Lineproof®
Engineering

Segmented carbon sealing rings

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Introduction

The self-lubricating properties of carbon make it an ideal material for both contact and non-contact types of gland rings. Segmented carbon rings are used for sealing liquids and gases, minimizing leakage. They offer a simple and effective sealing solution for impulse turbines, low-pressure fans and blowers, water turbines, and similar applications.

Segmented carbon rings are commonly used as shaft seals in fans, and in water and steam turbines. These rings are fabricated in segments that form a complete ring when held together by a garter spring.

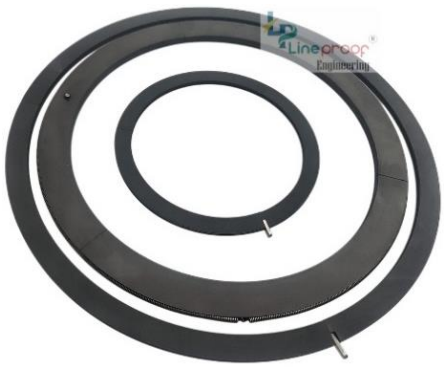
Manufacturing is done with extremely fine tolerances. A notable feature of segments produced by **LPE Carbon** is their interchangeability with rings of similar design.

Traditional fan or steam turbine glands have butt-jointed segments. Multiple rings may be used in tandem if required. This design ensures efficient sealing under stable operating conditions.

Labyrinth designs that incorporate graphite significantly improve sealing efficiency in both steam and gas turbines. Since the rubbing contact between shaft fins and graphite rings causes no damage, very small radial clearances are permissible—resulting in greatly reduced leakage. A special grade of graphite, developed for this purpose, can withstand high temperatures and pressures and is soft enough to allow shaft fins to cut into the stationary gland ring.

LPE Carbon also supplies segmented carbon rings for water turbines in hydroelectric installations. The wedge-type ring is a typical LPE design and has been adopted as a standard by many manufacturers due to its enhanced sealing efficiency, replacing the traditional tenon-jointed ring. In this design, the ends of the segments are beveled, and wedge pieces inserted between segments move outward to accommodate wear.

Design and Operation



- The number of segments is calculated based on the shaft diameter.
- These segments, similar to armored carbon rings, are staggered in a housing and seal radially against the shaft.
- Additional features like extraction systems, purge gas connections, and grease barriers can be integrated.
- Radial contact pressure is applied by a hose spring, ensuring the rings return to their original position after deflection.
- Recommended spring force: 1–1.5 N/cm² surface pressure.
- Rings are designed to handle radial deflections of up to 5 mm without damage.

Ease of Maintenance

A key advantage of segmentation is the ease of maintenance. With proper design, sealing rings can be replaced with minimal effort. Successful implementation requires:

- High-quality shaft and cover ring surfaces.
- Coated shaft sleeves or shafts.

For conditions below 200°C and with low sliding speeds, cost-effective polymer seals (with 25% graphite content) are available as alternatives to graphite rings.

Hose springs and drivers are supplied in standard stainless steel or Hastelloy, pre-assembled and designed for the specified groove width.

Spare Parts Availability

We supply spare parts for the following sealing ring models:

- LPEWD 100
- LPEWD 200
- LPEWD 500
- LPEWDK-BHS
- LPE WDKS

Assembly Information

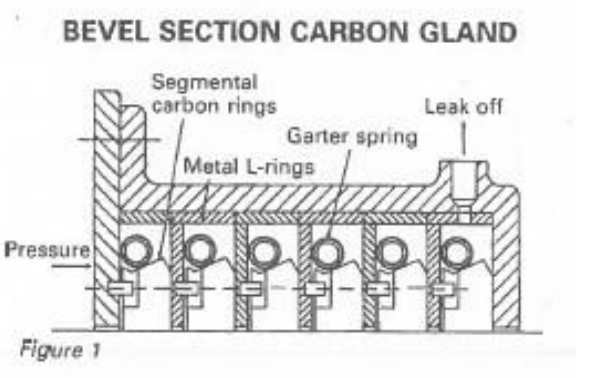
For assembly purposes, carbon rings are segmented and installed in L-shaped housings. A stop pin is provided to prevent the ring from rotating with the shaft. Rings may have either rectangular or bevelled cross-sections, and segments are typically butt-jointed.

2. Applications

2.1 Steam and Gas Turbines

In steam and gas applications, non-contact gland rings are used. These seal by throttling, with the bore of the carbon ring matched to the shaft diameter at operating temperature.

A **bevel-section gland ring** is shown in Figure 1 (not included in this version).



A bevel-section gland ring is shown in *Figure 1.*

In high-radial-clearance applications, mechanical seals and labyrinth seals are used due to their robust construction—especially in machines with large-diameter shafts or harsh operating conditions.

Segmented carbon seals are also used in small and medium steam turbines (both single and multi-stage). These are capable of operating under **dry conditions**.

2.2 Water Turbines

Segmented carbon rings with specially designed joints help maintain shaft contact as the carbon wears. These are extensively used in water turbines. Two main ring types are common:

- **Tenon Type**
- **Wedge Type**

Though these types may vary in detail, they generally adhere to these standard designs.

General Applications

- Blowers
- Compressors and Screw Compressors
- Turbines
- Centrifuges and Decanters
- Valves
- Rotary Dryers

Specifications

- **Shaft Diameter:** 40.00 mm to 600.00 mm
- **Operating Pressure:** Vacuum to 20 kg/cm²
- **Operating Temperature:** -120°C to +800°C
- **Speed:** Up to 150 m/s

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