Harsh Environment ESP Motor Seal

Metal bellows design helps increase ESP run life in the most challenging conditions

Applications

- Steam-assisted Gravity Drainage (SAGD) wells
- Thermally-assisted Gas-Oil Gravity Drainage (TA-GOGD) wells
- Chemically aggressive production fluids
- Abundant abrasives and solids in production fluids

Benefits

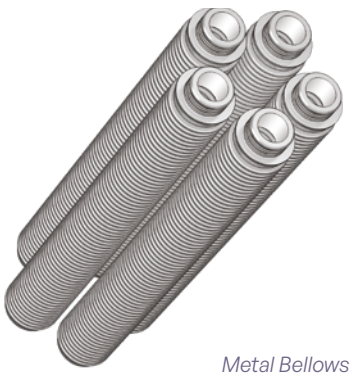
- Longer ESP run life in the most challenging conditions for ESPs
- Reduced ESP failure rate attributable to seal failure

Features

- Metal bellows design
- Two seal chambers each having an array of five metal bellows
- Positive seal (barrier) established between well fluids and motor oil
- Enhanced high-temperature thrust bearing design
- Active mechanism for enhanced thrust bearing lubrication and cooling
- Proprietary diamond-faced mechanical shaft seals
- Triple-redundant mechanical shaft seal configuration
- High-pressure ball style check valves
- Zero-leak plugs

High-temperature, aggressive chemical attack and large volumes of abrasive solids present significant challenges to electric submersible pump (ESP) run life used with thermal production methods such as SAGD and TA-GOGD for heavy oil.
The economic and engineering challenges around thermally produced heavy oil have largely resulted in a plateauing of ESP equipment design optimization and system run times.

The new Levare harsh environment ESP motor seal goes well beyond existing high-temperature seal products, incorporating several new technologies and design enhancements helping our ESP systems achieve substantially longer run lives in the harshest production environments.



Metal Bellows

The harsh environment motor seal is designed to reliably withstand the high temperatures of this environment using metal bellows instead of elastomeric bags in an innovative configuration.
Design advancements feature an array of five metal bellows set inside each of two chambers. The combination of these chambers in parallel and in series results in a positive seal or robust barrier between the well fluids and motor oil.

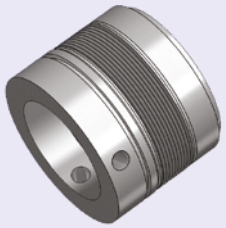
Thrust is managed in the seal using a high-load capacity (14,000 lbf) thrust bearing with a high-temperature or optional proprietary extreme-temperature coating, capable of withstanding operating temperatures up to 200°C (392°F) and 280°C (536°F), respectively.

The thrust chamber includes a split sleeve design, which enables an increased shaft horsepower rating and incorporates a castle pump, used to force oil flow through the bearing for improved lubrication and cooling, regardless of shaft rotational direction.

Specifications

Seal series	538	
Housing diameter	5.38 in. (136.70 mm)	
Shaft diameter	1.187 in. (30.15 mm)	
Shaft area	1.107 in.^{2} (713.95 mm^2)	
Motor Seal max. operating temperature	392°F / 200°C (AFLAS) 536°F / 280°C (EPDM)	
	60 Hz	**50 Hz**
Shaft power limit		
High-strength (INCONEL)	1,150 hp	709 kW
Hi-load thrust bearing, max.	14,000 lbf / 6,350 kgf	11,667 lbf / 5,292 kgf

Shaft sealing is enhanced using triple redundant mechanical shaft seals. These seals eliminate the use of dynamic elastomers. Used instead for each seal is a proprietary diamond face sealing surface for improved wear tolerance to heat and solids, providing for maximum longevity in the harshest downhole conditions.



Diamond Face Shaft Seal