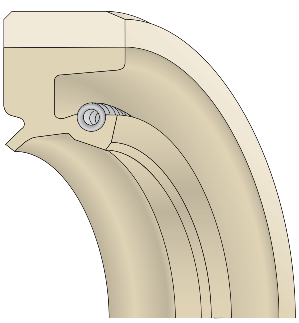
Page numbers correspond to Parker's Rotary Seal Design Guide, Catalog EPS5350

Clipper® Oil Seals Introduction

Contents



Clipper Oil Seal

Clipper Oil Seals provide superior performance in the most demanding and critical applications.

OEMs worldwide know Clipper Oil Seals for their ability to provide superior performance in the most demanding and critical applications. A one-piece molded construction and the ability to provide application-specific designs, if needed, are just a few of the reasons Clipper seals are specified for critical applications. These applications include as aircraft landing gear, military vehicles, underground mining equipment and roll chocks used in the steel industry.

Clipper seals are available for shaft diameters from 0.250" (6.35 mm) to over 65" (1651 mm) in both standard and high performance elastomer compounds. With over 10,000 tooled sizes, Clipper seals are readily available for most applications in either a solid or split design.

The most unique feature of the Clipper oil seal is nonmetallic construction. The metal case that is common with traditional lip seals is replaced with an aramid fiber and elastomer composite material.

A wide range of lip profiles are available with the aramid composite OD to suit virtually any application need. For standard profiles, see **Table 5-7** on **Page 5-10**.

Stainless Steel Springs Are Standard on all Clipper Oil Seals where the industry standard is a lower quality carbon steel. Clipper's spring material provides improved lip loading at higher temperatures and resists the rust and corrosion that is common with lower quality materials. The upgraded spring ensures consistent lip loading over the life of the seal.

03/28/06

Parker Hannifin Corporation
EPS Division
Toll Free: (800) 233-3900

Applications

Clipper Oil Seals are used in a wide range of industries including light industrial, mining, paper, steel, food processing, marine, aerospace and petrochemical.

Application equipment includes:

- Pumps
- Motors
- Gearboxes
- Crushers
- Fans
- Pillow blocks
- Runout tables
- Paper rolls
- Work rolls
- Mixers
- Compressors
- Overhead cranes
- Drag lines
- Hoists
- Elevators
- Mine cart wheels
- Flywheels
- Idler wheels
- Tapered bearings
- Custom equipment

Features, Advantages and Benefits

The Clipper Oil Seal can be used as a direct replacement for metal case seals and provides the following benefits:

1. Composite OD provides gasket-type seal at OD for improved sealing in worn housings. Compression plates are not required for seal retention or lip loading. The tight press fit eliminates the need for a cover plate.

2. Will not rust or corrode.

3. Consists of a seal lip and seal OD to form a one-piece molded construction across entire size range and a more robust design compared to gluing or crimping the seal lip to a metal case.

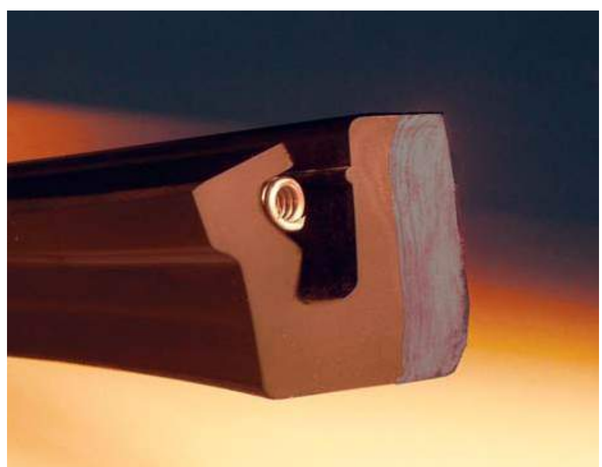
4. Resists problems caused by thermal expansion when seal case and housing are different materials.

5. Eliminates seal damage during installation. The Clipper seal is known for its user-friendly installation.

6. Nonmetallic construction allows splitable design.

7. Composite material provides unique design capabilities; i.e. flange, buttons, mounting holes.

8. Allows for faster delivery of non-stock items with no manufacturing delays caused by waiting on metal components. Seals 14" and over ship in under 10 days and typically less than four weeks for small diameter.

