•Not usable in aqueous media</li> </ul>
	•Better than NBR under hightemp.	•More costly than NBR
SIL	•Weathering/ozone resistant	•Poor oil / fuel resistance
EPDM	<ul style="list-style-type: none"> <li>•Chemical resistant</li> <li>•Electrical isolation</li> <li>•Weathering/ozone resistant</li> </ul>	•Not usable in gasoline
PTFE	<ul style="list-style-type: none"> <li>•Excellent for dry-running</li> <li>•Chemical resistant</li> <li>•Low coefficient of friction</li> </ul>	•High thermal expansion
HNBR	<ul style="list-style-type: none"> <li>•Applicable for most grease / oil</li> <li>•Excellent under high temp.</li> <li>•Long usage life</li> <li>•Cold resistance better than NBR</li> </ul>	•Expensive
SBR	<ul style="list-style-type: none"> <li>•Excellent under high temp.</li> <li>•Long usage life</li> <li>•Water resistant</li> </ul>	<ul style="list-style-type: none"> <li>•Not usable in outside environment, UV and ozone</li> <li>•Low flexibility</li> <li>•Poor adhesion</li> </ul>

## Rubber specifications:

	NBR	FPM	ACM	SIL	EPDM	PU	CR	SBR
Tensile Strength	●	●	▼	▼	△	◎	●	△
Elongation	●	▼	▼	◎	●	◎	●	△
Rebound Resistance	●	△	△	△	●	◎	◎	△
Tear Resistance	●	△	▼	▼	△	◎	●	△
Abrasion-Resistance	◎	△	△	▼	●	◎	●	●
Impact Strength Resistance	●	△	▼	▼	●	◎	◎	■
Gas Impermeability Resistance	●	●	△	▼	△	●	●	■
Ozone Resistance	▼	◎	●	◎	◎	●	●	▼
Weathering Resistance	△	◎	●	◎	◎	●	●	▼
Flame Resistance	▼	◎	●	◎	◎	●	●	●
Heat Resistance	△	◎	●	◎	◎	△	●	●
Low Temperature Resistance	△	●	▼	◎	●	●	△	■
Oil and Fuel Resistance	●	◎	●	△	▼	●	■	▼
Animal and Vegetable Oil Resistance	◎	◎	◎	■	●	●	●	▼
Alcohol Resistance	●	●	●	●	■	■	◎	●
Alkaline Resistance	●	■	▼	▼	●	▼	◎	●
Acid Resistance	●	●	△	△	●	▼	●	●
Aliphatic-solvent Resistance	- Aliphatic	◎	◎	◎	▼	▼	●	◎
	- Aromatic	■	◎	△	▼	▼	▼	■
Oxygenated-Solvent Resistance	▼	▼	▼	△	◎	▼	▼	▼
Water Resistance	●	●	▼	●	◎	△	●	●

◎ Excellent ● Good ■ Suitable △ Limited ▼ Poor

## Rubber Specification Reference Table:

-Note for special type:

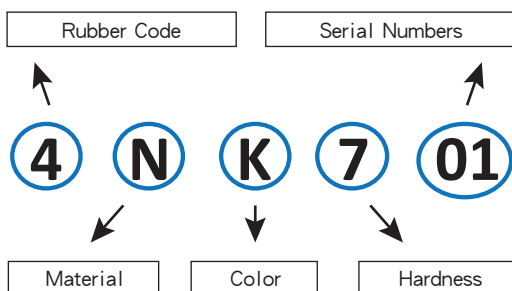
'\_\_-PL' means oil seals are manufactured with TEFLON.

-Note: Numbers are composed of six digits.

