



February 7, 2019

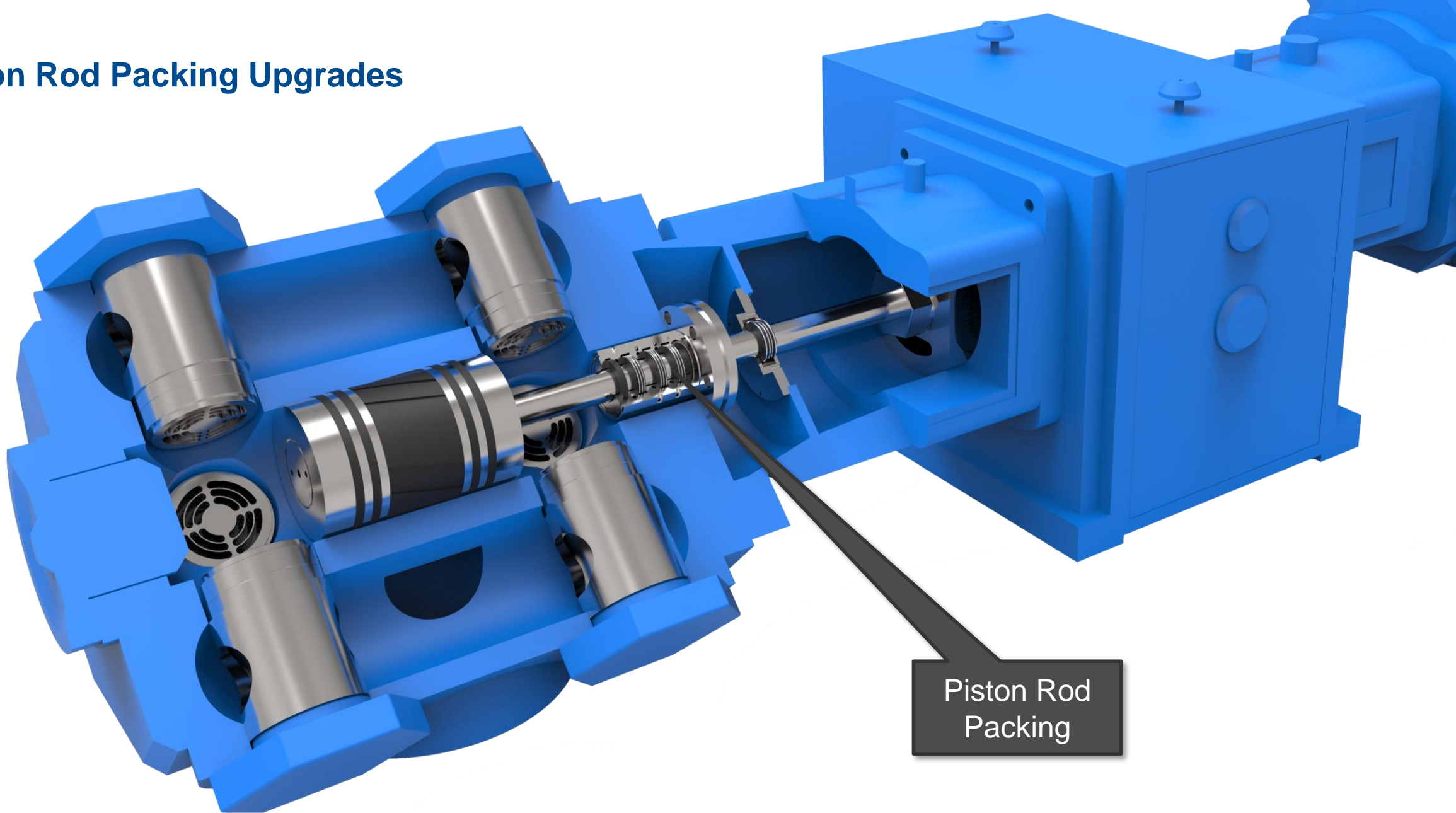
Piston Rod Packing Upgrades for Emissions Reduction in Reciprocating Compressors

Gas/Electric Partnership Conference 2019

David Johnson, Applications Engineer

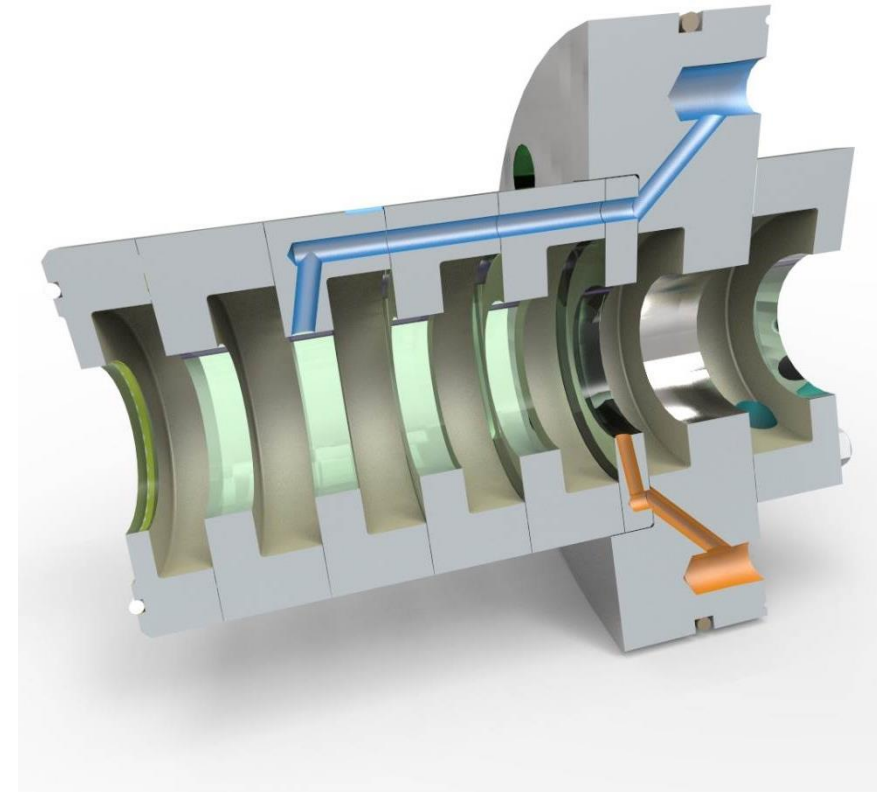
Craig Martin, Chief Engineer

Piston Rod Packing Upgrades



Piston Rod Packing: The Problem of Leakage

- Several potential sources:
 - Nose gasket
 - Between cup faces
 - Along piston rod

