Shaft Seal Designs

Spencer offers a variety of seals to meet broad application needs. Seal selection is influenced by the leakage rate, seal cost, maintenance requirement and also by the type of process gas, its pressure and temperature.

**Packing Box**
*Advantages:* Simplest, least expensive, most familiar design.  
*Disadvantages:* Highest leakage rate; leakage increases with time as packing wears.  
*Type:* Dry, contacting  
*Cost Factor:* $$  
*Leakage:* 1–5 SCFM  
*Max. Temp.:* 800°F

**Labyrinth Seal**
*Advantages:* Simplest and least expensive of noncontacting types.  
*Disadvantage:* Highest leakage rate among noncontacting seals.  
*Type:* Dry, noncontacting  
*Cost Factor:* $  
*Leakage:* 3–6 SCFM  
*Max. Temp.:* 1000°F

**Single Carbon Ring**
*Advantages:* Inexpensive, lower leakage than packing box. Low maintenance.  
*Disadvantages:* Limited life capacity, typically two to three years. Leakage increases with time.  
*Type:* Dry, contacting  
*Cost Factor:* $$  
*Leakage:* 0.1–1 SCFM  
*Max. Temp.:* 800°F

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**Gas Sealing Fundamentals**

Gas leaks occur most often where the power shaft passes through the blower casing. Every shaft seal leaks, but leakage can be restricted to acceptable levels through proper seal selection.

Dry-running seals are recommended by Spencer because they do not contaminate the process gas with cooling or lubricating liquids. They are also generally simpler, less expensive, easier to maintain, more reliable and longer lasting than wet seals.

Dry-running, contacting seals have touching seal faces that wear, generating a lubricant such as graphite powder. These seals are mainly used for low pressure, low temperature applications. Because they wear continually, these seals generate friction and heat, and must be periodically replaced. The power requirement is higher than for noncontacting seals.

Dry-running, noncontacting seals balance hydrostatic and hydrodynamic forces to keep seal faces from touching during operation. These seals do not wear and hence need no maintenance.

Single and double mechanical seals are preferred by Spencer for handling hazardous, corrosive and poisonous gases. They have very low, unvarying leakage rates. Capability ranges are very broad: temperatures from below 0°F to 800°F; pressures from 2 psia to 300 psig, shaft diameters to 4.5", speeds from 900 to 5000 rpm. Component materials can be
Double Carbon Ring

Advantage: Near-zero process gas leakage when cavity between seals is purged with air or nitrogen under higher pressure.
Type: Dry, contacting
Cost Factor: $$$
Leakage: 0.1 SCFM
Max. Temp.: 800°F

Single Mechanical Seal

Advantages: Near-zero leakage, low maintenance.
Disadvantages: Sensitive to misalignment.
Type: Dry, noncontacting
Cost Factor: $$$$
Leakage: 0.01 SCFM
Max. Temp.: 800°F

Double Mechanical Seal

Advantages: Highest sealing effectiveness of all seal types, low maintenance.
Disadvantages: Sensitive to misalignment. Minor contamination of process gas by purge gas.
Type: Dry, noncontacting
Cost Factor: $$$$
Leakage: 0 SCFM
Max. Temp.: 800°F

Other Sealing Methods

Wet Seals
Wet seals block gas emissions with a fluid such as oil or ethylene glycol. This approach requires accessory fluid pumping equipment that costs more than the seal itself. Fluid leakage contaminates the process gas; the oil film between seal faces increases power consumption.

Ferrofluidic® Seals
These seals achieve hermetic sealing by creating a magnetic fluid barrier between the rotating shaft and stationary housing. The operating temperature is restricted to 220°F without special cooling. The magnetic barrier fluid must be compatible with the process gas to avoid contamination.

Hermetic Sealing
The hermetic gas booster design, while not a sealing concept per se, deserves mention here because it provides wholly gastight performance—the ultimate in leak restriction. This product is described on page 6.