For example 4NK701

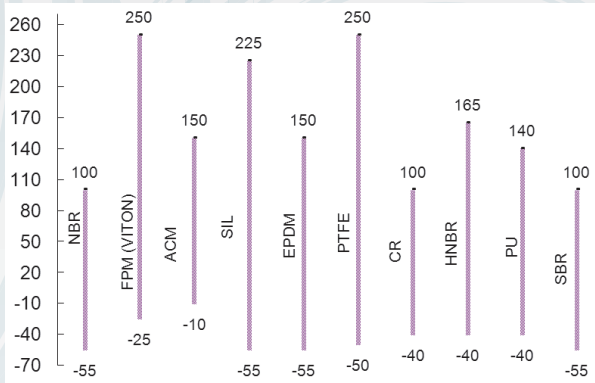
Rubber Code (4), NBR (N), Black (K),

70 SHA (7), Serial Number (01)

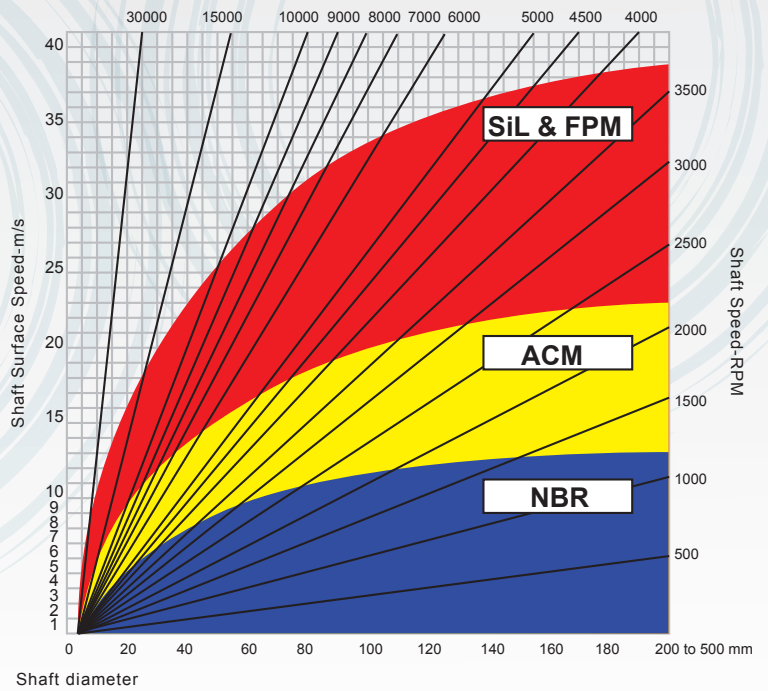


MATERIAL		COLOR		HARDNESS	
Code	Explanation	Code	Explanation	Code	Explanation
N	NBR	W	White	A	95
F	FKM/VITON	K	Black	9	90
V	VAMAC	B	Blue	B	85
E	EPDM	R	Red	8	80
C	CR/NEOPRENE	T	Gray	C	75
S	SILICONE	G	Green	7	70
A	ACM	N	Brown	D	65
P	PU	O	Orange	6	60
L	FLS (LEATHER)	P	Purple	E	55
H	HNBR	C	Transparent	5	50
X	XNBR	Y	Yellow	F	45
R	NR	Note: Above colors are based on TCS standard, for other special colors, please take PANTONE for reference.		4	40

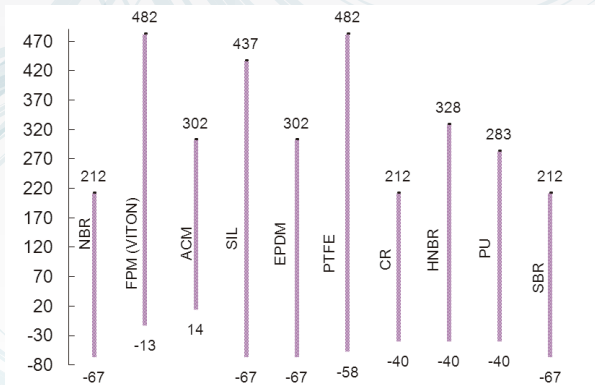
Material Temperature Range - Fahrenheit (°F):



Shaft RPM, surface speed, and seal material application:



Material Temperature Range - Celsius (°C):



