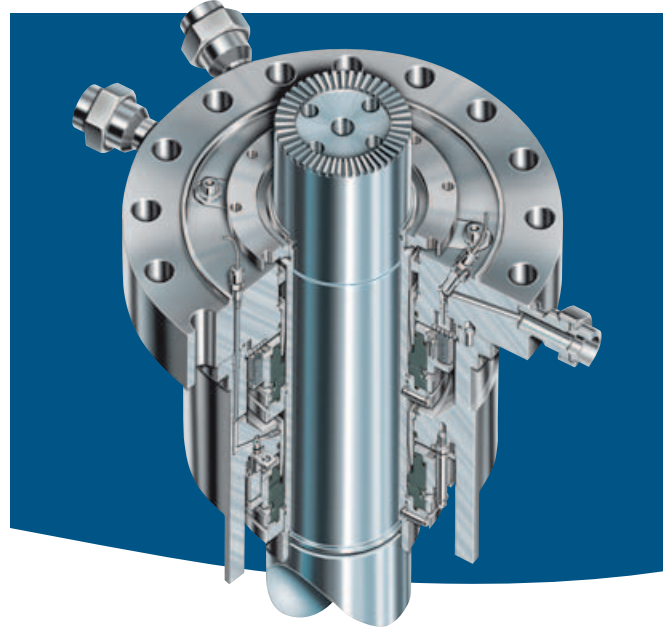




N-7500 Nuclear Seal Upgrades

Precision Face Topography and PZ Surface Treatment



Advancing Sealing Technology

For almost half a century, Flowserve has dedicated engineering resources to research and develop mechanical seals for the most rigorous nuclear applications. Today, scores of the Flowserve N-7500 seal are used in nuclear steam supply service around the globe.

- Boiling water reactor (BWR)
- Pressurized water reactor (PWR)
- Pressurized heavy water reactor (PHWR)

Improved Reliability and Service Life

Continued research and development has produced design and materials upgrades for the N-7500 seal. Intensive attention to the microstructure of the seal face surfaces has resulted in the creation of a unique treatment that significantly improves reliability and extends seal life.

These upgrades can be directly retrofitted in all existing N-7500 installations. They can also be applied as a direct cartridge replacement into the majority of other pumps of like shaft diameter in these services, regardless of pump manufacturer.

Precision Face Topography

Flowserve Precision Face Topography enhances the performance of mechanical seal faces by modifying their surface profile. Using a high-powered laser, smooth engineered features are machined onto the surface of the silicon carbide (SiC) face. N-7500 seals utilize low-amplitude waves to improve hydrodynamic stability and reduce contact loading for reliable, long-term operation.



What Is PZ Surface Treatment?

The Flowserve PZ surface treatment improves the corrosion resistance of SiC in pure water by altering the physical properties of the surface of the seal face. The laser modified surface exhibits higher hardness, extremely high electrical conductivity and a smoother surface finish. Precise control of the electrical resistance of the SiC face dramatically reduces electro-corrosion of the SiC face and pitting corrosion of the carbon face.

Upgraded Features and Benefits

Proven Face Materials include self-sintered silicon carbide rotating face with carbon graphite stationary face.

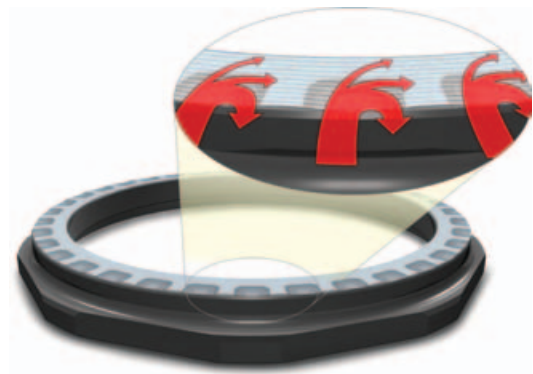
Advanced Seal Face Tribology provides both hydrostatic and hydrodynamic seal face load support for greater lubrication performance and extended seal life. Even at very low operating speeds and pressures, the Precision Face Topography produces sufficient lubrication and fluid film to overcome seal closing forces greater than twice the standard spring load.

Reduced System Drag and Heat Generation enable system components to tolerate a broader range of operational transients than conventional seal designs.

Reduced Contact Loading minimizes start-up torque and face damage associated with start-ups and shutdowns.

Self-Cleaning Design due to smooth contour and microscopic wave amplitude which generate circulating flow. Particulates are flushed away instead of becoming trapped between the seal faces.

Stationary Face Is Less Susceptible to Pressure and Temperature Distortion resulting in stable function during normal operation, normal transients and emergency transients.



Performance Testing

Seals upgraded with Precision Face Topography technology along with the PZ surface treatment were tested extensively. Single seal tests were followed by cartridge testing totaling 2000 hours under BWR operating conditions, including suspended solids.

Additional Upgrades

Lock bolt upgrade and redesigned balance sleeve enhance stationary face performance.

- Lock bolt material resists wear, prevents hang-up caused by mechanical wear
- Patterned sleeve design reduces friction between sleeve and Quad-Ring secondary seal
- Stationary face assembly easily complies with shaft motion

Upgrades Summary

Component	Standard Design	Upgrade Design
Stationary Face	Carbon	Carbon (premium resin)
Rotating Face	Silicon carbide	Precision Face Topography with PZ surface treatment
Balance Sleeve	17-4 PH stainless steel	17-4 PH stainless steel patterned machining
Lock Bolts	17-4 PH stainless steel	304L stainless steel with wear resistant overlay
Stationary Face Holder	17-4 PH stainless steel	17-4 PH stainless steel (slotted, no bushing)

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