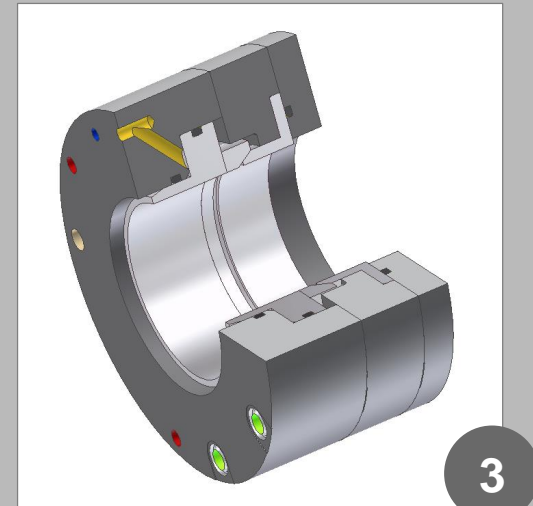
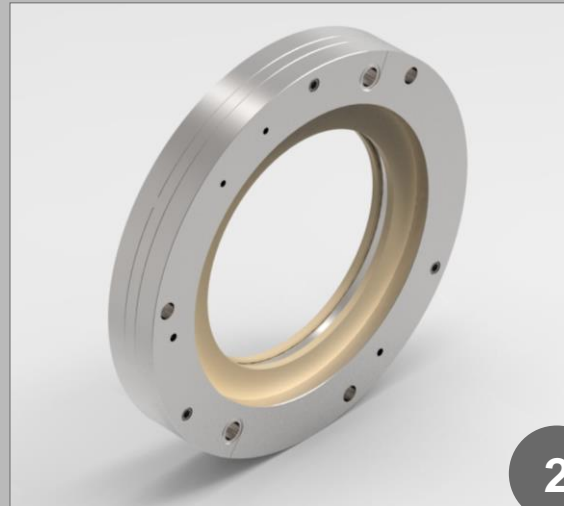
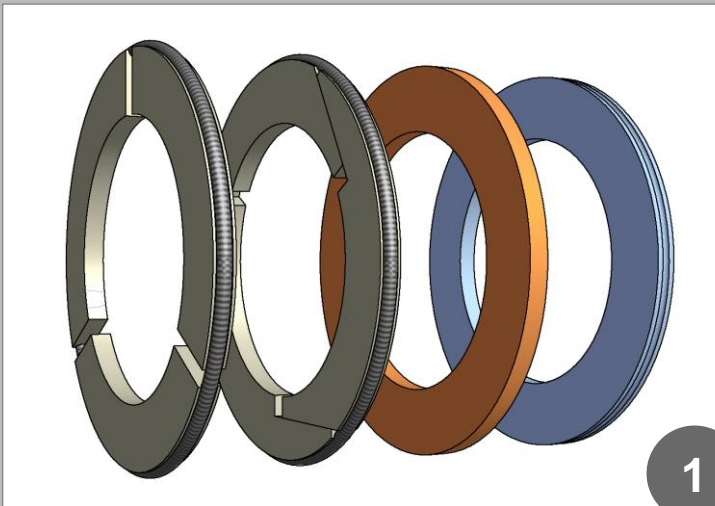


Piston Rod Packing Upgrades to Minimize Leakage

1 Rod ring upgrades to reduce dynamic leakage

2 Buffer seal systems

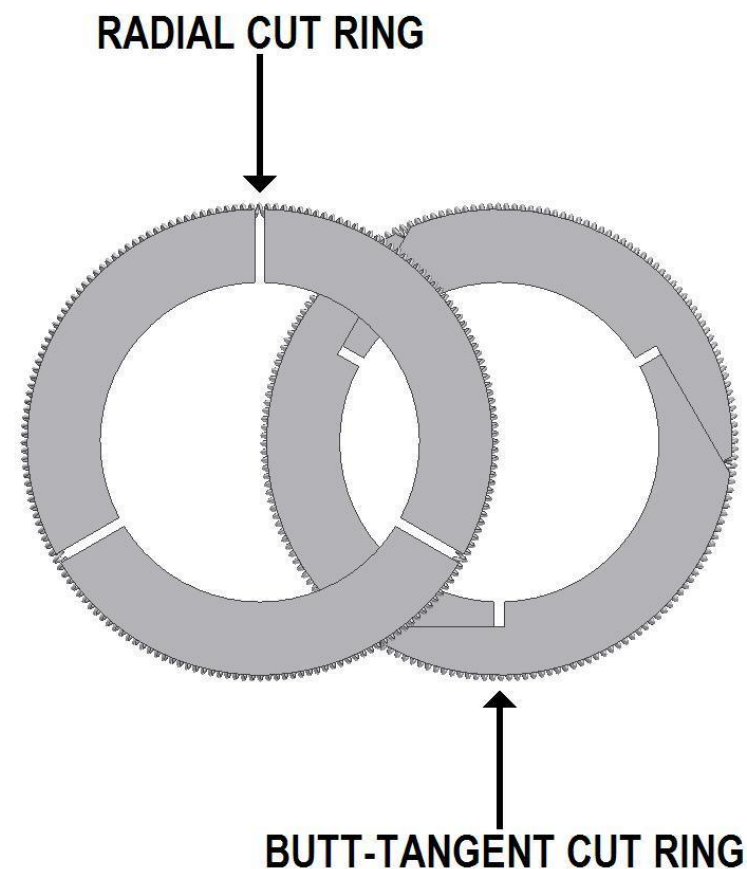
3 Standby seals to eliminate static leakage



Rod Ring Upgrades

Traditional packing rings

- Used to control dynamic leakage
- Rely on radial-cut/tangent-cut pairs
- Loading and frictional heat generated is proportional to pressure drop across ring
- Frictional heat increases wear rate, limits packing life
- Technology in use for over 100 years