## TCS SEALS DESIGN PRINCIPLES

Type		Illustration	Features
A	SA		<ul style="list-style-type: none"> <li>Additional inner metal case to reinforce the structure.</li> <li>T,K Types are good for dusty environment</li> <li>Rotating</li> <li>0.03MPa</li> </ul>
	TA		
	VA		
	KA		
B	SB		<ul style="list-style-type: none"> <li>Precision ground metal case O.D., precise and stable for installation. Suitable for fine surfaced housing.</li> <li>T,K Types are good for dusty environment</li> <li>Rotating</li> <li>0.03MPa</li> </ul>
	TB		
	VB		
	KB		
C	SC		<ul style="list-style-type: none"> <li>Rubber covered O.D., improve OD sealing ability at the housing.</li> <li>T,K Types are good for dusty environment</li> <li>Rotating</li> <li>0.03MPa</li> </ul>
	TC		
	VC		
	KC		
D	DB		<ul style="list-style-type: none"> <li>Two spring-loaded lips on opposite sides, designed for separating two different oil media</li> <li>Rotating</li> <li>0.03MPa</li> </ul>
	DC		
	DG		
	DM		
E	SEA		<ul style="list-style-type: none"> <li>Metal case extends to flex section for lip reinforcement.</li> <li>Pressure resistance depends on shaft speed and run-out</li> <li>Rotating</li> <li>0.05MPa</li> </ul>
	SEB		
	SEC		
	SEM		
F	SF		<ul style="list-style-type: none"> <li>Similar to type C, rubber covers the whole seal to protect internal metal case from corrosion</li> <li>Rotating</li> <li>0.03MPa</li> </ul>
	TF		
	VF		
	KF		



Type	Illustration	Features	Type	Illustration	Features	Type	Illustration	Features
G	SG	<ul style="list-style-type: none"> <li>• Similar to type C, outside rubber is corrugated, suitable for large thermal expansion housing material or when the installation is difficult or subject to damage the O.D. rubber</li> <li>• Good for high temperature housing.</li> <li>• Rotating</li> <li>• 0.03MPa</li> </ul>	N	KM	<ul style="list-style-type: none"> <li>• Suitable for mid-high pressure environment</li> <li>• Rotating</li> <li>• 0.06MPa</li> </ul>	4	DC4S	<ul style="list-style-type: none"> <li>• Shock Absorber Seal</li> <li>• High Temp Material</li> <li>• Reciprocating motion.</li> <li>• Type B, M, Z, D available.</li> <li>• Various designs available</li> <li>• 0.02~0.05MPa</li> </ul>
	TG			SCN			DG4J	
	VG			TCN			TC4B	
	KG			KMN			TG4J1	
H	SH	<ul style="list-style-type: none"> <li>• Reversed metal case, suitable for installation in special housing.</li> <li>• Rotating</li> <li>• 0.03MPa</li> </ul>	N1	SCN1	<ul style="list-style-type: none"> <li>• Mid-pressure, rubber covered O.D.</li> <li>• Rotating</li> <li>• 0.06MPa</li> </ul>	PL	KGJB	<ul style="list-style-type: none"> <li>• PTFE lined seals, low friction, applicable for dry-running or reducing lip running temperature.</li> <li>• Available in A, B, C, F, G, M, Z, N1/N2 types, single/dual lips, spring/ spring less designs</li> <li>• Rotating</li> <li>• 0.05MPa</li> </ul>
	VH			TCN1			SA-PL	
J	SBJ	<ul style="list-style-type: none"> <li>• Special metal case stop point design, for easy installation and replacement.</li> <li>• Rotating</li> <li>• 0.03MPa</li> </ul>	N2	SCN2	<ul style="list-style-type: none"> <li>• Mid-pressure, metal case O.D.</li> <li>• Rotating</li> <li>• 0.06MPa</li> </ul>	PS	TC-PL	<ul style="list-style-type: none"> <li>• Suitable for reciprocating motion, to retain internal fluid pressure</li> <li>• Rotating</li> <li>• 0.02~0.05MPa</li> </ul>
	TBJ			TCN2			SC4P	
	VBJ		OSA	<ul style="list-style-type: none"> <li>• Rotating Bore Seal</li> <li>• For grease application with bore rotates</li> <li>• Press fit on the shaft and seal the housing. Available in A,B,C,M types, single / dual lips and spring / spring less</li> <li>• Rotating</li> <li>• Special spring installation</li> <li>• Up to 5.1 m/s</li> <li>• 0.02~0.05MPa</li> </ul>	TC4P			
	KBJ		OSB		SCAP			
L	SL	<ul style="list-style-type: none"> <li>• Similar to type B, metal case has bevel angled edge for alignment</li> <li>• Rotating</li> <li>• 0.03MPa</li> </ul>	O	OSC	<ul style="list-style-type: none"> <li>• Triple flat-lips design for dusty, muddy environment</li> <li>• Rotating</li> <li>• 0.02~0.05MPa</li> </ul>	CNB	CNB	<ul style="list-style-type: none"> <li>• Power steering oil seal</li> <li>• Suitable for reciprocating motion, to retain internal fluid pressure</li> <li>• Rotating and Reciprocating</li> <li>• 0.02~0.05MPa</li> </ul>
	TL			OSM			CNB1	
	VL		OUA	CNB2				
	KL		SAP	CNB3				
M	SM	<ul style="list-style-type: none"> <li>• Similar to type B, with lead-in chamfer, rubber covers internal seal to prevent corrosion</li> <li>• Rotating</li> <li>• 0.03MPa</li> </ul>	P	SBP	<ul style="list-style-type: none"> <li>• Flange metal case for easy installation and replacement.</li> <li>• Available in A, B, L types, single/dual lips, spring/ spring less designs</li> <li>• Rotating</li> <li>• 0.02~0.05MPa</li> </ul>	CNB	CNB4	
	TM			TBPL			CNB5	
	VM		TC4	CNB6				



