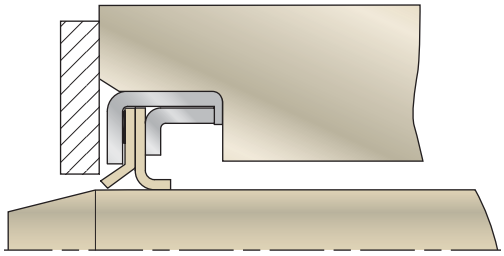
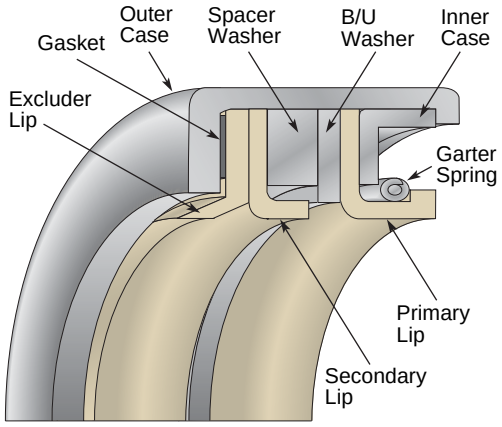
FlexiCase™ Rotary Seals Introduction

Contents

FlexiCase



FlexiSeal Application



FlexiCase Components

What Is a FlexiCase and How Does It Work?

The Parker FlexiCase is a rotary lip seal that features an ID lip that seals dynamically on a shaft and metal casing on its OD to seal statically press-fit into a bore. A gasket is sandwiched between layers of sealing lips and the can to seal off the potential leak path. Since the lip is not spring-energized, the radial lip contact forces are lower than a rotary FlexiSeal, which allows the seal to function at much higher surface speeds (up to 10,000 sfpm).

The seals are manufactured from a wide variety of PTFE composites and other machinable plastic materials. Standard gasket choices are fluorocarbon, nitrile, EPDM and Armstrong reinforced paper. Users can choose between stainless steel, cold-rolled steel, zinc plated cold-rolled steel and aluminum. This broad foundation of standard gasket, metal and PTFE materials can be tailored to suit nearly all applications. Standard and Nonstandard FlexiCase profiles are precision machined to fit inch and metric gland geometries. FlexiCase seals are used in demanding applications where the operating conditions exceed the capabilities of elastomeric seals.

Applications

The FlexiCase's versatility makes it suitable for a wide range of applications including:

- Motors
- Gear Boxes
- Pumps
- Bearings
- Compressors
- Cryogenics
- Extruders
- Valves
- Blowers
- Spindles
- Robotics
- Mixers

Markets

FlexiCase's low costs and high production capability make the FlexiCase an appealing choice for customers in a variety of markets including:

- Aerospace
- Automotive
- Chemical Process
- Appliances
- Machine Tools
- Marine
- Medical
- Pharmaceutical
- Military
- Heavy Machinery
- Pulp & Paper
- Hydraulic
- Food Processing
- Electronic
- Oil & Gas
- Steel Mill
- Plastics

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Part Number Nomenclature — FlexiCase

Table 9-1. FlexiCase Part Number Nomenclature

English

0 5 0 2 CF E 2 5 0 0 0 8 7 5 2 5 0 N S

4-Digit Material Code
Examples:
0502 = Carbon Fiber Filled PTFE
0301 = Graphite Filled PTFE

Gland Cross-Section
Examples:
250 = 0.250"
375 = 0.375"
750 = 0.750"

Seal Height Designation
250 = 0.250"
375 = 0.375"
750 = 0.750"

Excluder Lip Designation
E = Excluder Lip
N = No Excluder Lip

Shaft Diameter
Examples:
00875 = 0.875"
02500 = 2.500"
11000 = 11.000"

Internal Gasket Material Designation
N = Nitrile (NBR)
V = Fluorocarbon (FKM)
E = EPDM
A = Special Paper

FlexiCase
Lip Style Designation
CF = Mandrel Formed Lip
CM = Machined Lip
CE = Elf-Shoe Lip
CD = Dual Lips
CG = Garter Spring Lip
CJ = Dual Lip w/Garter Spring on Primary Lip
CH = Dual Lip High Pressure

