GE
Oil & Gas

Sealing Kit
for MS5002, MS5001, MS3002

Benefits

- ■■□ **Increased production**
- ■■□ **Higher efficiency**
- □□□ Compliance with environmental regulations
- □□□ Availability and Reliability
- □□□ Life extension

The installation of the advanced sealing kit in a gas turbine **improves the management of cooling air and combustion gas**, reducing leakage and **increasing efficiency and power output**. These kits **reduce the losses** that result from damage and aging of conventional seals.

What it is

The compressed air used for cooling the gas turbine hot parts or that is lost by leakage, can account for as much as 20% of the total flow.
The leakage adversely impacts performance, emissions and reliability.
The purpose of the following modifications is the reduction of leakage and improved management of cooling air and combustion gas during the operating cycle.

1st Stage Shroud with Spline Seals

The new shroud includes a new spline seal arrangement designed to reduce leakage between shroud segments. In most of GE's current production units, shroud designs include an interlocking labyrinth configuration at the inter-segment interface to reduce leakage from the forward to the aft side of the shroud.
A single, large spline seal parallel to the flow path inhibits leakage out of the shroud.

Abradable Coating on 1st Stage Shroud

The abradable coating on the stage 1 shroud allows for improved airflow control. Clearances between static and rotating components allow for airflow leakage with no performance benefit from the air. The abradable coating is a metal with an integral material. This material was chosen based on its resistance to oxidation, abradability, erosion resistance and thermal shock resistance.

2nd Stage Shroud with Honeycomb

Honeycomb seals are designed to reduce leakage of hot gases that flow around the tips of the buckets thereby improving both the heat rate and output. Honeycomb seals allow contact between the bucket tip and the casing shrouds and provide relatively tight clearances during steady state operation. Aircraft engines have used honeycomb seal designs for a number of years. The use of honeycomb shrouds requires buckets with cutter teeth.

Honeycomb shroud

What it is

High Pressure Packing Inner Brush Seal

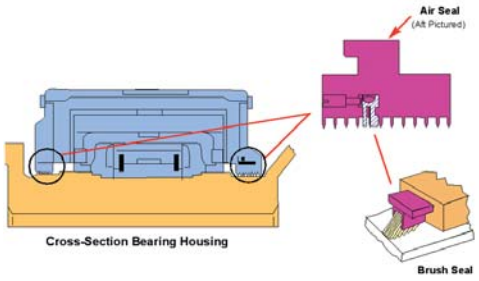
The seal between the compressor discharge casing inner barrel and the compressor aft stub shaft is commonly referred to as the High Pressure Packing (HPP). Brush seals increase control of flow in this region. Rub-tolerant brush seals are designed to withstand rubs and maintain clearances in this critical sealing area. Since the clearance between the brush seal and the rotor is reduced relative to the design clearance used with labyrinth tooth packing, there is an increase in performance compared to a labyrinth tooth seal.

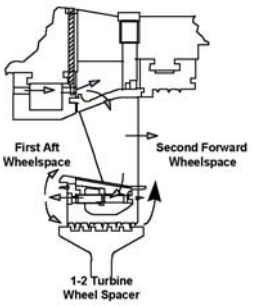
#2 Bearing Brush Seal

This option applies brush seals in two of the air seals of the #2 bearing housing. Since brush seals provide tighter clearances than the original labyrinth seals, the leakage flow into the bearing housing is reduced. This leakage flow is typically vented to exhaust and, therefore, does not perform useful work in the system. By reducing the leakage, the brush seals improve the performance of both the output and heat rate.

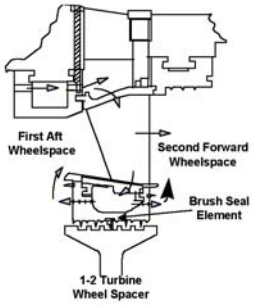
Interstage Brush Seals FS2Z

An interstage brush seal is inserted into a slot machined in a new diaphragm and replaces one of the labyrinth teeth. These interstage brush seals are able to accommodate larger radial excursions.





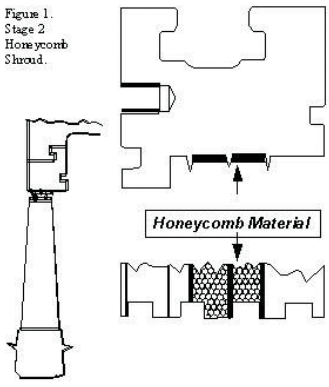
Current stage 2 nozzle design



Proposed stage 2 nozzle design

How it works

All the sealing kits are designed to reduce leakage and avoid irreversible damage due to transient conditions and vibration that may occur on standard configuration machines.
The **brush seal**, thanks to the inherent flexibility of the bristles, is able to maintain contact with the rotor surface even after radial excursions. The bristles are simply displaced during the excursion and then return to their position once the transient condition has passed. During testing, the sealing efficiency of a single brush is found to be about 10 times that of a labyrinth seal under similar conditions. A brush seal can easily accommodate misalignment normally not tolerated by labyrinth designs and will perform over longer hours of operation.
The abradable seals are designed to reduce leakage. The clearance between the static and rotation components can be influenced by several factors. Transient thermal growth, rotor alignment, rotor sag, and turbine shell out of roundness contribute to clearances between the stage 1 bucket and the stage 1 shroud. The abradable coating compensates for these factors to minimize the clearance. The improved clearance and associated reduction in tip leakage creates a performance benefit.
Honeycomb seals also reduce performance degradation by maintaining tighter clearances throughout the life of the shroud. Strips of honeycomb material made of a high-temperature, oxidization resistant alloy are brazed between the teeth of the casing shrouds. "Cutter teeth" on the leading edge of the shrouded second stage bucket tip rails "cut" the honeycomb material away if contact occurs during transients. This produces steady-state running clearances that are, on an absolute basis, no larger than the difference between the steady state and the transient clearances. The effective clearance is actually tighter than the absolute clearance since the resulting groove in the honeycomb provides a tighter labyrinth seal which could be obtained with solid materials.



GE imagination at work

GE Oil & Gas
via F. Matteucci, 2
50127 Florence - Italy
T +39 055 4272500
F +39 055 4232800

E customer.service.center@ge.com
www.ge.com/oilandgas

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