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Split seal technology has come a long way since its original application on Navy ships and submarine propeller shafts four decades ago. More recent applications on large industrial equipment, such as mixers and agitators, show that split seal technology provides effective solutions for horizontal and vertical pumps in a variety of duties. Operating successes have shown that split seals are not just for difficult-to-disassemble equipment.

Cartridge split seals also offer a high degree of reliability that provides clear environmental benefits. And they address the dilemma that more and more companies face every day: how to increase production while decreasing costs.

Split seals increase uptime and reduce maintenance costs in two ways. First, newer split seal designs take less time to install (typically less than 30 min) than other sealing technologies, including packing and mechanical seals. Second, split seals are highly reliable and can operate for longer periods of time without maintenance. Both factors reduce downtime and maintenance requirements.

Advances make correct installation easy

Traditionally, split seals are used because they are designed to be installed without dismantling the equipment. Components are split in half and can be installed directly to the shaft or packing sleeve.

Design advances make it easier to install the seals quickly and to install them correctly for maximum reliability without any leakage. Cartridge designs eliminate the need to measure or center the seal to the shaft, and provide direct flush connections for cooling and debris removal.

Split seals often arrive with many of the difficult-to-assemble components already connected. That means there are fewer pieces for a maintenance technician to install, making it easier to avoid assembly errors when trying to get back up and running. For example, elastomers and gaskets are often preassembled into the hardware, a plus especially when installing seals in confined areas. Installers will not need to snap or glue o-rings together.

COST COMPARISON—PACKING VS. 3.000 IN. SPLIT MECHANICAL SEALS*

	Packing			Seals			
	Unit cost	Usage	$ per year	Unit cost	Usage	$ per year	Annual savings
Initial installation							
Material cost	$75			$2000			
Expected life		0.5 yr	$150		3 yr	$667	($517)
Water							
Cost per 1000 gal	$0.20	5 gpm	$525	$0.20	1 gpm	$105	$420
Effluent treatment							
Cost per 1000 gal	$0.40			$0.40			
1/2 water influent		2.5 gpm	$525		0.5 gpm	$105	$420
Labor							
Loaded labor rate/hr	$30			$30			
Time to install		2 hr			1 hr		
Expected life		0.5 yr	$120		3 yr	$10	$110
Periodic maintenance							
Time required		0.1 hr/mo	$36		0 hr/mo	$0	$36
Time to rebuild pump		8 hr			8 hr		
Expected life		1.5 yr	$160		3 yr	$80	$80
Annualized parts costs							
Shaft sleeve	$275	3 yr	$92	$275	0	$0	$92
Bearings, etc.	$100	1.5 yr	$67	$100	3 yr	$33	$34
Lantern ring	$125	1 yr	$125	$20	0	$0	$125
Annual electrical cost							
Cost per kWh	$0.067			$0.067			
Hp consumption		1.5 hp	$650		0.3 hp	$145	$505
Total costs			$2450			$1145	$1305

*Comparison of a 3.000 in. diameter split seal vs. packing on a stock pump application in the pulp and paper industry.

Fig. 1 One newer split seal (see Fig. 1) has a compact design that uses a finger spring both to load the seal and provide positive drive to the face. The finger spring achieves even face loading and excellent travel. Since the spring is located well outside the process fluid, hang-up and clogging problems often associated with coil springs are virtually eliminated.

Advanced materials and design enhancements also contribute to easy installation of newer designs. Old split seal designs used ceramic face materials that were susceptible to fracturing from thermal shock.

The seal in Fig. 1, for example, has a rigid mating ring assembly to promote correct installation. Constructed of a 30 percent carbon-impregnated silicon carbide that has a rough surface at the split, the mating ring halves nest together securely, eliminating the potential for misalignment. Then, a retaining ring holds the halves together while the installer secures the assembly with a specially designed clamp ring. The result is a rigid mating ring assembly that retains the seal faces flat during assembly and operation. The clamp is so secure that this seal achieves vacuum capability.

Reliability nets lower costs

Correct installation plays a vital role in the reliable operation of any technology. Selecting a split seal with correct installation designed in will increase reliability significantly.

Recent advances in this technology add another level of reliability. The seals are hydraulically balanced and therefore not prone to failure during system upsets. Clogging problems associated with small coil springs are eliminated. And since split seals have very low leakage levels, they also prevent the type of bearing failure and downtime that is associated with packing. All of these factors add up to a seal technology that can operate for extended periods of time, without the maintenance time and costs associated with other sealing technologies. See the accompanying Cost Comparison table.

For example, packing requires frequent adjustments and repacks, occasional sleeve/shaft replacements due to scoring damage, and high power draw. These costs can easily exceed $2000 a year per pump. With the split seals, no adjustments are necessary, so manpower is used more efficiently. Seals do not damage the sleeve or shaft, so costly replacements are not a factor. Split seals reduce frictional horsepower to one fifth of a typically packed piece of equipment, saving significant energy costs.

Split seals also have dramatically less leakage, which leads to longer bearing life and eliminates the cleanup common with packing. The reduced flush requirements of split seals reduce process dilution and costs for clean water, de-watering, and chemical additives, while increasing overall efficiency. Because of the reduced water consumption, lower leakage, and lower horsepower draw, split seals are more environmentally sound. Split seals also have dramatically less leakage, which leads to longer bearing life and eliminates the cleanup common with packing.

Since split seals have a longer operating life than packing, typically four times as long, equipment can run longer without interruptions. This translates into maximum production capacity.

Finding the perfect combination

The cost benefits of split seals should be considered when selecting a sealing method. Once a decision is made to use a split seal, ease of installation should be an important part of the selection criteria. A number of good seal designs are available that combine reliability with easy installation. By using them, a plant can experience significant savings in maintenance costs and reduced downtime associated with split seal technology. **MT**

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