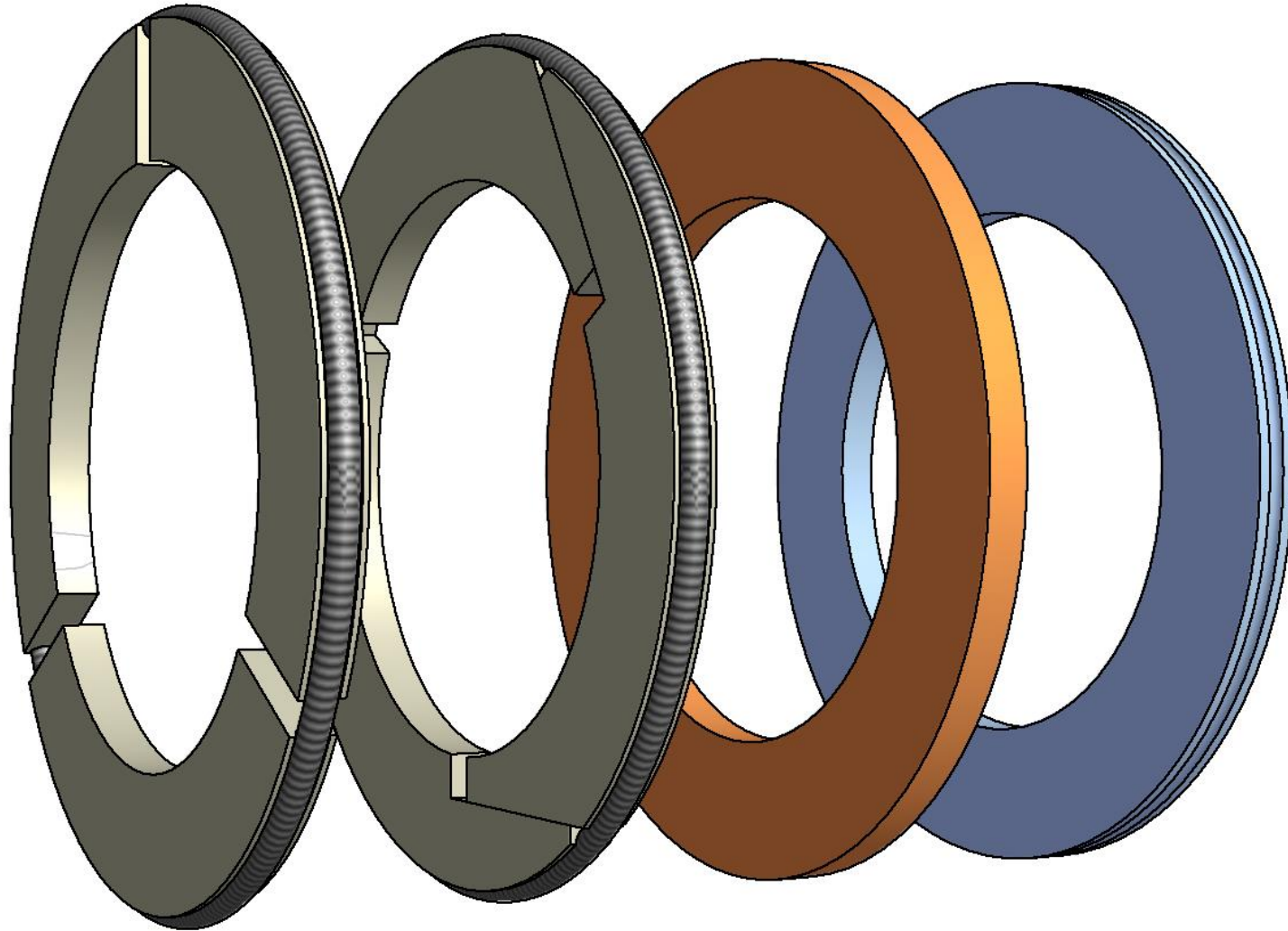
Rod Ring Upgrades

Solid Ring Technology introduces a new method of sealing

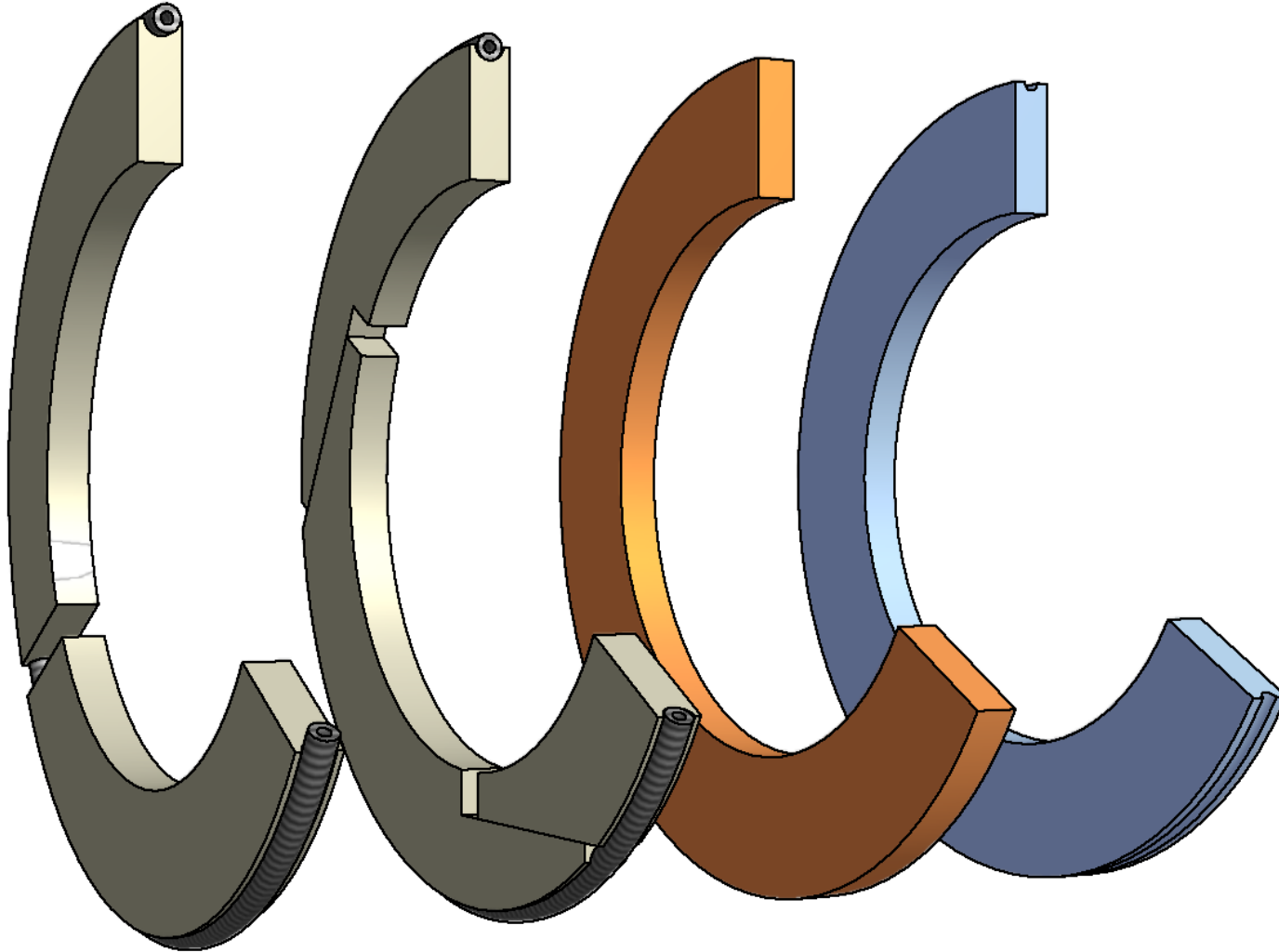
- Solid rod rings utilize compressive properties of materials to seal with less frictional load
- Four rings in assembly
- Rings seal sequentially to distribute pressure load