Metal Case Material Designation
S = 304 Stainless Steel
C = Cold Rolled Steel
Z = Zinc Plated CRS
A = Aluminum

Metric

M 5 0 2 CF E 1 4 0 0 1 2 0 0 0 2 0 0 N S

4-Digit Material Code
Examples:
M502 = Carbon Fiber Filled PTFE
M301 = Graphite Filled PTFE
("M" indicates metric)

Gland Cross-Section
Examples:
0900 = 9.00 mm
1250 = 12.50 mm
1400 = 14.00 mm

Seal Height Designation
090 = 9.0 mm
200 = 20.0 mm
384 = 38.4 mm

Excluder Lip Designation
E = Excluder Lip
N = No Excluder Lip

Shaft Diameter
Examples:
00705 = 7.05 mm
05050 = 50.50 mm
12000 = 120.00 mm

Internal Gasket Material Designation
N = Nitrile (NBR)
V = Fluorocarbon (FKM)
E = EPDM
A = Special Paper

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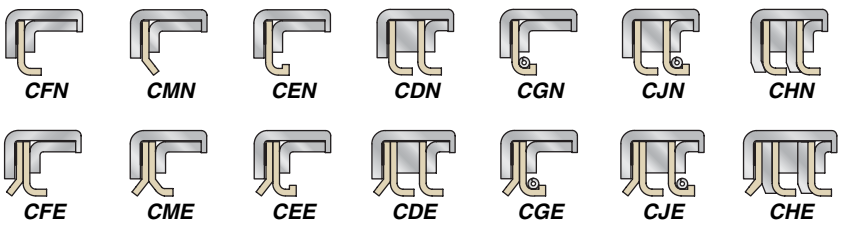

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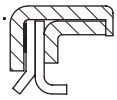
Choosing the Right Design

From Gland Dimensions to Part Number

Step 1 — Choose profile. Choose the best profile for your application from the decision tree and table on **Pages 9-7** through **9-9**, and place the 3-character profile description into the part number as shown here in this example.



Choice: CFE profile
xxxx**CFE**xxxxxxxxxxxxx

Step 2 — Choose material. Choose the best material for the application and place the 4-digit material code into the part number as shown here:

Choice: 0301 — Graphite Filled PTFE
0301CFExxxxxxxxxxxxx

Step 3 — Choose gasket material. Choose the best gasket material after considering the chemicals and temperatures it will be exposed to. Consult the *Parker O-Ring Handbook* (ORD 5700A/US Section II) as a general reference and choose the most appropriate material family. Place in the part number as shown here:

Choice: Nitrile gasket (N code)
0301CFExxxxxxxxxxx**N**x

Step 4 — Choose metal can material. Consult **Page 9-6** and choose the best fit for the application. Place the choices in the part number as shown here:

Choice: Cold rolled steel can (C code)
0301CFExxxxxxxxxxxN**C**

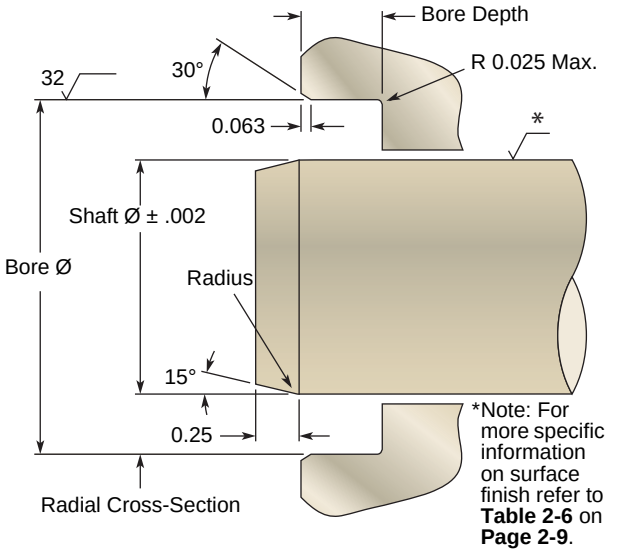
Step 5 — Fill in the size portion of the part number. Choose the optimal size of the part based on the limitations of the cross-section and diameter (**Pages 9-8** to **9-9**) and place into the part number as shown:

Choice: 2.250" shaft x 3.125 ± .0015 bore Ø x 0.500" bore depth

Calculate Radial Gland Cross-Section and input into part number:

(3.125" Bore – 2.250" Shaft) ÷ 2 = 0.4375", rounds to 0.438"
0301CFE**438**xxxxxxxxNC

Input shaft diameter into part number:
0301CFE438**02250**xxxNC



Step 6 — Find minimum seal width from **Pages 9-8** to **9-9** and input into part number. Minimum seal width is always the most economical, but you can choose any width between the minimum recommended seal width and the actual bore depth. In this case you could choose any width between 0.200" and 0.500".