Type	Illustration	Features	Type	Illustration	Features	Type	Illustration	Features	
CNB7		<ul style="list-style-type: none"> <li>• Power steering oil seal</li> <li>• Suitable for reciprocating motion, to retain internal fluid pressure</li> <li>• Rotating and Reciprocating</li> <li>• 0.02~0.05MPa</li> </ul>	GNB5		<ul style="list-style-type: none"> <li>• Power steering oil seal</li> <li>• Suitable for reciprocating motion, to retain internal fluid pressure</li> <li>• Rotating and Reciprocating</li> <li>• 0.02~0.05MPa</li> </ul>	AJ / AO / AP	AO		<ul style="list-style-type: none"> <li>• Trailer Industry Seal</li> <li>• Suitable in heavy dust, muddy environment</li> <li>• Various designs available</li> <li>• Rotating</li> <li>• 0.5MPa</li> </ul>
CNB8			GNB7			AP			
CNB10			GNB8			AP1			
CNB11			GNB13			BC / BG	SBC		<ul style="list-style-type: none"> <li>• Rotary Seal</li> <li>• Rubber covers half of O.D., dual lip design available</li> <li>• Easy installation design</li> <li>• 0.02~0.05MPa</li> </ul>
CNB12			GNB14				SBG		
CNB13			GNB15			ST	ST		<ul style="list-style-type: none"> <li>• Hub seals, suitable for rigorous operating conditions</li> <li>• Available in various designs</li> <li>• Rotating</li> <li>• 0.5MPa</li> </ul>
CNB14			UA		ST1				
CNB15			UB		ST7				
CNB16			UC		ST8				
CNB17			UM		CRS1				
CNB18			X / X1	TXA		CRS2		<ul style="list-style-type: none"> <li>• Combined with PU, felted wool or foam to enhance dust-proof function.</li> <li>• Available in various designs</li> <li>• Rotating</li> <li>• 0.5MPa</li> </ul>	
CNB19				TX1A		CRS3			
GNB	GNB			Z	SZ		CRS4		
	GNB1				TZ		CRS5		
	GNB2				VZ		CRS8		
	GNB3				KZ		CRS9		
	GNB4				AJ		CRS10		

