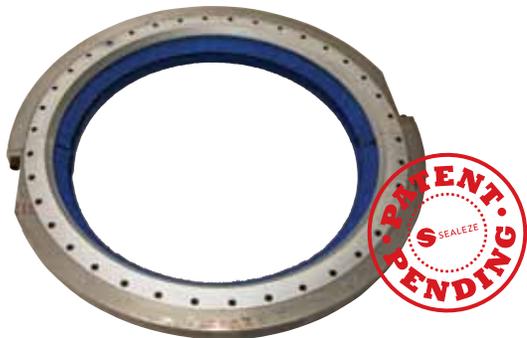


The auxiliary exterior turbine brush seal is designed to resolve air in-leakage problems resulting from turbine housing gland seal wear. These seals restore output capacity and operating efficiency, thus avoiding the very expensive opportunity costs of lost generation, maximizing dispatchability, flexibility and revenue preservation.

These brush seals simply mount to the turbine housing and can be installed in a single shift. This allows the plant to restore capacity with minimal downtime and conduct the gland seal replacement at a time that better fits their schedule.

Until now, there has been no reasonable solution to this problem, which is relatively common. The cost and time to repair the gland seals is very high (approximately \$80,000-\$100,000, plus several weeks of downtime).

Brush seals have a long history of providing excellent sealing combined with high reliability. Thousands of filaments, as an aggregate, nestle tightly together creating an extremely dense seal. The inherent high elasticity dissipates stress under deformation, reducing drag, allowing a contact seal without generating any heat in the turbine shaft. Even multi-tier labyrinth seals inside turbines are now being replaced by single-layer brush seals because of their improved sealing capabilities (50-80% better), longer service life and greater reliability.



The exterior turbine brush seal is an angled, 2-layer brush system with an imbedded malleable membrane that improves sealing.



The seal ring is constructed in two parts for fast and easy installation. Simply attach to the turbine housing with 4-6 bolts and some RTV.

Case Example: Pennsylvania Power Station

(reference available upon request)



Problem

- 300 MW Westinghouse Tandem-Compound Steam Turbine
- Severe air in-leakage reducing output capacity 15+MW
- Negatively impacting the plant's dispatchability

Solution

- Sealeze Brush/Membrane Exterior Turbine Shaft Seals
- Installed July 2010 and August 2010
- Time to Install: 8 hours per pair

Results

- Reduced air in-leakage 83%-96%
- Restored Vacuum: 1-1.5" HgA
- Returned Unit to Full Capacity and Improved Dispatchability
- Avoided Unit Derate of 10-15MW
- Postponed a \$90,000, multi-week turbine housing gland seal replacement to their desired outage time frame.

Plant's Estimated Income Recovery

(at the average wholesale market rate of \$67/MWh[†] for the months of July, August & September)

\$24,120 per day x 90 days = \$2,170,800

[†]<https://www.theice.com/marketdata/reports/ReportCenter.shtml> -Sept 2010

Seals were installed in the following locations:



- LP Turbine No. 2 South
- LP Turbine No. 1 North



- LP Turbine No. 2 North
- LP Turbine No. 1 South

TURBINE BRUSH SEALS

Adaptive exterior auxiliary turbine seals

LP Turbine No. 1 South Gland Seal Housing before installation of seals.



Sealeze continues development on filament and membrane materials with higher temperature stability, lubricious characteristics, and strong wear and tear resistance.

Auxiliary Brush Seal Installed:



LP No. 1 North Gland Seal Housing
The 2-Layer Turbine Seal is 2.375" in depth.



LP No. 2 South Gland Seal Housing

Helium Leakage Test Results (PPM)
Before & After Installation of the XtraSeal HT™ Exterior
Turbine Brush Seals

Location	Before	After	Reduction
LP#1 South	60,000+	3,600*	94.0%
LP#1 North	30,000	5,200**	82.7%
LP#2 South	48,000	1,800**	96.3%
LP#2 North	60,000+	6,200*	89.7%

*After 60 days in service
**After 2 days in service
+Leakage measurement device limited to readings of 60,000.

For enhanced sealing and extended functional service life, Sealeze has developed a 3-layer seal system with advanced filament and membrane materials.



3-layer Auxiliary Turbine Brush Seal with heat stabilized nylon filament. The 3-layer turbine brush seal is 3.25" in depth.



Sealeze creates brush-based solutions that solve our customers' problems. From sealing, shielding and guiding to positioning and static-dissipation, Sealeze offers a broad range of brush for industrial applications.

Sealeze's high customer satisfaction is supported by our ISO 9001, Kaizen, and Lean TPM programs.



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