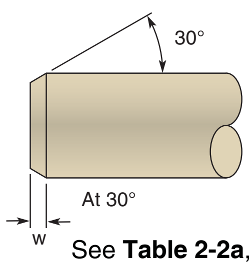


Shaft Recommendations

Material — Parker recommends a shaft material of carbon steel with a minimum hardness of Rockwell C30 (30 Rc). Soft materials such as bronze, aluminum or plastic should be avoided because they are susceptible to grooving and will cause premature seal failure. If a soft shaft material must be used, a Parker Quick Sleeve or Parker Wear Sleeve can be installed over the soft shaft material to provide a durable sealing surface. See **Section 7** for details.

Shaft Finish — Parker recommends a plunge ground finish of 8 to 17 µin Ra (0.20 to 0.43 µm Ra) with zero lead. A shaft finish significantly smoother or rougher will shorten the service life of the seal. For additional information on shaft finish refer to **Page 2-6**.

Shaft Profile — The shaft profile should include a lead-in chamfer per the following example. The leading edge helps prevent lip roll-back and spring dumping. The leading edge and trailing edges should be free of burrs or sharp edges that could cut the contact point of the seal lip. See **Table 2-2a** on **Page 2-8** for recommended minimum chamfer length.



See **Table 2-2a**, **Page 2-8** for chamfer length

Figure 5-1. Shaft Profile

Shaft Tolerance — To ensure the proper lip-to-shaft interference is maintained, shaft diameters should fall within the tolerances specified in **Tables 5-1** and **5-2**. Shafts significantly over the tolerance will increase the underlip temperatures and lead to premature failure. An undersized shaft compromises the amount of lip interference available to maintain a positive seal.

Table 5-1. Shaft Tolerance for Inch/Fractional

Shaft Diameter	Tolerance
Up to 4.000"	±.003"
4.001 – 6.000"	±.004"
6.001 – 10.000"	±.005"
Over 10.000"	±.006"

Table 5-2. Shaft Tolerance for Metric*

Shaft Diameter	Tolerance
Up to 10 mm	+0 to -.09 mm
Over 10 – 18	+0 to -.11 mm
Over 18 – 30	+0 to -.13 mm
Over 30 – 50	+0 to -.16 mm
Over 50 – 80	+0 to -.19 mm
Over 80 – 120	+0 to -.22 mm
Over 120 – 180	+0 to -.25 mm
Over 180 – 250	+0 to -.29 mm
Over 250 – 315	+0 to -.32 mm
Over 315 – 400	+0 to -.36 mm
Over 400 – 500	+0 to -.40 mm

*ISO Standard 286-2, h11

5

03/28/06

Housing Recommendations

Material — The most commonly used materials for seal housings are steel and cast iron. Care must be taken when softer housing materials such as aluminum, bronze or plastic are used.

Housing Finish — A finish range of 40 to 100 µin Ra (1.0 to 2.5 µm Ra) is recommended. The Clipper seal is more tolerant of housing finishes that are toward the upper limit than metal OD seals.

Housing Profile — A lead-in chamfer per the following example is highly recommended for all seal housings. The chamfer aligns the seal during installation and helps prevent the seal from cocking. Both corners of the chamfer should be free of burrs and sharp edges to eliminate OD damage during installation.

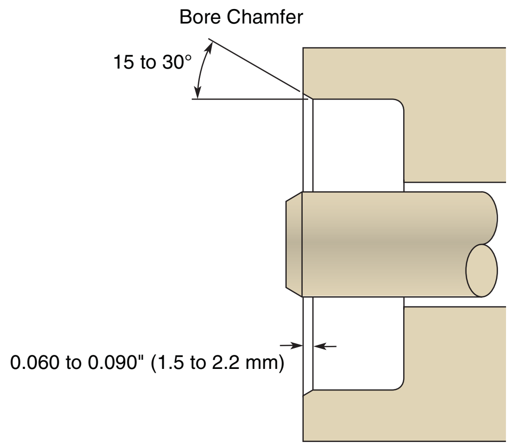


Figure 5-2. Housing Profile

Housing Tolerance — The diametrical tolerance of the housing for Clipper Oil Seals should be within the limits specified below.

