Backgrounder

Brush seals

It’s a simple concept with a big impact: More than 30 years ago, MTU Aero Engines set out to develop its first brush seal. The innovative components are suitable for use not only in aircraft engines – as, for example, in Pratt & Whitney’s successful family of PurePower® geared turbofans –, but also in steam and gas turbines, pumps and a variety of other mechanical engineering applications. MTU has established itself as a global leader in the field.

Technology

The idea behind the technology of brush seals is as simple as it is brilliant: “The construction typically includes thousands of thin bristles forming a very flexible seal which continuously adapts to the moving surface to be sealed,” explains Benjamin Großkurth, who heads up brush seal production at MTU. This way, brush seals clearly outperform conventional sealing systems, such as labyrinth seals. Says Großkurth: “MTU’s brush seals reduce leakages by up to 90 percent, which boosts the performance of the engine or gas turbine.” Every increase in efficiency improves the eco-efficiency of a propulsion system, resulting in lower fuel consumption and reduced CO₂ emissions.
Advantages

- Versatile applicable
- Stable operating behaviour
- Applicable under extreme conditions
- Easy to install
- Less space required at the same effect
- Long life
- Easy to maintain
- Easy to replace
- Slim operating costs

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Benjamin Großkurth, Head of brush seals

Take a single-aisle aircraft, for example. The innovative seals will save around one percent of the, say, 20,000 tons of kerosene the jet typically burns every year – and that is the equivalent of the amount of fuel carried by ten tank trucks with a capacity of 20 tons each. Moreover, CO₂ emissions are reduced by the same percentage as fuel consumption.

Applications

The latest example of applications that highlight MTU’s capabilities in the field of brush seals is the successful PurePower® PW1000G series of geared turbofan (GTF) engines: MTU already contributes three brush seals each to the GTF engines to power Bombardier’s CSeries, Mitsubishi’s MRJ regional jet and Embraer’s E-Jets. Now the company has been selected to also supply its seals for the two additional GTF engine models: both the PW1100G-JM engine to power the A320neo aircraft and the PW1400G-JM engine to power the Irkut MC-21 aircraft will incorporate a total of four MTU brush seals. MTU’s innovative sealing systems were originally designed for use in military engines. Back in 1983, MTU launched initial tests with brush seal components and soon filed for a patent for its new concept. The first brush seal ever developed at MTU was intended for installation on the RB199 engine powering the Tornado.™ Engine applications include the EJ200 powering the Eurofighter Typhoon, the TP400-D6 powering the Airbus A400M military airlifter and the PW6000 powering the Airbus A318.

550°C 700°C

At the beginning, brush seals had a maximum temperature exposure limit of 550 °C. Today, brush seals are capable of withstanding up to 700 °C.

170m/s 500m/s

The surface speeds brush seals are exposed to when in service, too, were increased markedly.

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of MTU made brush seals are used in fields outside the aviation industry. New fields of application include industrial plants, such as gas and steam turbines for power generation, compressors and water pumps.

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