



Prime Mover Actuators Compressors/Pumps Rotary Feedthroughs

Engineered Bellows Devices

Zero Leakage,
Clean Operation,
High Performance,
High Reliability

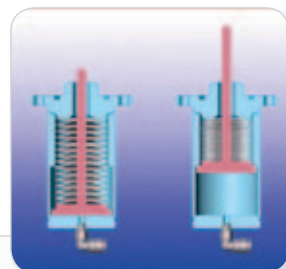
senior
OPERATIONS LLC



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PRIME MOVER™ Precision Linear Actuators



Using our advanced metal bellows technology, the PRIME MOVER™ is a unique linear actuator that provides superior reliability and maintenance-free performance.

- Operates in harsh environments
- Operates at extreme temperatures
- Actuates across pressure boundaries

The PRIME MOVER™ is designed to deliver precise linear actuation time-after-time from the day you install it.

- Factory preset and tested
- Fast system level integration
- Plug-and-play
- Completely maintenance-free

Construction

What makes the PRIME MOVER™ unique is that it uses a welded metal bellows as the force generating mechanism instead of a piston. A welded metal bellows is essentially a hermetic spring. If you apply a pressure differential across the bellows, the bellows will compress or extend depending on the direction of the pressure. If pressure is applied external to the metal bellows, the bellows will compress, extending the actuator. If the pressure is removed, the bellows spring force will retract the actuator. Double actuating versions are also available.

Unique Advantages

By combining sealing and actuator capabilities in one unit, the PRIME MOVER™ delivers a number of unique performances and cost advantages.

- Superior reliability and performance – virtually zero friction
- Compatible with normal, exotic or corrosive fluids – all wetted surfaces stainless steel construction or high nickel alloys as required.
- Sturdy construction – operates from cryogenic to +450°C
- Contamination free actuation
- Cost-effective – simplifies system design with fewer components
- Facilitates system level integration – true plug-and-play, factory preset and tested
- Compact design – By combining a pressure seal and actuator in the same envelope, the PRIME MOVER™ is significantly smaller than conventional actuators
- Completely maintenance free – long life without service
- Pneumatic or hydraulic actuation

Features

- All metal wetted surfaces
 - No dynamic elastomeric seals to replace from wear or degradation
- Hermetic actuation seal
 - Leak tight actuation across pressure boundaries
- Zero friction
 - Repeatable performance
 - Smooth actuation
- 1 million minimum cycles
- Ultra-clean actuation, meets ISO-14644-1 Class 1
- Actuation forces up to 100 lbs.
- Accurate and repeatable positioning
 - Z axis (stroke) accuracy $\pm .003"$ (.01 cm) as a standard
 - $\pm .001$ (.01 cm) as requested
 - Lateral accuracy .010" (.1 cm) \varnothing True position
 - Unit to unit uniformity $< .005"$ (.01 cm)

Standard and Custom Designs

Standard designs are available for a range of actuation strokes from .5" (1.3 cm) to 1.5" (3.8 cm) and have a force output up to 10 lbs. The standard designs use a stainless steel bellows and housing and have a simple mounting flange. These units are suitable for a wide range of uses.

Custom designs are available on request.

With custom designs we can consider:

- Materials selection to suit various environmental extremes with temperature or corrosive gasses
- Specific force output and stroke requirements
- Position monitoring options
- Multi-stage stops

Housing

- 304L Stainless Steel
- 316L Stainless Steel
- Inconel 625

Bellows

- AM-350 Stainless Steel
- Inconel 625
- Hastelloy C-276
- Haynes 242

Position Monitoring

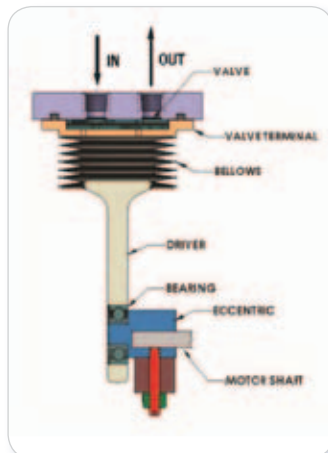
- Magnetic switch
- Fiber Optic Switch
- LVDT

Applications

The PRIME MOVER™ is ideally suited for a wide range of applications.

- Pin lifters
- High temperature valves
- Wafer handling
- Robotics
- Shutters
- Wherever linear actuation is required

Vacuum Pumps/Compressors



Bellows vacuum pumps/compressors provide zero leakage, hermetic gas handling for semiconductor processing applications.

Features

- Long Life
 - Uniform, symmetrical welds that assure long life
- Stainless Steel
 - All wetted surfaces made from corrosion-resistant 300 Series stainless steel except for the valve seal, which is available in Teflon, Viton, aluminum or silver-plated stainless steel
- No Maintenance
 - No wearing surfaces and no lubrication required
- Hermetically Sealed
 - Hermetically sealed AM350 welded bellows provide positive containment
 - Every pump is pressure tested to assure leak-tight integrity, with certification to mass spectrometer leak testing available up to 2×10^{-10} scc/sec He on certain models
- High Reliability & Long Service Life
 - Bellows and valves are designed with stress levels below defined endurance limits of materials allowing for 10,000 hours of continuous operation
- Sealed Ball Bearings
 - Driver assembly containing permanently lubricated and sealed ball bearings
- Positive Bellows Displacement
 - Eccentric cams are mounted on the motor output shaft and the rotary motion of the motor is converted to reciprocating motion at the bellows via connecting rods that provide motion for positive bellows displacement

Double Containment Option

Our double containment pumps/compressors use two bellows in series, a primary pumping bellows and a secondary containment bellows, to provide double containment reliability. In the event that one bellows fails the second will continue to provide containment while a signal is triggered to alert the user.

Rotary Feedthroughs



- Provides rotary motion through a pressure boundary
- Hermetic Sealing
 - Welded metal bellows construction
 - Leak tight to 1×10^{-9} std cc/sec He
- Suitable for use with gasses, liquids or vapor
- High Reliability & Long Life
 - All welded metal construction
 - No elastomers
 - Virtually friction free operation
- Clean Operation
 - Rotating bearings are sealed by welded metal bellows
- Precision Torque Transmission
 - Zero backlash
- Smooth Operation
- Operates at temperature extremes -40°F to 300°F



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