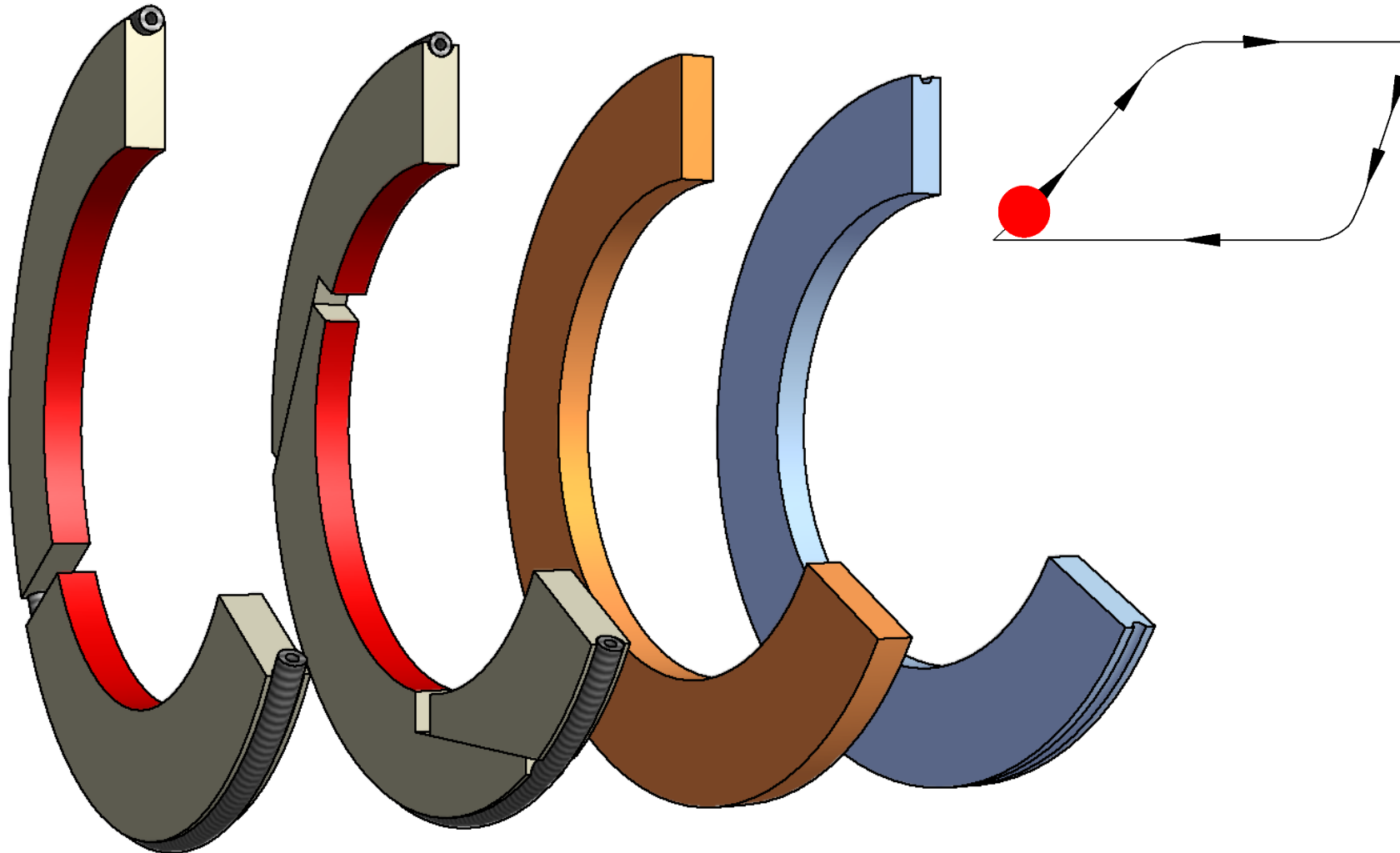
Solid Ring Technology



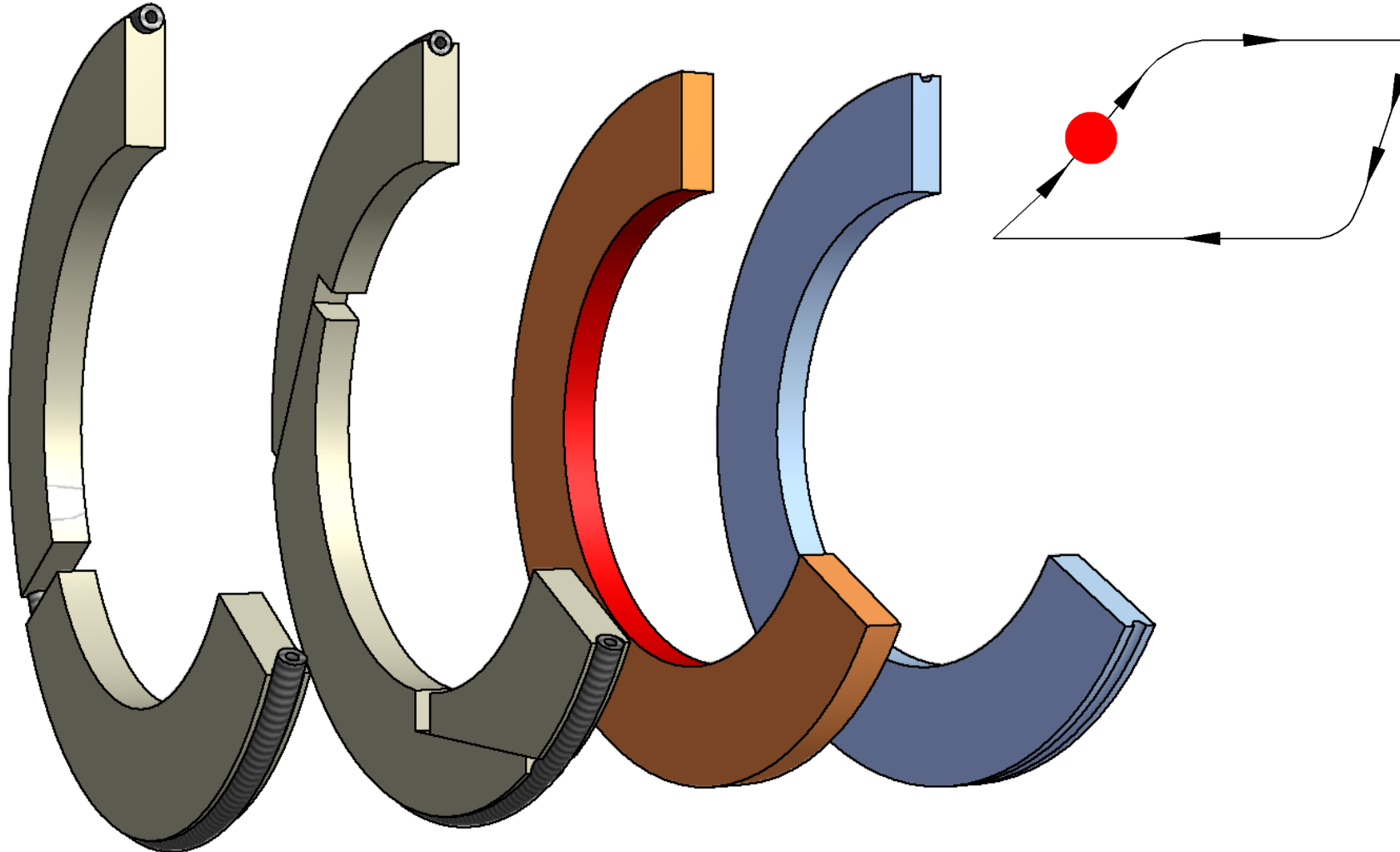
Solid Ring Technology



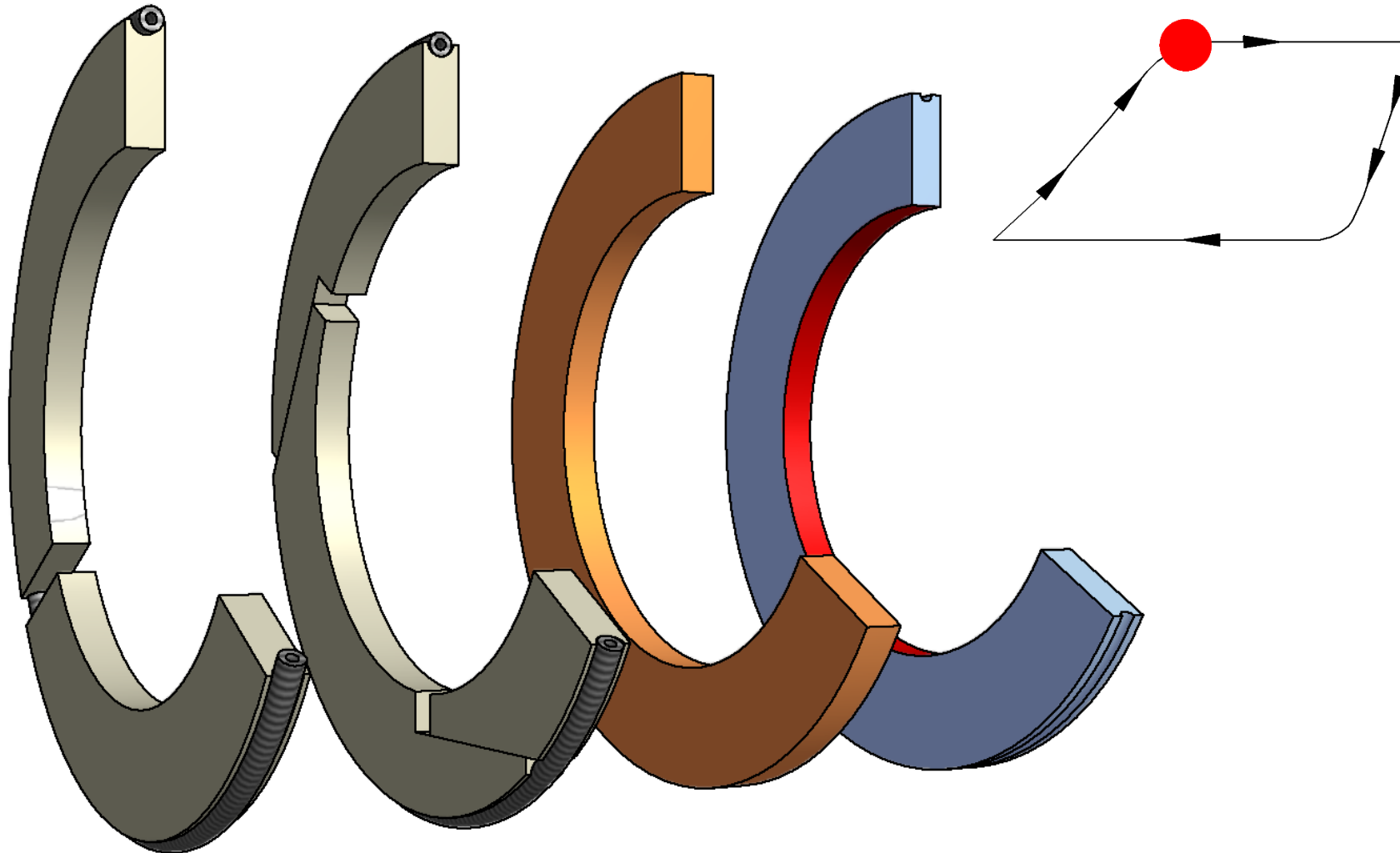
Solid Ring Technology



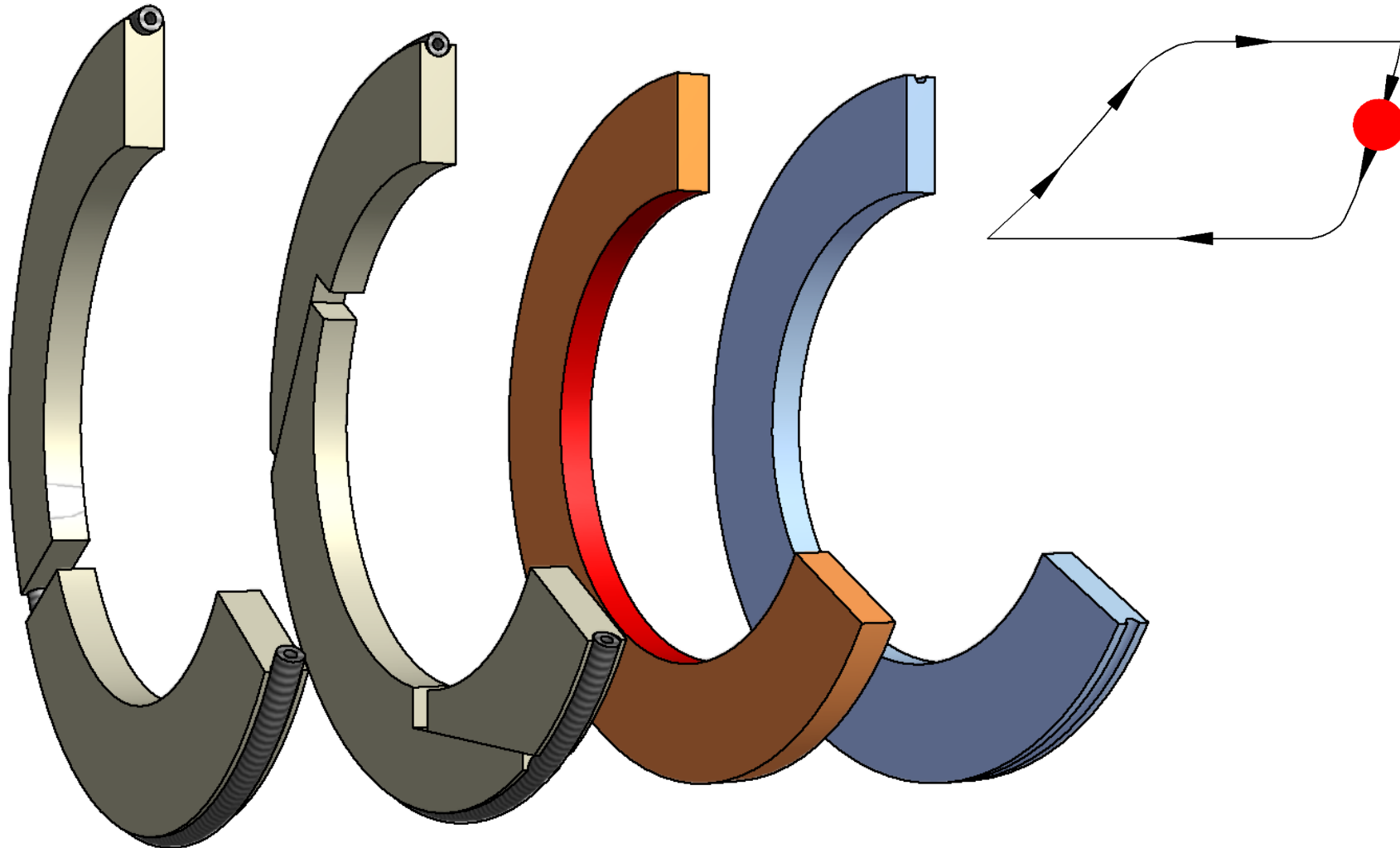
Solid Ring Technology



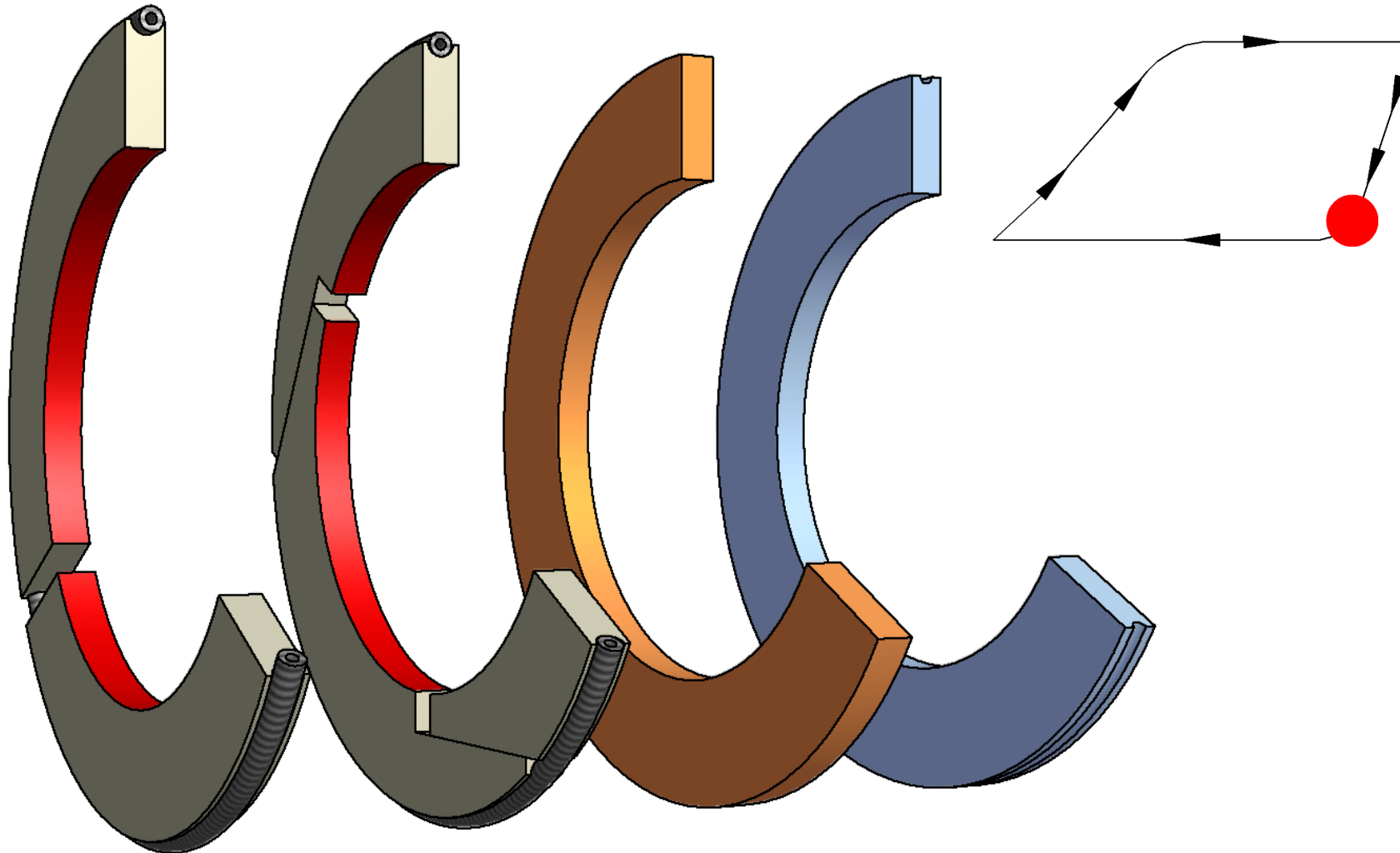
Solid Ring Technology