Type	Illustration	Features	Type	Illustration	Features	Type	Illustration	Features			
CRS	CRS11										
VGA	VGA1		VS	VSB2	<ul style="list-style-type: none"> <li>Valve Stem Seal</li> <li>Reciprocating motion.</li> <li>G Type available, various designs available.</li> <li>0.02~0.05MPa</li> </ul>	U-R	UIR	<ul style="list-style-type: none"> <li>U-Packing, Rubber</li> <li>Suitable for reciprocating motions, rubber material.</li> <li>Various designs available</li> <li>0.02~0.05MPa</li> </ul>			
	VGA2						UOR				
	VGA13		UNR								
RO	SBRO	<ul style="list-style-type: none"> <li>Automobile</li> <li>Industry Seal</li> <li>Special flex section design, suitable for high run-out conditions. Available in various designs</li> <li>Rotating</li> <li>0.5MPa</li> </ul>	V	VA	<ul style="list-style-type: none"> <li>V-ring (VA, VS series number available)</li> <li>Prevent dust from the side.</li> <li>All rubber</li> <li>0.02~0.05MPa</li> </ul>	U-P	UIP	<ul style="list-style-type: none"> <li>U-Packing, Polyurethane</li> <li>Suitable for reciprocating motions, rubber material.</li> <li>Various designs available</li> <li>0.02~0.05MPa</li> </ul>			
				VL					UOP		
EC	EC	<ul style="list-style-type: none"> <li>End Cap</li> <li>O.D. sealing cap.</li> <li>G type OD available</li> <li>0.03MPa</li> </ul>	WS	WS	<ul style="list-style-type: none"> <li>Bonded seals</li> <li>Various designs available</li> <li>0.02~0.05MPa</li> </ul>		PA		PA	<ul style="list-style-type: none"> <li>PTFE and helix design, low friction, chemical and temperature resistance, suitable for high speed rotation and dry-running</li> <li>Rotating</li> <li>0.05MPa</li> </ul>	
ECA	ECA	<ul style="list-style-type: none"> <li>Similar function to EC type, used in static sealing. Available in various designs</li> <li>0.02~0.05MPa</li> </ul>		WS1 (GM500)				GM 2000			
PV	PVC1	<ul style="list-style-type: none"> <li>Gas spring seals</li> <li>Applications for the automotive vehicles (tailgate, engine, lever), furniture (beds, sofas, lazy chairs, rotating chair), luggage compartment drawbars</li> <li>G type available</li> <li>Reciprocating</li> <li>0.02~0.05MPa</li> </ul>		600				1000			K1
	PVC3		WP	WP1		<ul style="list-style-type: none"> <li>Wiper Seal</li> <li>PU, suitable for reciprocating motions, to wipe clean the axis, prevent dirt ingress.</li> <li>Available in various designs</li> <li>0.02~0.05MPa</li> </ul>	Ring	O	<ul style="list-style-type: none"> <li>All rubber material products</li> </ul>		
	PVG1			WPB				V			
	PVG3			WPC				D			
	PVG4		SQF	<ul style="list-style-type: none"> <li>Reinforced seal</li> <li>Rubber and nonwoven covered O.D., used where radial space is limited</li> <li>Available in single/dual lips, spring/spring less designs</li> <li>Rotating</li> <li>0.05MPa</li> </ul>	WPK		K	K	K		
	PVG5				WPR					R	
RE	RE	<ul style="list-style-type: none"> <li>Axial Face Seal</li> <li>Corrosion-Resistant metal case protection</li> <li>Metal case combined with V-ring</li> <li>Prevent dust from the outside</li> <li>Speed up to 12m/s (2360ft/min)</li> </ul>	WPG		H	H	H				
	RE1		WPM					SQ			