Minimum seal width = 0.200"
0301CFE43802250**200**NC

From Part Number to Gland Dimensions

Step 1 — Extract shaft dimensions from part number:

0301CGN500**01125**437VS

01125 = 1.125" shaft diameter
Apply tolerance according to **Table 9-2**
For 1.125" shaft tolerance = ±.003" plunge grind shaft to achieve low surface finish

Step 2 — Extract bore diameter from part number:

0301CGN**50001125**437VS

500 = 0.500" cross-section
Bore Ø = Shaft Ø + (2 x cross-section)
Bore Ø = 1.125" + (2 x .500) = 2.125"
Apply tolerance according to **Table 9-2**
For 2.125" bore, tolerance = ±.001"

Step 3 — Extract bore depth from part number:

0301CGN50001125**437**VS

437 = 0.437" seal height
min. bore depth = seal height
min. bore depth = 0.437"

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Table 9-2. Bore Tolerance

Bore Ø	Bore Tolerance	Max. Housing Radius	Metric Bore Ø	Bore Tolerance	Max. Housing Radius
Up to 3"	±.001"	0.045"	Up to 75 mm	±.025"	1.14 mm
3.001 to 6"	±.0015"	0.054"	75.01 to 150 mm	±.038"	1.37 mm
6.001 to 8"	±.002"	0.072"	150.01 to 200 mm	±.050"	1.83 mm
8.001 to 9"	±.002"	0.090"	200.01 to 230 mm	±.050"	2.29 mm
9.001 to 10"	±.002"	0.125"	230.01 to 254 mm	±.050"	3.18 mm

Table 9-3. Part Number Examples

	Profile	Shaft Ø	Bore Ø	Min. Bore Depth	Gasket Material
0204CEN43702750375VCN	CEN	2.750 ± .002"	3.624 ± .0015"	0.385"	FKM
0301CJE50104548525NSP	CJE	4.548 ± .002"	5.550 ± .0015"	0.535"	Nitrile
M127CDN091004800140NSZ	CDN	48.0 ± .08 mm	66.2 ± .025 mm	14.25 mm	Nitrile
M615CFE125013500200EAG	CFE	135.0 ± .08 mm	160.0 ± .050 mm	20.25 mm	EPDM

FlexiCase Installation

Proper installation tools and techniques must be used to install the seal without damaging the critical sealing areas.