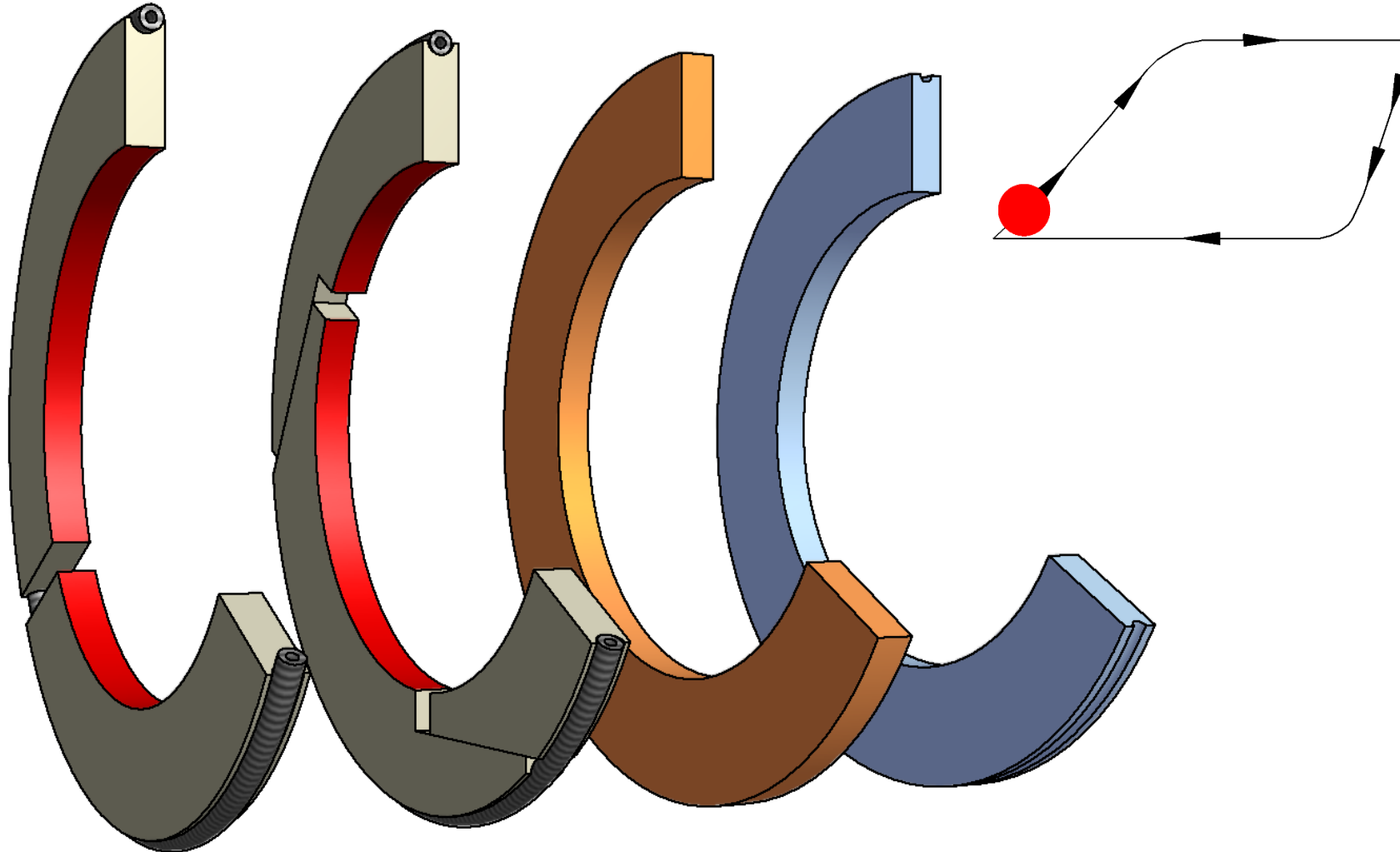
Solid Ring Technology



Solid Ring Technology

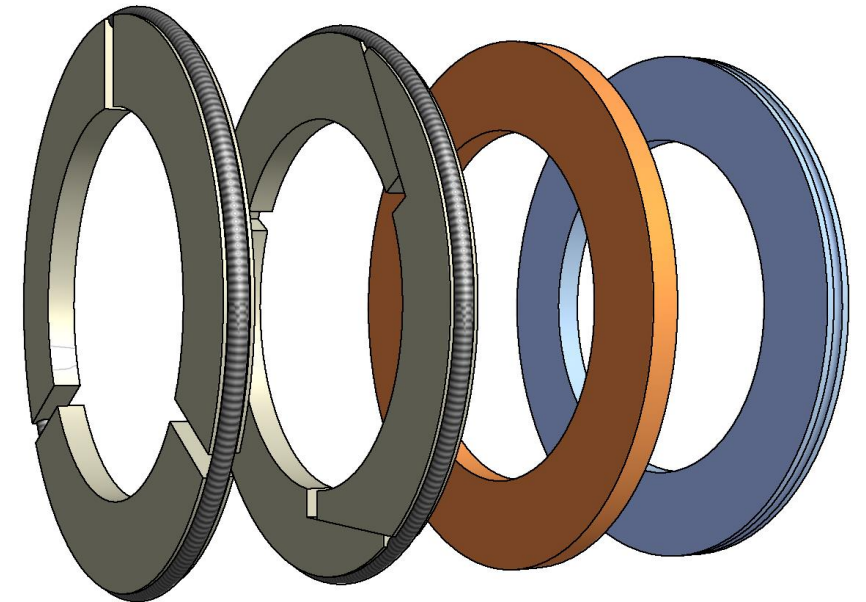


Solid Ring Technology



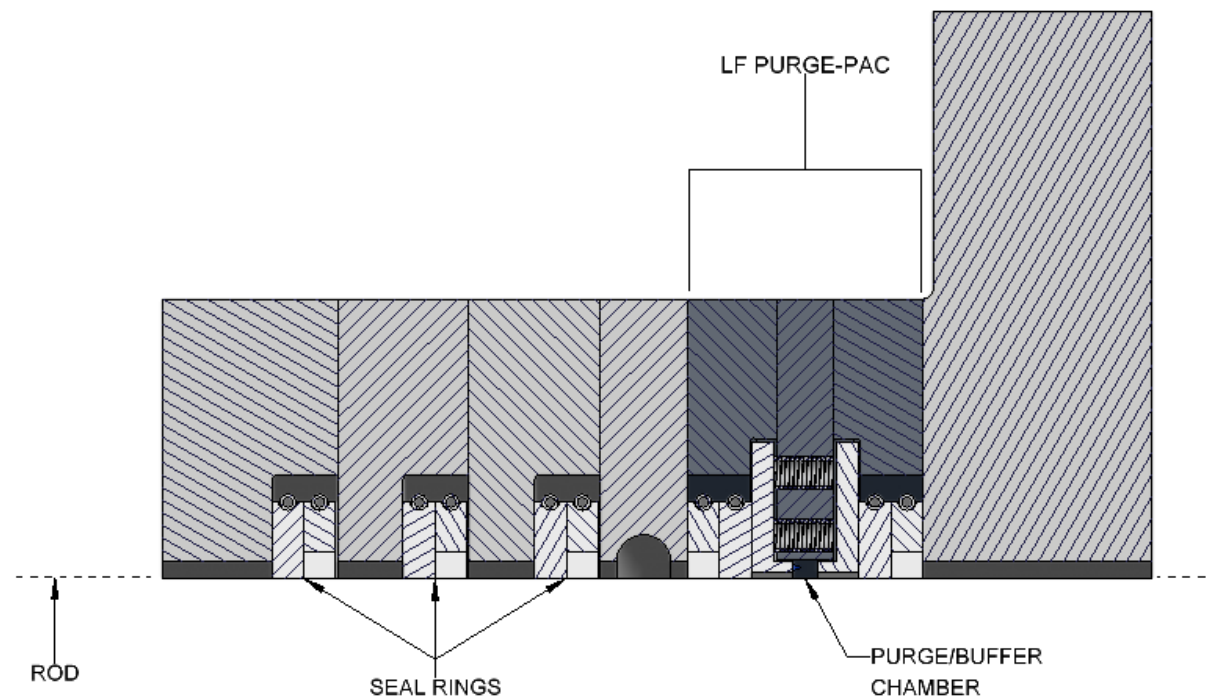
Benefits of Solid Ring Technology

- Reduced frictional load, due to:
 - Sequential loading
 - Compression of ring absorbing pressure energy
- Less frictional heat results in longer packing life
