Packing Selection Guidelines for Fisher™ Rotary Valves

This bulletin provides information and insight to help you select packing systems properly. The following application guidelines for each packing selection have been developed to aid in the packing selection process. It is important to note that these guidelines were developed based on the results of numerous tests on various packing systems conducted in the Emerson laboratory. Exceeding these guidelines might result in reduced service life. The ratings for these systems do not affect the pressure/temperature class rating of the valve.

The traditional valve selection process entailed selecting a valve design based on pressure and temperature capabilities, flow characteristics, and material compatibility. An additional factor—packing selection—is now involved in the valve selection process.

Proper packing selection is being driven by USA Clean Air Act Amendments, subsequent EPA (Environmental Protection Agency) regulations, and our customers’ increasing concern for improved packing performance (less maintenance and longer life).

In the past, packing selection was primarily based on process temperature; that is, PTFE was selected for temperatures below 232°C (450°F) and graphite was selected for temperatures above 232°C (450°F). Considerations now include the effect of packing friction on process control, hysteresis, seal quality, and cycle life.

Given the variety of process applications and installation conditions, these variables are difficult to quantify. A relative packing performance comparison can be made that provides an engineered approach to the packing selection process.

Clarification of trade names is required for proper understanding of the tables shown in this bulletin. From an Emerson engineering perspective, ENVIRO-SEAL™ packing systems are defined as advanced packing systems using a compact, live-load spring design. From a user perspective, ENVIRO-SEAL packing systems are most typically thought of as emission-reducing packing systems.

This bulletin will help extend your thinking of ENVIRO-SEAL packing systems as being suitable not only for certain applications where the control of fugitive emissions is a requirement, but also for nonenvironmental applications involving higher temperatures and pressures. The use of ENVIRO-SEAL packing systems in applications involving non-environmental service offers the benefit of lower ongoing maintenance costs.
The packing selection guidelines in table 1 present two categories of service conditions. The first category defines packing systems designed for environmental or fugitive emission applications where 100 ppmv (parts per million volume) seal performance is required. The second category defines application guidelines for non-environmental services.

Depending on category requirements, different pressure/temperature guidelines have been established for the packing systems. In addition, a given packing design has certain characteristics concerning seal performance, service life, and friction. The pressure and temperature guidelines and the relative comparison of these characteristics are defined in table 1. See figure 1 for illustrations of typical packing examples.

Today, Emerson Automation Solutions offers three selections for environmental service. These selections include ENVIRO-SEAL PTFE (single arrangement), KALREZ with Vespel CR-6100 (single arrangement), and ENVIRO-SEAL graphite (single arrangement). Each of these options has different pressure/temperature service ranges.

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**Single PTFE V-Ring Packing**

This packing arrangement offers very good seal performance with the lowest packing friction.

**ENVIRO-SEAL PTFE Packing**

The ENVIRO-SEAL PTFE packing arrangement is suitable for environmental applications on services up to 103 bar and 232°C (1500 psig and 450°F). The sealing capability is excellent. The ENVIRO-SEAL PTFE packing system is designed to operate at high stress. This gives the ENVIRO-SEAL PTFE packing system the ability to compensate for shaft or packing bore imperfections. The high packing stress design approach also results in an increase in shaft friction. The slight increase in shaft friction does not cause problems with actuator sizing or process control, such as hysteresis.

ENVIRO-SEAL PTFE packing systems can be used in vacuum service applications with packing rings in the standard orientation. It is not necessary to reverse the PTFE packing rings.
Figure 1. Typical Packing Examples

PTFE PACKING

GRAPHITE PACKING

SPRINGS (N07718)
Packing Follower (Stainless Steel)

ANTI-EXTRUSION WASHERS

PTFE PACKING

PACKING BOX RING (STAINLESS STEEL)

ENVIRO-SEAL PTFE and Live-Loaded PTFE

ENVIRO-SEAL GRAPHITE

KALREZ

KALREZ Packing

KALREZ packing is available in KVSP-500 (260°C [500°F] service). The KVSP-500 series packing uses a DuPont V-ring material called Vespel CR-6100, which is a carbon fiber-reinforced PTFE. KALREZ packing is only available for Vee-Ball™ and eccentric disc valves.

Note that KALREZ packing arrangements require that a controlled low stress be applied to the packing in order to seal properly and also have a longer life.

This is achieved by using similar springs to those used in ENVIRO-SEAL packing systems, but with a lower initial deflection, thus a lower force.
In contrast to KALREZ packing, the ENVIRO-SEAL PTFE packing system is designed to operate at high stress (approximately 10 times the KALREZ packing stress). This gives the ENVIRO-SEAL PTFE packing system the ability to tolerate less-than-perfect conditions and continue to seal reliably. For example, in changing installed valves to ENVIRO-SEAL PTFE packing, minor imperfections in the shaft finish or packing bore can be tolerated because of the high stress design of the packing system.

**ENVIRO-SEAL Graphite Packing**

ENVIRO-SEAL graphite packing is designed for environmental applications from -6 to 316°C (20°F to 600°F), or for those applications where fire safety is a concern and graphite packing is desired. The ENVIRO-SEAL graphite arrangement can also be used with higher pressures up to 103 bar (1500 psi) and still maintain the 100 ppmv EPA leakage criteria.

**Graphite Ribbon Packing**

Graphite ribbon packing is designed for nonenvironmental applications that span a wide temperature range from -198 to 538°C (-325 to 1000°F).

**Non-environmental Services**

For the non-environmental pressure/temperature guidelines, service life can be extended by using ENVIRO-SEAL packing systems. As service pressures and temperatures increase, the ENVIRO-SEAL packing systems provide a significant step change in performance, compared to the traditional single PTFE V-ring or graphite ribbon arrangements.

**Conclusion**

It is important to recognize that many parameters affect seal performance and service life. Even if the optimum design is selected, other factors such as shaft finish, packing bore finish, and job site installation practices will have an effect on performance.

The knowledge gained by Emerson as a result of the ENVIRO-SEAL packing development program has provided an opportunity to help you engineer the packing selection. Proper selection has a bottom line result; that is, increased service life and reduced maintenance.

If you need a more detailed engineering discussion of the design principles affecting packing seal design, contact your Emerson sales office or Local Business Partner. The sales representative can provide you with a copy of Emerson Automation Solutions TM-38, Control Valve Packing Systems.

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Emerson Automation Solutions
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Cernay, 68700 France
Dubai, United Arab Emirates
Singapore 128461 Singapore

www.Fisher.com

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