

Viscous Deployment Damper

Lightweight Viscous Deployment Damper which provides torque/speed-dependent rotation resistance in order to prevent high shock loads when the end stop of the deployment mechanism to which it is mounted is reached.



The Viscous Deployment Damper essentially consists of housing and rotor. When turned, the rotor forces highly viscous working fluid through narrow gaps. The resistive torque thus generated is proportional to shaft angular rotation rate and fluid viscosity. The damper thus eliminates the need for high ratio gears and their corresponding mass and friction.

The damper is available in versions for deployment angles up to 90° and up to 270° deployment.

Features

The Viscous Deployment Damper provides the following design features:

- Low mass and design simplicity
- Double independent seals arranged in series for the shaft seals (dynamic) and for all static seals, each capable of retaining the working fluid in the damper
- The shaft seals and the working principle of the damper generate exceptionally low starting torque, thus requiring significantly less deployment spring torque and thus reduces spring mass of the corresponding mechanism
- The damper characteristic (resistive torque vs. shaft angular rate) can be set and tuned by suitable selection of the viscosity of the silicone oil working fluid. For a given characteristic, the damper volume, expressed in terms of housing outer diameter and length, can be varied to match the specific needs of the application
- Mass: 230 g (90° deployment)
- 285 g (270° deployment)
- Overall flange diameter: 63 mm
- Overall length: 81 mm (90°)
- 95 mm (270°)
- Housing diameter: 50 mm
- Working fluid: Silicone oil baysilone
- Damper characteristics (example 90°- damper, at 11 Nm external torque, for oil viscosity M100000, other values selectable, tolerance $\pm 20\%$):
 - -30°C: 1260 Nms/rad
 - +25°C: 315 Nms/rad
 - +50°C: 210 Nms/rad
- Resistive torque:
0.09 Nm (= Break-away torque)
- Temperature range survival after deployment in orbit:
 - 150°C/+150°C
- Temperature range survival before deployment:
 - 100°C/+150°C
- Temperature range operation: -30°C/+50 °C
- Leak rate: space environment 3×10^{-9} g/s
- Life time in space: 15 years
- Thermal vacuum cycling and quantitative leak rate test.

The Qualification process has comprised:

Characteristic (resistive torque vs. shaft angular rate) vibration thermal vacuum cycling and quantitative leak rate test.

Acceptance Testing comprises typically:

Helium-leak rate test, Performance test (resistive torque).

Programs

The Viscous Deployment Dampers have been developed in the frame of ESA development programs and is being used for European and non-European satellite programs.