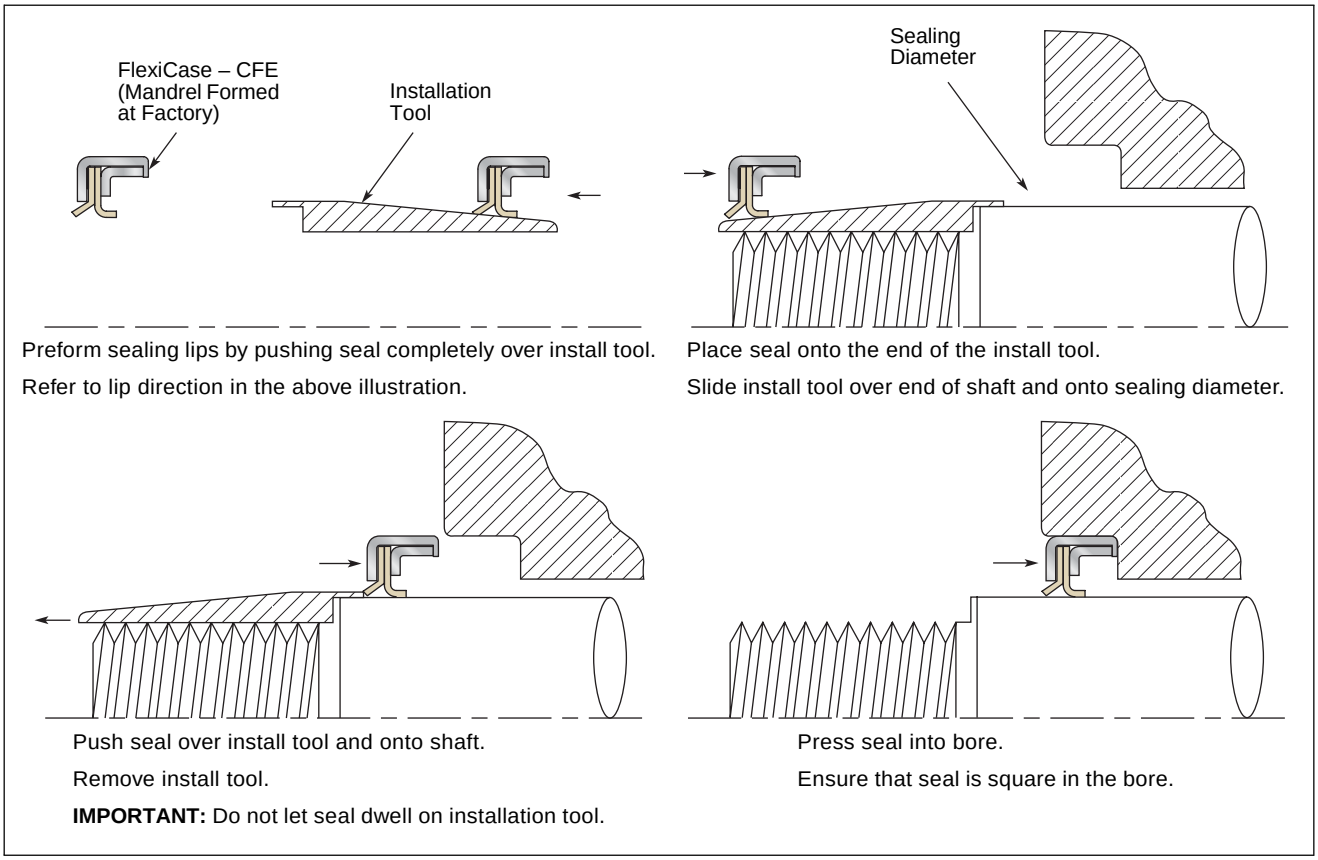

Figure 9-1. FlexiCase Installation

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FlexiCase Installation Tool

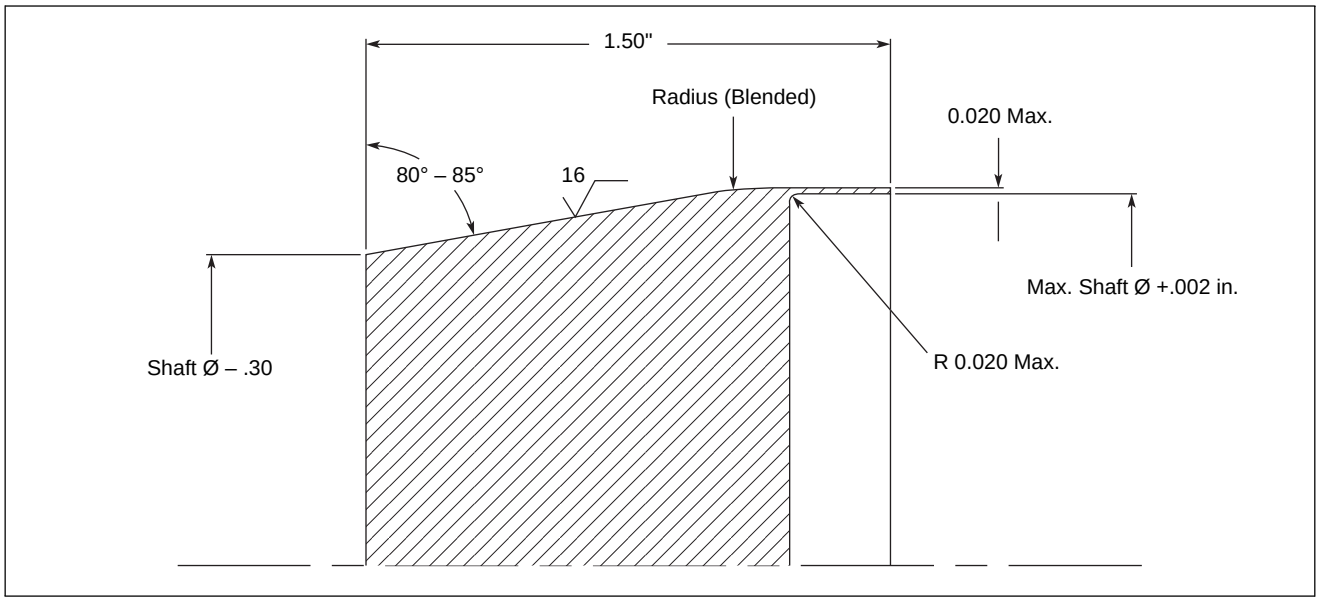

Figure 9-2. Installation Tool Dimensions

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Common Materials Used in this Product

The most popular fillers for FlexiCase products are graphite, fiberglass/molybdenum disulfide, carbon fiber and mineral.

A complete listing of material properties and limitations appears on **Page 3-4**. Feel free to contact the EPS division PTFE Engineering Team at (801) 972-3000 for more guidance on material selection.

0301 — Graphite Filled

Since graphite is often used as a lubricant, it does not significantly increase the coefficient of friction of PTFE when used as a filler. The low friction allows the compound to be used when both shaft speed and pressure are high. Graphite also is chemically inert which enables its use in corrosive medias.

0615 — Proprietary Low Wear PTFE

This proprietary filled PTFE offers low wear and friction properties, used in general applications where long life is required. Not recommended for applications with abrasive media.

0204 — Molybdenum Disulfide and Fiberglass Filled

Molybdenum disulfide increases the hardness of the seal surface while decreasing friction. It is normally used in small proportions combined with other fillers such as glass. MoS_2 is inert towards most chemicals.

0502 — Carbon Fiber Filled

Carbon fiber lowers creep, increases flex and compressive modulus and raises hardness. Coefficient of thermal expansion is lowered and thermal conductivity is higher for compounds of carbon fiber filled PTFE. Ideal for automotive applications in shock absorbers and water pumps.

0127 — Mineral Filled

Mineral is ideal for improved upper temperatures and offers low abrasion to soft surfaces. PTFE with this filler can easily be qualified to FDA and other food-grade specifications.

Metal Can Materials

S — Stainless Steel

Good chemical resistance properties up to 600 °F. Resists corrosive media up to 400 °F.

C — Cold-Rolled Steel

Good in oils and other media friendly to ferrous metals up to 600 °F. Excellent value for cost-sensitive projects.

Z — Zinc-Plated Cold-Rolled Steel

Good in oils and mildly corrosive media up to 450 °F. A lower cost alternative to stainless steel.

A — Aluminum

Excellent lightweight, high-strength material. Should be used with aluminum housing when thermal cycling is likely.

