

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 Automation Solutions 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.



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Typical ENVIRO-SEAL Rotary Packing System

Clarification of trade names is required for proper understanding of the tables shown in this bulletin. From an Emerson Automation Solutions 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.

Table 1. Packing Selection Guidelines for Rotary Valves

PACKING SYSTEM	MAXIMUM PRESSURE AND TEMPERATURE LIMITS FOR 100 PPM SERVICE ⁽¹⁾		APPLICATION GUIDELINE FOR NONENVIRONMENTAL SERVICE ⁽¹⁾		SEAL PERFORMANCE INDEX	SERVICE LIFE INDEX	PACKING FRICTION
	Metric	Customary U.S.	Metric	Customary U.S.			
Single PTFE V-Ring	---	---	103 bar -46 to 232 °C	1500 psig -50 to 450 °F	Better	Long	Very low
ENVIRO-SEAL PTFE	103 bar -46 to 232 °C	1500 psig -50 to 450 °F	207 bar -46 to 232 °C	3000 psig -50 to 450 °F	Excellent	Very long	Low
Live-Loaded PTFE for V250 Valves	69 bar -29 to 93 °C	1000 psig -20 to 200 °F	155 bar -46 to 232 °C	2250 psig -50 to 450 °F	Excellent	Very long	Low
KALREZ® with Vespel® CR-6100 (KVSP 500) ⁽³⁾	24.1 bar 4 to 260 °C	350 psig 40 to 500 °F	51 bar -40 to 260 °C	750 psig -40 to 500 °F	Excellent	Long	Very low
ENVIRO-SEAL Graphite	103 bar -7 to 315 °C	1500 psig 20 to 600 °F	207 bar -198 to 371 °C	3000 psig -325 to 700 °F	Excellent	Very long	Moderate
Graphite Ribbon	---	---	103 bar -198 to 538 °C ⁽²⁾	1500 psig -325 to 1000 °F ⁽²⁾	Acceptable	Acceptable	High

1. The values shown are only guidelines. These guidelines can be exceeded, but shortened packing life or increased leakage might result. The temperature ratings apply to the actual packing temperature, not to the process temperature.
 2. Except for oxidizing service, -198 to 371 °C (-325 to 700 °F).
 3. The KALREZ pressure/temperature limits referenced in this bulletin are for Fisher valve applications only. DuPont may claim higher limits.

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.

Single PTFE V-Ring Packing

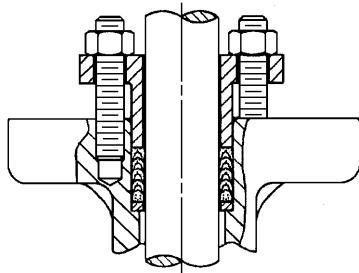
This packing arrangement offers very good seal performance with the lowest packing friction.

ENVIRO-SEAL PTFE Packing

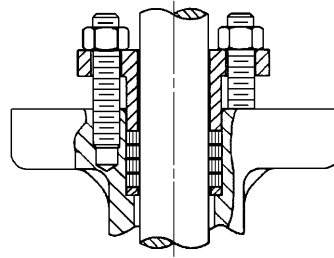
The ENVIRO-SEAL PTFE packing arrangement is suitable for environmental applications on services up to 103 bar and 232 °C (1500 psig and 450 °F). The sealing capability is excellent. The ENVIRO-SEAL PTFE packing system is designed to operate at high stress. This gives the ENVIRO-SEAL PTFE packing system 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.

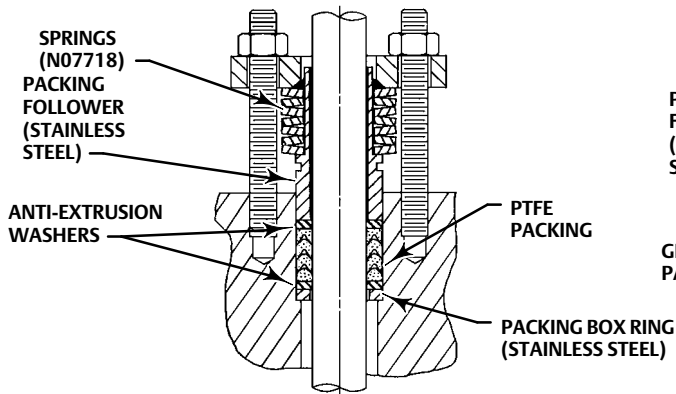
Figure 1. Typical Packing Examples



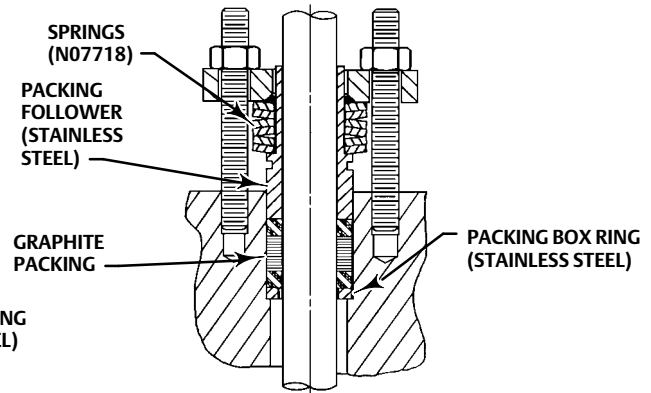
PTFE PACKING



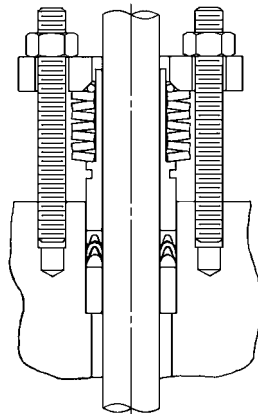
GRAPHITE PACKING



ENVIRO-SEAL PTFE
and Live-Loaded PTFE



ENVIRO-SEAL GRAPHITE



KALREZ

34B5064-A
42B8445-C
44B7499-A
A6786

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 Automation Solutions 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 Automation Solutions sales office](#). The sales representative can provide you with a copy of Emerson Automation Solutions TM-38, Control Valve Packing Systems.

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