



# Techtron® HPV PPS

## Thrust Reverser Limiter Washer

### Challenge

**Develop efficient and high reliability components that meet the extreme demands required in thrust reverser systems**

Landing speeds of aircrafts of up to 300 km/h and varying sizes of runways in combination with the trend to short cut taxiing to save fuel and gas require the usage of thrust reversers. These support the aircraft wheel brakes as well as aerodynamic speed brakes to eliminate kinetic energy and decrease speed after touch down. Thrust reversers are operated by linear hydraulic actuators.

On hard landings or aborted takeoffs, the thrust reverser needs to be operated at maximum thrust level. To enable the full efficiency, the actuator shafts are supported by washers. The washer guides the shaft under those high loads to open the cascade door and keep them in place.



Limiter Bushing

After flight temperatures can be as low as minus 60 °C (140 °F) and the thrust reverser can be exposed to temperature peaks of up to 160 °C (320 °F) for a short period. Smooth gliding without wear or judder is required over this whole temperature range.



### Key Requirements

- Low coefficient of friction versus light weight metal alloys
- Wide operational temperature window
- Thermal expansion similar to aluminum
- Low or no abrasion against aluminum alloys
- Chemically resistant to aircraft fuels and other aircraft liquids like Skydrol®
- Minimum 20 years lifetime

## Why Techtron® HPV PPS?

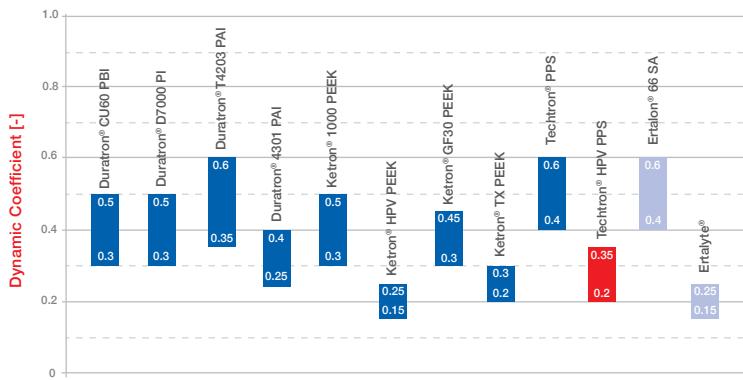
Techtron® HPV PPS has been developed for glide and wear applications in extreme environments and is able to withstand very harsh chemical conditions. Its dimensional stability over a wide temperature range enables a combination with lightweight aluminum alloys at low tolerance. Techtron® HPV PPS is a lighter weight material solution offering optimal performance qualities to replace the previously used metal.

## Customer Benefits

- Higher reliability of the operation under aircraft “engine” conditions
- Cost savings of up to 60% in up-scaling process
- Cost savings through low system maintenance requirements
- Optimized component surface and tolerances provided by precise material machinability

### Dynamic Coefficient of Friction

[measured on a “plastics pin on rotating steel disk” - tribo system]



Test Conditions:  
Pressure: 3 MPa  
Sliding Velocity: 0.33 m/s  
Surface Roughness of the C35 steel mating

Surface: Ra = 0.7 - 0.9 µm  
Total Distance Run: 28 km  
Normal Environment [air, 23°C / 50% RH]  
Unlubricated Operation

## Mitsubishi Chemical Advanced Materials Added Value

- Understanding of the aerospace environment and requirements; experience in very diverse and demanding applications
- Laboratories & material testing capabilities in order to e.g. generate data on wear and abrasion behavior
- Full project management by our solution development from metal to plastic conversion
- Support in the up scaling process and identification of significant cost savings potential: We are able to manage and deliver orders of any size, from single to high quantity machined pre-shapes which enables cost savings by 60%

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