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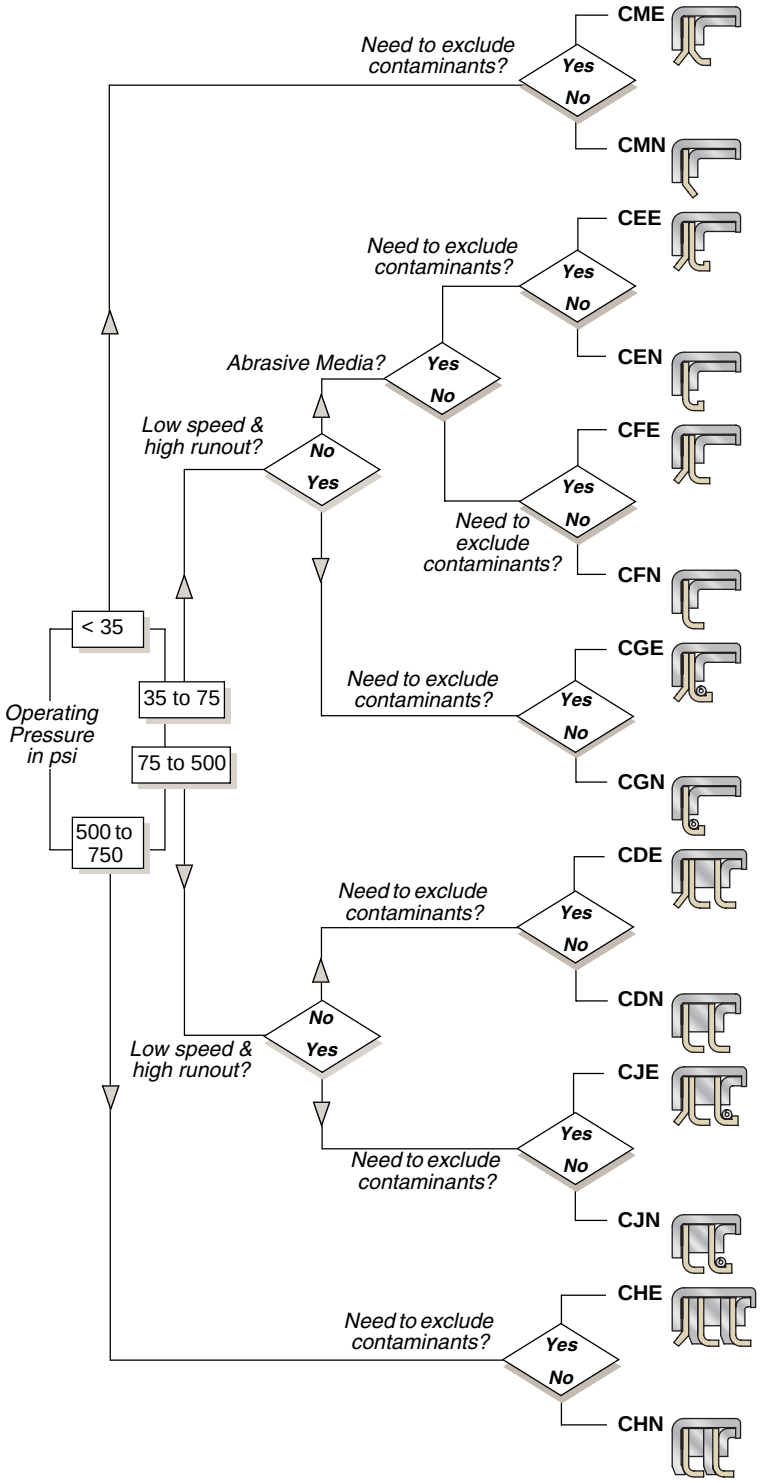
The key application considerations that help in the selection of the right FlexiCase profile are operating temperature, media abrasiveness, pressure, external contamination, friction requirements, shaft diameter and Total Indicator Runout (TIR). Also see **Table 9-4** for more information on temperatures, pressures, speeds and friction.

Total Indicator Runout (TIR) is how far the shaft is misaligned with the bore during rotation. This is fully characterized in the general engineering section on **Page 2-19**. Four FlexiCase profiles are able to handle continuous service with runout conditions up to 0.010" if speeds are slower than 200 RPM; the CGN, CGE, CJN and CJE. Keep in mind that the faster a shaft spins, the less TIR the seal can withstand.

These decision trees are to be used as an engineering guide only. Often several other parameters must be considered to optimize seal design. Contact Parker's PTFE Engineering Team for confirmation of your choice or further recommendations. Parker also recommends that any seal be tested in the application conditions before releasing for production.

Decision Tree



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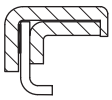
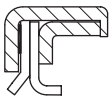
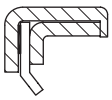
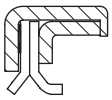
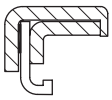
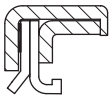
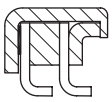
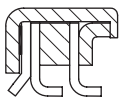
Profiles

