

# CROSS

# Seals for the Turbine Industry

For 60 years Cross Manufacturing has maintained a lead in the development and manufacture of mechanical seals for extreme environments.

Founder Roland Cross, inventor of the Cross Rotary Valve also faced the challenge of cast iron piston ring failures. He developed a technique for making sealing rings from tough wrought alloys. This was the start of a tradition of innovative problem solving that the Company is renowned for today.

The phenomenal growth of new technology has continually challenged Cross engineers to develop and manufacture superior seals. Seals that have contributed directly to the realisation of the gas turbine, nuclear power generation, and exhaust gas turbo-charging.

Possibly the greatest contribution was the development of the Brush Seal for use on the rotating shafts of gas turbines. The development of the Brush Seal was a significant step in the move to large and efficient multiple shaft gas turbines.

While continuing to develop gas turbine seals Cross engineers are also working closely with the manufacturers of steam turbines to exploit the performance and efficiency of Brush Seals in this application.

Part of this program is to develop Brush Seals that can be retro-fitted to existing steam turbines to enhance overall efficiencies. Manufacturing processes are developed to produce seals that fully exploit continuing metallurgical advances, and in some cases drive that process forward.

The Company has extensive Research and Development facilities where seals are tested and evaluated over extended periods in hot and hostile conditions.

Manufacturing is centred on the City of Bath and the Town of Devizes both in Southern England and about thirty kilometres apart. Cross Manufacturing employs 260 staff, and remains family owned. At present three Directors, all qualified mechanical engineers, are descended from Roland Cross.

It is this knowledge, experience, and continuity, that is so valued by our customers.

## Cross Brush Seals

are applicable to many locations in Turbo Machinery

|                              |  |
|------------------------------|--|
| <b>Size</b>                  | 20 mm to 1200 mm in one piece rings<br>Greater than 1200 mm generally supplied in multiple segments. |
| <b>Temperature</b>           | Up to 600°C  |
| <b>Pressures</b>             | 20 bar per single stage of seal.   |
| <b>Speed</b>                 | Shaft surface speed up to 384 ms <sup>-1</sup>   |
| <b>Materials (main body)</b> | Alloy steels<br>Stainless steels<br>Nickel and Cobalt Superalloys.                                   |

### Cross Brush Seals are used to seal:

- Gas turbines for Aerospace and Power Generation.
- Steam turbines for Power Generation
- Rotary pumps and Compressors

## Cross Metal Piston Ring Seals

used in Power Generation.

For the extreme conditions of Gas Turbine, Steam Turbine and Nuclear Power Generation Cross make piston ring type seals.

|                    |   |
|--------------------|---|
| <b>Size</b>        | 1900 mm (6 ft 3 in) diameter is a regular part of our product range.<br>Bigger seals are now in development.              |
| <b>Temperature</b> | Piston Ring Seals for use at 760°C (1400°F) are part of everyday production.<br>Some rings operate even hotter than this. |
| <b>Pressures</b>   | Delta P's to 700 bar (70 MPa, 10000 psi) are being sealed by our<br>piston ring seals.                                    |

### Cross Rings are used to seal:

- Aerospace gas turbines when they are used as gas generators.
- Steam pipe joints.
- Static seals and retaining devices within the heat of gas and steam turbines.

## Cross Test Facilities

Available for evaluation of dynamic and static seals.

Hot and Cold dynamic brush seal rigs. These rigs have accumulated thousands of hours evaluating the best material combinations for shaft and seal.

### Evaluating the seal characteristics under realistic operating conditions.

- $\Delta P$  up to 20 bar (300 psi)
- Shaft surface speed 384 m/s (1260 ft/s)
- Gas temperature up to 620°C (1150°F)

The high temperature piston ring Fretting rig has proved invaluable over the years when selecting the best material pairs for a wide range of piston ring applications.

**Cross Manufacturing Co. (1938) Limited**

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