 - Have observed piston rod temperature reduction of up to 100°F compared to traditional rings
- Improved sealing
 - Solid Rings have no gaps, seal very tightly
 - Greatly reduced leakage versus traditional packing rings
 - Confirmed in numerous case studies
- Efficient sealing allows for fewer packing rings



Buffer Seal Systems

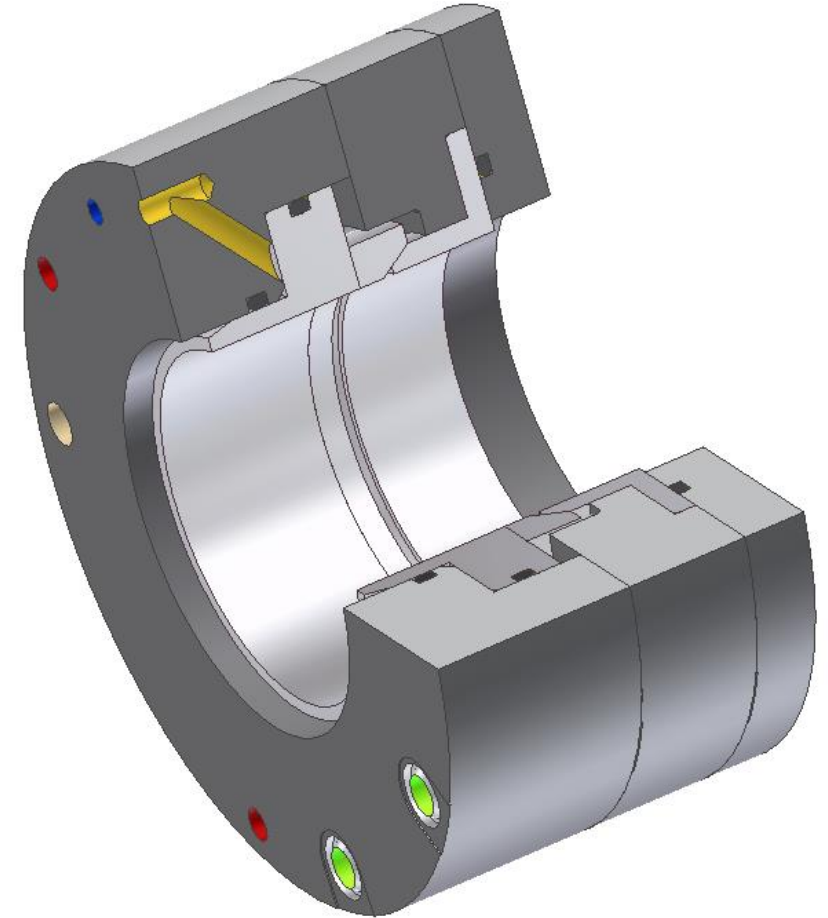
- Packing leakage needs to be contained
 - Packing vent allows controlled disposal or recapture
 - Avoid leakage to distance piece
- Buffer seals help contain dynamic leakage
 - Use Nitrogen or sweet gas to force dynamic leakage out through vent
 - Use axially-loaded packing rings under pressure