Table 9-4. Product Profiles

Profile	Features	Recommended Applications	Shaft Diameter Limits	Cross-Section Limits	Height Limits*	Pressure Limit at Room Temp.	Surface Speed Max.	Friction Rating
CFN 	Formed Primary Lip	General purpose rotary shaft seal.	0.125" to 6"	Min 0.250" Max 2"	0.175"	250 psi	5000 sfpm	2
CFE 	Formed Primary Lip w/ Excluder Lip	Ideal to keep oil in and water & dirt out.	0.250" to 6"	Min 0.250" Max 2"	0.200"	125 psi	5000 sfpm	3
CMN 	Machined Primary Lip	General purpose rotary shaft seal w/ low breakaway torque.	0.250" to 6"	Min 0.250" Max 2"	0.175"	125 psi	6000 sfpm	1
CME 	Machined Primary Lip w/ Excluder Lip	Ideal to keep oil in and water & dirt out. Low Breakaway torque.	0.250" to 6"	Min 0.250" Max 2"	0.200"	125 psi	6000 sfpm	2
CEN 	Elf-Toe Primary Lip	General purpose rotary shaft seal where shaft runout is 0.005" to 0.010" or abrasive media.	0.125" to 6"	Min 0.250" Max 2"	0.175"	250 psi	5000 sfpm	2
CEE 	Elf-Toe Primary Lip w/ Excluder Lip	Ideal to keep oil in and water & dirt out where shaft runout is 0.005" to 0.010" or abrasive media.	0.250" to 6"	Min 0.250" Max 2"	0.200"	125 psi	5000 sfpm	3
CDN 	Dual Primary Lips	Redundant sealing for aircraft or other low leakage systems.	0.250" to 6"	Min 0.250" Max 2"	0.500"	250 psi	5000 sfpm	3
CDE 	Dual Primary Lips w/ Excluder Lip	Redundant sealing for aircraft or other low leakage systems. Keeps water & dirt out.	0.250" to 6"	Min 0.250" Max 2"	0.500"	250 psi	5000 sfpm	4

*Minimum height requirements can be reduced significantly if pressures are low and diameters are small. Consult PTFE Engineering for recommendations.

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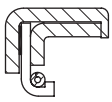
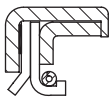
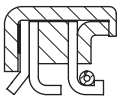
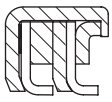
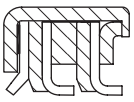
Table 9-5. Product Profiles (Continued)

Profile	Features	Recommended Applications	Shaft Diameter Limits	Cross-Section Limits	Height Limits*	Pressure Limit at Room Temp.	Surface Speed Max.	Friction Rating
CGN 	Primary Lip Energized with Garter Spring	Use when shaft runout is 0.010" to 0.020" or abrasive media.	0.250" to 6"	Min 0.250" Max 2"	0.200"	125 psi	2000 sfpm	3
CGE 	Primary Lip Energized with Garter Spring w/ Excluder Lip	Use when shaft runout is 0.010" to 0.020" or abrasive media. Keeps water & dirt out.	0.250" to 6"	Min 0.250" Max 2"	0.200"	125 psi	2000 sfpm	4
CJN 	Dual Lip Seal w/ Primary Lip Energized with Garter Spring	Use when redundant sealing is needed & shaft runout is 0.010" to 0.020" or abrasive media.	0.250" to 6"	Min 0.250" Max 2"	0.500"	125 psi	2000 sfpm	4
CJE 	Dual Lip Seal w/ Primary Lip Energized with Garter Spring w/ Excluder Lip	Use when redundant sealing is needed & shaft runout is 0.010" to 0.020" or abrasive media. Keeps water & dirt out.	0.250" to 6"	Min 0.250" Max 2"	0.500"	125 psi	2000 sfpm	5
CHN 	High Pressure Dual-Lip Seal with Metal Backup Washer	Redundant seal for high pressure aircraft or other low leakage systems.	0.250" to 6"	Min 0.250" Max 2"	0.500"	500 psi	2000 sfpm	4
CHE 	High Pressure Dual-Lip Seal with Metal Backup Washer w/ Excluder Lip	Redundant seal for high pressure aircraft or other low leakage systems. Keeps water & dirt out.	0.250" to 6"	Min 0.250" Max 2"	0.500"	500 psi	2000 sfpm	5

* Minimum height requirements can be reduced significantly if pressures are low and diameters are small. Consult PTFE Engineering for recommendations.

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