# CONVERSION CHART

Inch Fraction	Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12
		1	2	3	4	5	6	7	8	9	10	11	12	12
0	-	-	25.400	50.800	76.200	101.600	127.000	152.400	177.800	203.200	228.600	254.001	279.401	304.801
1/64	0.0156	0.396	25.796	51.196	76.596	101.996	127.396	152.797	178.197	203.597	228.997	254.397	279.797	305.197
1/32	0.0313	0.795	26.195	51.595	76.995	102.395	127.795	153.195	178.595	203.995	229.395	254.796	280.196	305.596
3/64	0.0469	1.191	26.591	51.991	77.391	102.791	128.192	153.592	178.992	204.392	229.792	255.192	280.592	305.992
1/16	0.0625	1.588	26.988	52.388	77.788	103.188	128.588	153.988	179.388	204.788	230.188	255.588	280.988	306.388
5/64	0.0781	1.984	27.384	52.784	78.184	103.584	128.984	154.384	179.784	205.184	230.584	255.984	281.384	306.784
3/32	0.0938	2.383	27.783	53.183	78.583	103.983	129.383	154.783	180.183	205.583	230.983	256.383	281.783	307.183
7/64	0.1094	2.779	28.179	53.579	78.979	104.379	129.779	155.179	180.579	205.979	231.379	256.779	282.179	307.579
1/8	0.1250	3.175	28.575	53.975	79.375	104.775	130.175	155.575	180.975	206.375	231.775	257.176	282.576	307.976
9/64	0.1406	3.571	28.971	54.371	79.771	105.171	130.572	155.972	181.372	206.772	232.172	257.572	282.972	308.372
5/32	0.1563	3.970	29.370	54.770	80.170	105.570	130.970	156.370	181.770	207.170	232.570	257.971	283.371	308.771
11/64	0.1719	4.366	29.766	55.166	80.566	105.966	131.367	156.767	182.167	207.567	232.967	258.367	283.767	309.167
3/16	0.1875	4.763	30.163	55.563	80.963	106.363	131.763	157.163	182.563	207.963	233.363	258.763	284.163	309.563
13/64	0.2031	5.159	30.559	55.959	81.359	106.759	132.159	157.559	182.959	208.359	233.759	259.159	284.559	309.959
7/32	0.2188	5.558	30.958	56.358	81.758	107.158	132.558	157.958	183.358	208.758	234.158	259.558	284.958	310.358
15/64	0.2344	5.954	31.354	56.754	82.154	107.554	132.954	158.354	183.754	209.154	234.554	259.954	285.354	310.754
1/4	0.2500	6.350	31.750	57.150	82.550	107.950	133.350	158.750	184.150	209.550	234.950	260.351	285.751	311.151
17/64	0.2656	6.746	32.146	57.546	82.946	108.346	133.747	159.147	184.547	209.947	235.347	260.747	286.147	311.547
9/32	0.2813	7.145	32.545	57.945	83.345	108.745	134.145	159.545	184.945	210.345	235.745	261.146	286.546	311.946
19/64	0.2969	7.541	32.941	58.341	83.741	109.141	134.542	159.942	185.342	210.742	236.142	261.542	286.942	312.342
5/16	0.3125	7.938	33.338	58.738	84.138	109.538	134.938	160.338	185.738	211.138	236.538	261.938	287.338	312.738
21/64	0.3281	8.334	33.734	59.134	84.534	109.934	135.334	160.734	186.134	211.534	236.934	262.334	287.734	313.134
11/32	0.3438	8.733	34.133	59.533	84.933	110.333	135.733	161.133	186.533	211.933	237.333	262.733	288.133	313.533
23/64	0.3594	9.129	34.529	59.929	85.329	110.729	136.129	161.529	186.929	212.329	237.729	263.129	288.529	313.929
3/8	0.3750	9.525	34.925	60.325	85.725	111.125	136.525	161.925	187.325	212.725	238.125	263.526	288.926	314.326
25/64	0.3906	9.921	35.321	60.721	86.121	111.521	136.922	162.322	187.722	213.122	238.522	263.922	289.322	314.722
13/32	0.4063	10.320	35.720	61.120	86.520	111.920	137.320	162.720	188.120	213.520	238.920	264.321	289.721	315.121
27/64	0.4219	10.716	36.116	61.516	86.916	112.316	137.717	163.117	188.517	213.917	239.317	264.717	290.117	315.517
7/16	0.4375	11.113	36.513	61.913	87.313	112.713	138.113	163.513	188.913	214.313	239.713	265.113	290.513	315.913
29/64	0.4531	11.509	36.909	62.309	87.709	113.109	138.509	163.909	189.309	214.709	240.109	265.509	290.909	316.309
15/32	0.4688	11.908	37.308	62.708	88.108	113.508	138.908	164.308	189.708	215.108	240.508	265.908	291.308	316.708
31/64	0.4844	12.304	37.704	63.104	88.504	113.904	139.304	164.704	190.104	215.504	240.904	266.304	291.704	317.104
