Low Friction, Low Stiction Gimbal/Pod/Pan-Tilt Seals

Bal Seal® spring-energized seal: The ultimate low-friction sealing solution

With the Bal Seal® spring-energized seal, you can finally achieve the elusive balance between friction and sealing effectiveness. Our seal combines low friction materials, a canted coil spring energizer, and custom jacket profiles to improve accuracy and reliability in gimbals, pods, pan-tilt systems and other demanding rotary/oscillating applications.

BAL SEAL® ENGINEERING, INC.

Photo: U.S. Air National Guard

In C4ISR, high energy laser, LaserComm, and other gimbal/pod/pan-tilt applications, no other seal can match the superior protection and low-friction performance of the Bal Seal®. Here's why:

Bal Seal® feature	Why is it relevant?	What's the benefit?
PTFE Seal Material	• Lower friction and stiction	• Reduces torque required to move pod, allowing for smaller motor size and lower overall system weight (SWaP) • Helps prevent jitter during target tracking, promoting faster, more accurate positioning and better pointing stability • Manages high-speed bi-directional rotational movement
	• Media resistance	• Seals effectively against salt, dust, hydraulic fluid, fuel, and other media, preventing corrosion and contamination
	• Tolerance for high temperature variances	• Performs well in temperatures ranging from cryogenic up to 500 °F
Bal Spring® Energizer	• Nonlinear spring behavior	• Promotes consistency of friction • Ensures effective sealing in adverse conditions such as weather, speed, elevation, and extreme temperatures
	• Compensates for large tolerances and stack-up	• Provides greater design flexibility • Helps reduce hardware cost and complexity
Unique Bal Seal® Geometry	• Smaller seal cross section	• Reduces space requirements (SWaP)
	• Greater frictional consistency over operating range	• Offers improved frictional control of dynamic seal lip • Optimizes lip contact to seal effectively with minimal stiction/stick-slip • Reduces wear for prolonged service life • Compensates for thermal expansion
Custom-Engineered Locking Ring	• Consistent sealing despite thermal cycling	• Lowers risk of extrusion, cold flow, and leakage • Prevents seal jacket shrinkage • Eliminates unwanted seal movement

Factors Impacting Gimbal Design

FRICTION

- Presents challenges for precision pointing/stability
- Influenced by temperature, pressure, hardware surface finish
- Drives actuator selection/sizing and impacts power usage

ENVIRONMENTAL CONDITIONS

- Application in air, land, sea, and space, with demanding accuracy and service life requirements
- Exposure to moisture, salt spray, dust, hydraulic fluid, fuel, other potential contaminants
- Broad temperature variations (-40 °F to >180 °F), vibration, rotation, high speeds and pressures

Key Gimbal Seal Design Considerations

- Low friction/low stiction (drives selection of other system components)
- Sealing efficacy (prevents contamination, corrosion)
- Survivability (withstands range of temperatures, vibration, rotation)
- Seal service life (meets field maintenance requirements)

Get a custom seal proposal in 3 working days and a prototype in 4-6 weeks. Leverage our FMEA, engineering expertise, and gimbal experience to save time and money in development and testing.

REQUEST A DESIGN

Bal Seal Engineering, Inc.
19650 Pauling
Foothill Ranch, CA 92610, USA
T 949 460 2100
F 949 460 2300

Bal Seal Engineering Europe, B.V.
Jollemanhof 16, 5th floor
1019 GW Amsterdam,
The Netherlands
T +31 20 638 6523
F +31 20 625 6018

www.balseal.com • sales@balseal.com

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