Table 5-3. Housing Tolerance for Inch/Fractional

Bore Diameter	Diameter Tolerance H1	Diameter Tolerance STH1	Depth Tolerance (-0/+)
Up to 5.9	±.002	±.002	+.031
6.0 – 15.9	±.005	±.002	+.062
16.0 – 30.9	±.008	±.005	+.062
Over 31.0	±.010	±.005	+.062

Table 5-4. Housing Tolerance for Metric

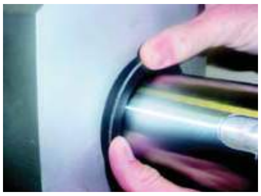
Bore Diameter	Diameter Tolerance H1	Diameter Tolerance STH1	Depth Tolerance (-0/+)
Up to 150.0	±.05	±.05	+.8
151 – 403	±.13	±.05	+1.5
404 – 785	±.20	±.13	+1.5
Over 786	±.25	±.13	+1.5

Solid Clipper Seal Installation

1. Clean seal bore and shaft. Remove all burrs and nicks.

2. Pre-lubricate the seal ID and shaft before installing the seal into the cavity. Use a pre-lube that is compatible with the system lubricant. The pre-lube will make the seal easier to install and prevent dry running during initial start-up. **(Do not lubricate the seal OD or housing.)**

3. Protect seal lip against damage from sharp keyways, splines and screw threads. This can be done by either taping the keyway, inserting an element into the keyway or using an assembly sleeve that fits over the shaft.

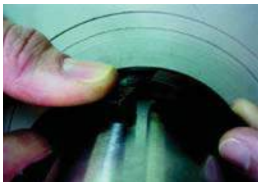


4. Point seal lip in correct direction and push to edge of the counter bore.

5. Start seal into cavity by finger pressure. After starting seal in housing, tap evenly with a soft-faced mallet all around until seated.

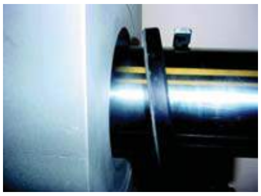
6. Finish installation by using a flat plate tool to drive seal in final position. The plate diameter should be large enough so it contacts the face of seal housing. This will ensure seal is positioned straight and perpendicular to the shaft.

Split (R Series) Clipper Seal Installation

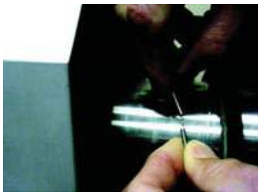


1. Clean the equipment cavity recess area thoroughly. Remove all burrs and sharp corners. Provide adequate lead-in chamfers.

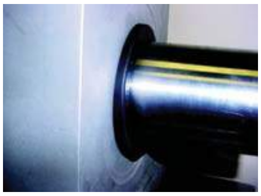
2. Apply light grease or oil coating to the shaft area where the lip will engage. **Do not apply grease or oil to seal OD or equipment bore surface.**



3. Separate the cut ends of the seal sideways so that seal forms a helix. Do not try to form the seal into a "U" shape. Separate ends far enough so that the seal can be slipped over the shaft.



4. Insert the garter spring over the shaft, between the seal and the bore cavity, connecting the ends of the spring with the hook-and-eye connectors. Insert the garter spring into the lip carrier groove with the connection at least 45° from the split juncture. Push the seal toward the bore cavity until it touches, making sure that the split ends are well aligned and positioned at 12 o'clock.



5. Start inserting the seal into the cavity with the split juncture at top, compressing the OD slightly, until the split juncture has been inserted to about one-third of its width. Continue pressing the balance of the seal into the cavity, working away from the split, until the entire seal has been started into the cavity recess. Tap evenly around the back face of the seal with a soft-faced mallet until it is completely seated.

6. Use a flat plate tool that will drive the seal flush with the housing to ensure seal is installed square and perpendicular to the shaft.

03/28/06

Parker Hannifin Corporation
EPS Division
Toll Free: (800) 233-3900

Common Materials Used in this Product

Clipper Oil Seals are available in a wide range of materials. The following general material descriptions are for the OD material "H" and corresponding lip material "L".

OD and Lip Materials

H1L5 & H1L7 — Nitrile (NBR)

Standard Nitrile is the most commonly used polymer in the rotary shaft seal industry. NBR has very good resistance to oil, fuel and alkali solutions. Nitrile offers excellent resistance to petroleum-based hydraulic fluids and is resistant to hydrocarbon solvents. Standard Nitrile has poor resistance to ozone, ketones, automotive or aircraft brake fluid, and steam or hot water. Standard Nitrile is recommended for operating in temperatures ranging from -20 to +250 °F (-29 to +121 °C) and offers good mechanical properties and abrasion resistance.