1/2	0.5000	12.700	38.100	63.500	88.900	114.300	139.700	165.100	190.500	215.900	241.300	266.701	292.101	317.501
33/64	0.5156	13.096	38.496	63.896	89.296	114.696	140.097	165.497	190.897	216.297	241.697	267.097	292.497	317.897
17/32	0.5313	13.495	38.895	64.295	89.695	115.095	140.495	165.895	191.295	216.695	242.096	267.496	292.896	318.296
35/64	0.5469	13.891	39.291	64.691	90.091	115.491	140.892	166.292	191.692	217.092	242.492	267.892	293.292	318.692
9/16	0.5625	14.288	39.688	65.088	90.488	115.888	141.288	166.688	192.088	217.488	242.888	268.288	293.688	319.088
37/64	0.5781	14.684	40.084	65.484	90.884	116.284	141.684	167.084	192.484	217.884	243.284	268.684	294.084	319.484
19/32	0.5938	15.083	40.483	65.883	91.283	116.683	142.083	167.483	192.883	218.283	243.683	269.083	294.483	319.883
39/64	0.6094	15.479	40.879	66.279	91.679	117.079	142.479	167.879	193.279	218.679	244.079	269.479	294.879	320.279
5/8	0.6250	15.875	41.275	66.675	92.075	117.475	142.875	168.275	193.675	219.075	244.475	269.876	295.276	320.676
41/64	0.6406	16.271	41.671	67.071	92.471	117.871	143.272	168.672	194.072	219.472	244.872	270.272	295.672	321.072
21/32	0.6563	16.670	42.070	67.470	92.870	118.270	143.670	169.070	194.470	219.870	245.271	270.671	296.071	321.471
43/64	0.6719	17.066	42.466	67.866	93.266	118.666	144.067	169.467	194.867	220.267	245.667	271.067	296.467	321.867
11/16	0.6875	17.463	42.863	68.263	93.663	119.063	144.463	169.863	195.263	220.663	246.063	271.463	296.863	322.263
45/64	0.7031	17.859	43.259	68.659	94.059	119.459	144.859	170.259	195.659	221.059	246.459	271.859	297.259	322.659
23/32	0.7188	18.258	43.658	69.058	94.458	119.858	145.258	170.658	196.058	221.458	246.858	272.258	297.658	323.058
47/64	0.7344	18.654	44.054	69.454	94.854	120.254	145.654	171.054	196.454	221.854	247.254	272.654	298.054	323.454
3/4	0.7500	19.050	44.450	69.850	95.250	120.650	146.050	171.450	196.850	222.250	247.650	273.051	298.451	323.851
49/64	0.7656	19.446	44.846	70.246	95.646	121.046	146.447	171.847	197.247	222.647	248.047	273.447	298.847	324.247
25/32	0.7813	19.845	45.245	70.645	96.045	121.445	146.845	172.245	197.645	223.045	248.446	273.846	299.246	324.646
51/64	0.7969	20.241	45.641	71.041	96.441	121.842	147.242	172.642	198.042	223.442	248.842	274.242	299.642	325.042
13/16	0.8125	20.638	46.038	71.438	96.838	122.238	147.638	173.038	198.438	223.838	249.238	274.638	300.038	325.438
53/64	0.8281	21.034	46.434	71.834	97.234	122.634	148.034	173.434	198.834	224.234	249.634	275.034	300.434	325.834
27/32	0.8438	21.433	46.833	72.233	97.633	123.033	148.433	173.833	199.233	224.633	250.033	275.433	300.833	326.233
55/64	0.8594	21.829	47.229	72.629	98.029	123.429	148.829	174.229	199.629	225.029	250.429	275.829	301.229	326.629
7/8	0.8750	22.225	47.625	73.025	98.425	123.825	149.225	174.625	200.025	225.425	250.826	276.226	301.626	327.026
57/64	0.8906	22.621	48.021	73.421	98.821	124.221	149.622	175.022	200.422	225.822	251.222	276.622	302.022	327.422
29/32	0.9063	23.020	48.420	73.820	99.220	124.620	150.020	175.420	200.820	226.220	251.621	277.021	302.421	327.821
59/64	0.9219	23.416	48.816	74.216	99.616	125.017	150.417	175.817	201.217	226.617	252.017	277.417	302.817	328.217
15/16	0.9375	23.813	49.213	74.613	100.013	125.413	150.813	176.213	201.613	227.013	252.413	277.813	303.213	328.613
61/64	0.9531	24.209	49.609	75.009	100.409	125.809	151.209	176.609	202.009	227.409	252.809	278.209	303.609	329.009
31/32	0.9688	24.608	50.008	75.408	100.808	126.208	151.608	177.008	202.408	227.808	253.208	278.608	304.008	329.408
63/64	0.9844	25.004	50.404	75.804	101.204	126.604	152.004	177.404	202.804	228.204	253.604	279.004	304.404	329.804

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