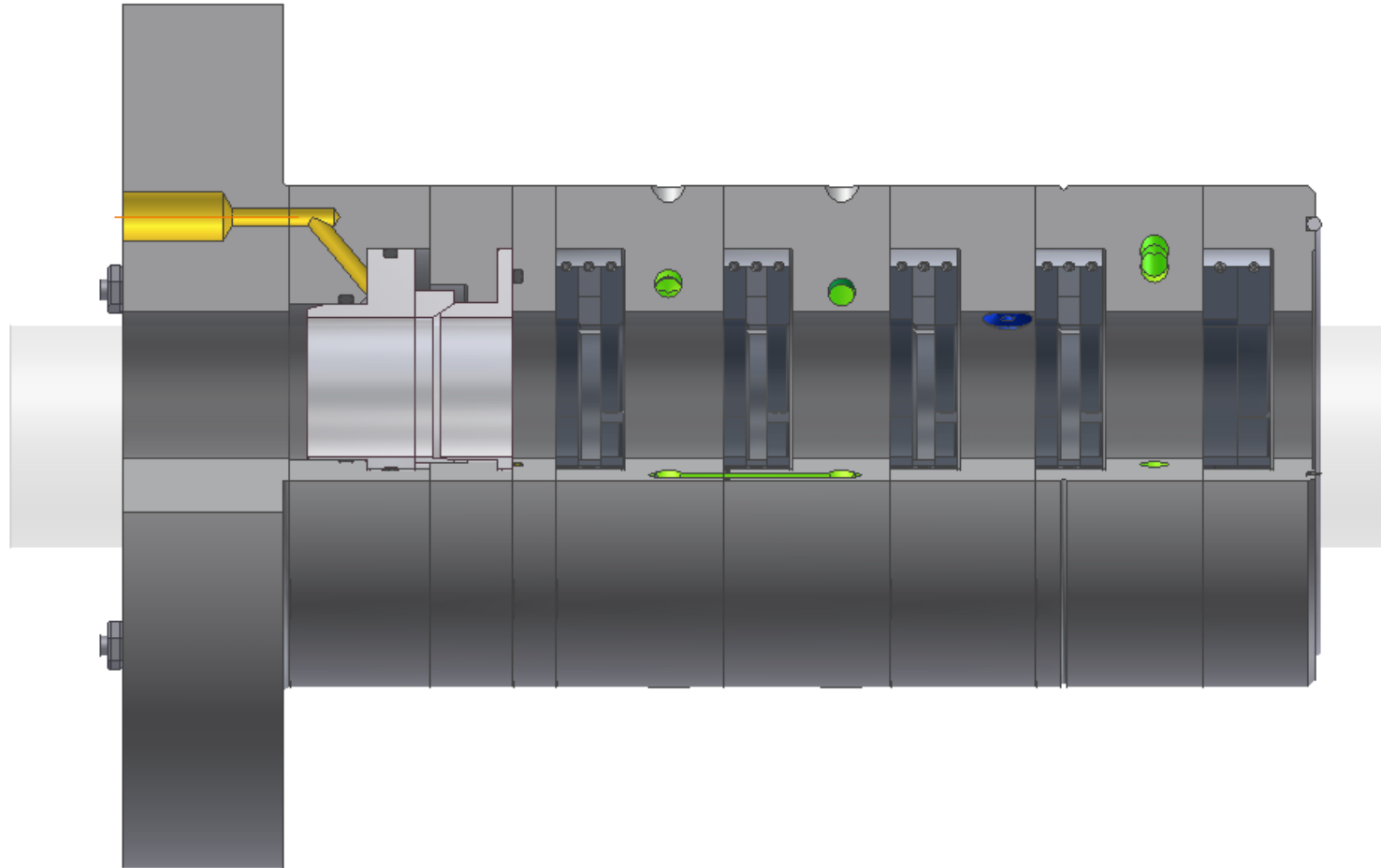
Shutdown Seals

Pressure-activated standby seal to eliminate static leakage

- Packing rings do not actively seal gas in standby mode
- Especially for use on compressors in intermittent service
- Soft PTFE seal is positively activated against piston rod to contain all gas within cylinder
- Process gas is used to activate this seal

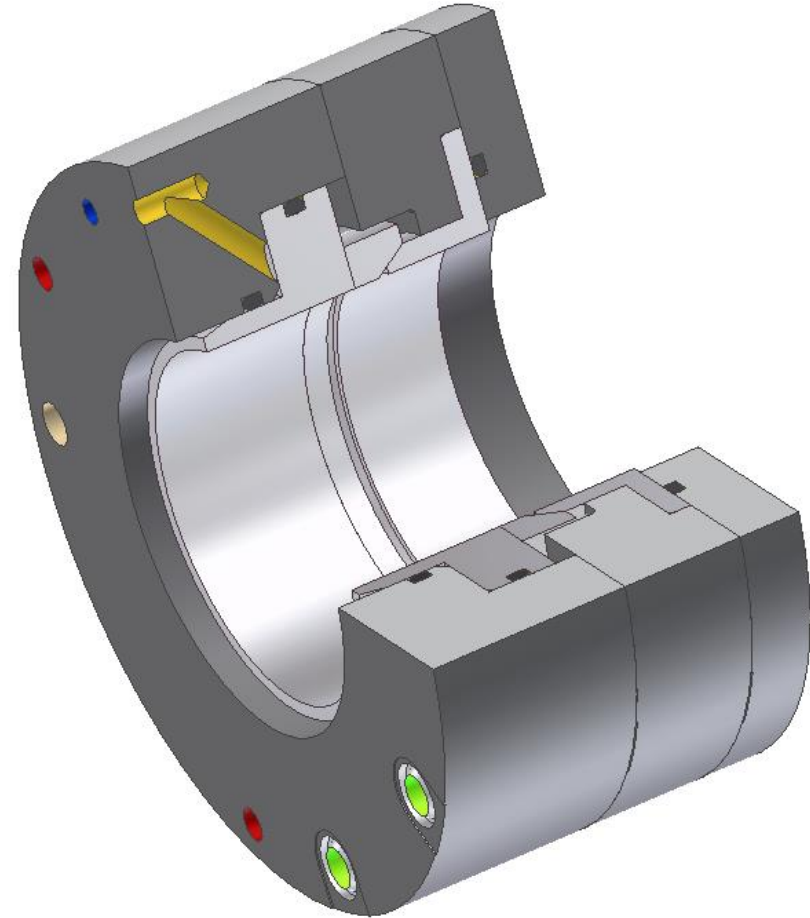


Shutdown Seals



Shutdown Seal Benefits

- No need to blow-down
- All gas is maintained at settle-out pressure within the cylinder

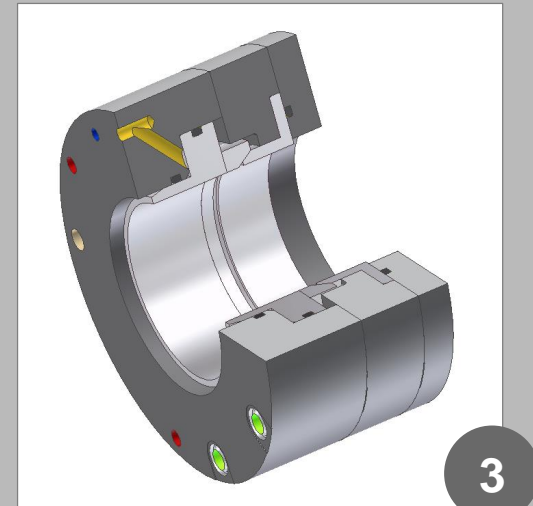
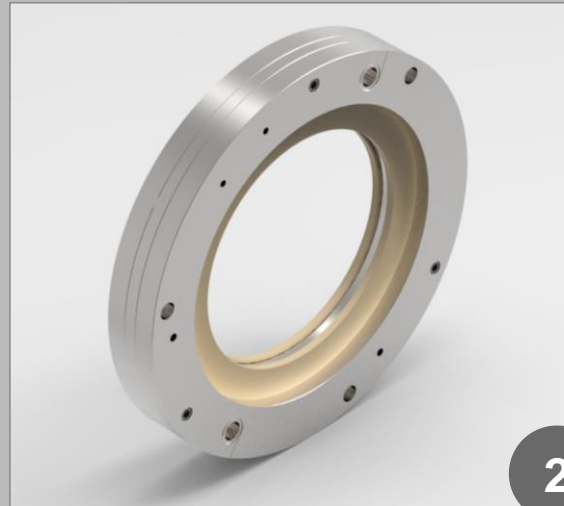
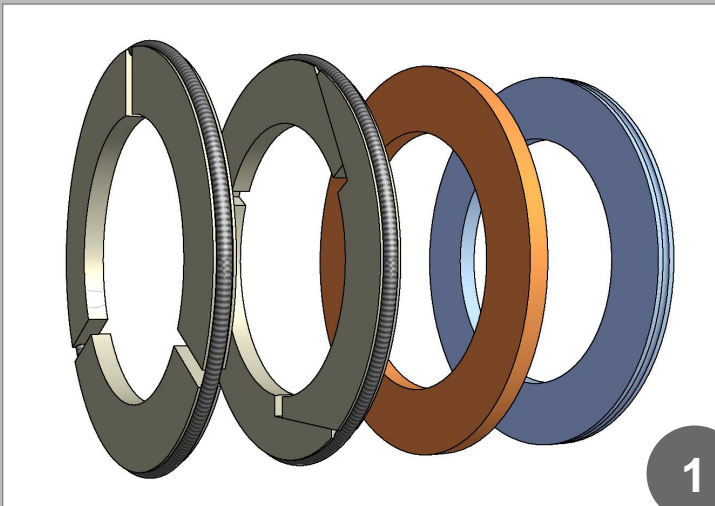


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3 Shutdown seals to eliminate static leakage





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