H1L50 & H1L70 — Low Temp Nitrile (NBR)

Nitrile compounds can be formulated for applications in extreme cold weather environments. These special formulations of Nitrile allow for operation at minimum temperatures ranging down to -70 °F (-57 °C), while maintaining good chemical and abrasion resistance, but the upper temperature limit is lowered to 212 °F (100 °C).

H1L20 — Carboxylated Nitrile (XNBR)

XNBR is formulated to greatly enhance tear and abrasion resistance over standard Nitrile, while maintaining similar chemical compatibility. It is used in applications where abrasive materials may collect at the point of shaft contact. XNBR is less resilient and flexible at low temperature, and offers poorer compression set resistance than standard Nitrile. Carboxylated Nitriles are recommended for operation at temperatures ranging from -30 to +250 °F (-34 to +121°C).

H1L30 — Hydrogenated Nitrile (HNBR)

Hydrogenated Nitriles offer improved abrasion resistance, excellent chemical resistance and higher operating temperatures than standard NBR. Ozone and weather resistance, as well as resistance to hot water are also increased. HNBR compounds are recommended for operating temperatures ranging from -40 to +300 °F (-40 to +149 °C).

H1L8 — Neoprene (CR)

Neoprene offers very good resistance to weather, ozone and natural aging as well as good flame resistance while maintaining moderate resistance to oil and gasoline. Good abrasion, flex and cracking resistance is available with the Neoprene material. Neoprene is recommended for operating temperatures ranging from -45 to +250 °F (-43 to +121 °C).

H1L21 — Ethylene Propylene (EPDM)

EPDM offers excellent heat, ozone and sunlight resistance. EPDM offers very good low temperature flexibility, good resistance to alkalis, acids (such as acetic), and oxygenated solvents (such as MEK). Provides improved resistance to water and steam in applications where NBR and FKM exhibit poor service life. Good replacement for FKM where solvents are a problem. It is not recommended for petroleum oil. EPDM is recommended for operating temperatures of -60 to +300 °F (-51 to +149°C).

H5L16 — Fluoroelastomer (FKM)

FKM provides excellent resistance to oils, fuels and hydraulic fluids at temperatures that far exceed standard Nitrile. It also has very good resistance to flame and excellent impermeability to gases and vapors. FKM is recommended for operating temperatures that range from -40 to +400 °F (-40 to +204 °C).

Case Materials

H1, H3 — Neoprene/Aramid Composite

The aramid fiber-reinforced composite shell will fit a wide range of bore tolerances and provides a rustproof gasket-type seal at the OD. The composite case also will fill slight imperfections in the bore housing, reducing machining cost. Usually combined with a Nitrile lip material.

H5 — Fluoroelastomer/Aramid Composite

Offers the same construction benefits mentioned above. Usually combined with a Fluoroelastomer lip material.

Spring Materials

Springs are available in a wide range of materials from Parker. Clipper Oil Seal designs are furnished with 302 stainless steel springs as standard. Other spring materials are available at an additional cost. **Table 5-5** shows general operating parameters for the most common spring materials.

Table 5-5. Spring Material Parameters

Wire Type	Maximum Service Temperature		Application
	°C	°F	
Carbon Steel	120	250	General purpose
Monel 400	230	450	Saltwater
Inconel 750	675	1250	Extreme temperature
Phosphor Bronze	95	200	Saltwater
302/304 Stainless Steel	260	500	Corrosion resistance
316 Stainless Steel	315	600	Hi-temp corrosion resistance

Spring Type

For lip loading, the Clipper Oil seal uses a coil wire spring (garter spring).

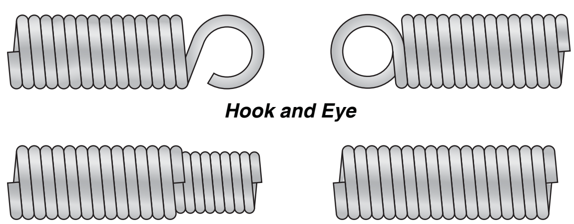
Garter spring benefits:

- Provides a more uniform load to sealing lip
- Heat treated — stress relieved
- Constant load with minimum load variations
- Able to adjust the spring in the field to increase load

Two types of spring connections are used:

1. Threaded type is used on most solid seals.

2. Hook and eye type are used on splits seals because they are easier for the end user to connect during installation.



Threaded

Table 5-6. Clipper Oil Seal Standard Material

Matl. Code Case/Lip	Material Description	Abrasion Resistance	Min. Temp	Cont. Temp	Peak. Temp
H1L5	Nitrile (75 Duro NBR) **Standard NBR offering.** The NBR lip material has very good resistance to oil and gasoline. Superior resistance to petroleum based hydraulic fluids. Good resistance to hydrocarbon solvents. Very good resistance to alkalis and solvents. Poor resistance to oxygenated solvents.	Very Good	-20 °F -29 °C	212 °F 100 °C	250 °F 121 °C
H1L7	Nitrile (85 Duro NBR) The L7 lip material has a lower minimum temperature capability than the L5 material.	Very Good	-30 °F -34 °C	212 °F 100 °C	250 °F 121 °C
H1L20	Carboxylated Nitrile (83 Duro XNBR) The XNBR lip material is generally tougher and more resistant to tear and abrasion than standard NBR.	Outstanding	-30 °F -34 °C	212 °F 100 °C	250 °F 121 °C
H1L30	Hydrogenated Nitrile (75 Duro HNBR) The HNBR lip material offers improved abrasion resistance, chemical resistance, higher operating temperature and better ozone resistance than standard NBR.	Outstanding	-40 °F -40 °C	250 °F 121 °C	300 °F 149 °C
ALLL5	Nitrile (75 Duro NBR) Homogenous NBR material without aramid fiber OD provides a very pliable seal that can be stretched over flanges or other obstructions on the shaft. A cover plate is recommended to keep the seal retained in the housing bore.	Very Good	-20 °F -29 °C	212 °F 100 °C	250 °F 121 °C
H1L50	Arctic Nitrile (85 Duro Low Temp NBR) Low temperature Nitrile lip material allows for lower minimum temperatures while providing good chemical and abrasion resistance.	Very Good	-50 °F -46 °C	200 °F 93 °C	212 °F 100 °C
H1L70	Alaska Nitrile (75 Duro Low Temp NBR) Same characteristics as L50, but softer with lower minimum temperature range.	Very Good	-70 °F -57 °C	200 °F 93 °C	212 °F 100 °C
H5L16	Fluoroelastomer (90 Duro FKM) FKM lip material offers outstanding resistance to high heat. Excellent resistance to oil, gasoline, petroleum hydraulic fluids and hydrocarbon solvents. Very good impermeability to gases and vapors. Very good resistance to flame, weather, oxygen, ozone and sunlight. Very little resistance to oxygenated solvents. Poor tear resistance.	Good	-40 °F -40 °C	325 °F 163 °C	400 °F 204 °C
H5L89	Fluoroelastomer (90 Duro FKM) Improved steam resistance.	Good	-40 °F -40 °C	325 °F 163 °C	400 °F 204 °C
N/P	PTFE bonded to NBR lip — PTFE layer provides improved dry running capability, chemical resistance, and reduces torque consumption.	Very Good	-20 °F -29 °C	212 °F 100 °C	250 °F 121 °C
F/P	PTFE bonded to FKM lip	Very Good	40 °F -40 °C	325 °F 163 °C	400 °F 204 °C
H1L21	Ethylene Propylene (75 Duro EPDM) Excellent heat, ozone and sunlight resistance. Very good low temperature flexibility, good resistance to alkalis, acids (such as acetic) and oxygenated solvents (such as MEK). Provides improved resistance to water and steam in applications where NBR and FKM exhibit poor service life. Good replacement for FKM where solvents are a problem. Not recommended for petroleum oil.	Very Good	-60 °F -51 °C	250 °F 121 °C	300 °F 149 °C

5

Part Number Nomenclature — Clipper Oil Seals

Solid Seals

English

1 7 6 4 3 H 1 L 5

Mold Number (1 7 6 4 3)

Material Code (H 1 L 5)

Metric

M 1 7 6 4 3 H 1 L 5

Metric Dimensions (M)

Mold Number (1 7 6 4 3)

Material Code (H 1 L 5)

Split Seals

English

1 3 2 5 9 8 5 6 [ ]

Shaft Size
Example:
1325 = 13.250"

Mold Number

Lip Material
Leave blank if NBR
V = FKM

Metric

M 0 2 0 0 1 4 2 8 2 [ ]

Metric Dimensions

Shaft Size
Example:
0200 = 200 mm

Mold Number

Lip Material
Leave blank if NBR
V = FKM

03/28/06