SEALING SENSE

Q. *What are packings?*

A. Packings are one of the oldest sealing devices, so called because of the way they perform the sealing function. Made from relatively soft, pliant materials, packings consist of a number of rings of either braided or molded material that are inserted into the annular space (stuffing box) between the rotating or reciprocating member and the body of the pump or valve. By tightening a follower or packing gland against the top or outboard ring, pressure is transmitted to the packing set, thereby expanding the rings radially against the side of the stuffing box and the reciprocating or rotating member, affecting a seal.

Q. *How does pump packing work?*

A. Packings used in pumps, whether in rotating or reciprocating service, normally depend on a fluid film between the surface of the moving member of the equipment and the packing for lubrication. Sources of this fluid film are built-in lubricants (liquid, solid or in combination), leakage of the medium handled or an external lubricant supply.

Q. *What are the major considerations for successful sealing with packing?*

A. Packings are relatively easy to install and maintain. With proper attention, successful operation can be anticipated. Successful sealing with packing is a function of several important interrelated factors:

1. careful selection of packing materials to meet the specific application requirements;
2. attention to good installation and break-in procedures;
3. high standards of equipment maintenance.

Q. *What key factors influence the choice of a pump or valve packing?*

A. The acronym "STAMPS" is a good way to remember the principal factors that should be taken into account to assure proper packing selection:

S: Size (Stuffing box bore – Shaft or sleeve diameter / 2)
T: Temperature inside the stuffing box
A: Application Details (pump, valve, mixer, refiner, pH level, fluid handled, etc.)
M: Motion. (Rotary, helical, reciprocal)
P: Pressure inside the stuffing box
S: Surface speed expressed in feet per minute (RPM x shaft size / 4)

Q. *How do you approximate stuffing box pressure?*

A. Stuffing box pressure is roughly the pump suction plus 25% of the TDH (Total Dynamic Head).

Q. *What is a typical start-up process for most pump packing?*

A. On equipment start-up, lubricants may be released from the packing by gland pressure to provide initial lubrication and sealing or the material may be naturally lubricious. During the break-in period, these lubricants bridge the period between dry operation and the introduction of the steady-state lubricating system. Gradually, by adjustment of the gland pressure, the pumped medium or the external lubricating source takes over the lubricating function by providing a continuous source of fluid film. Gland pressure is regulated to provide optimum lubrication to seal and prevent overheating and consequent damage to the shaft. Any built-in lubricants that are slowly lost during the operation of the equipment are compensated for by further gland adjustment. When the volume loss of lubricated packing approximates the original amount of built-in lubricant or the packing itself is completely densified the effectiveness of the packing is lost and replacement is required.

Q. *Is it important to adjust bolt tension on gland-follower after pump start-up?*

A. It is imperative to slowly adjust the gland-follower after start-up to achieve the desired minimal leakage rate. This simply cannot be achieved by over-compressing the packing during installation. Adjusting compression by one bolt flat every 15 to 30 minutes is acceptable to avoid heat build-up. If excessive heat or smoke is generated, back off slightly to release the gland-follower until the situation stabilizes so that the packing does not overheat.

Q. *What is an acceptable leak rate for pump packing?*

A. This will vary greatly depending on packing materials. Some materials, like flexible graphite, will function with almost no cooling water under ideal conditions, while some more traditional materials will require larger quantities of water to function effectively. As a rule of thumb, 10 to 50 milliliters a minute per inch of shaft is usually adequate, as long as excessive heat build-up is not experienced.

Q. *What is the function of the water injected in the stuffing box?*

A. Water injected into the stuffing box fulfills three principal functions: cooling the packing and the sleeve, lubricating the assembly and, finally, if injected at the correct pressure (approximately 7 to 15 PSI higher than stuffing box pressure), it prevents process impurities from entering the stuffing box, and thereby keeps a clean environment inside the stuffing box.

Q. *Why does pump packing generally require some minimal leak rate for optimum performance, while valves can be made leak-tight?*

A. Since pump packing is more a dynamic seal, both cooling and lubricating is required to remove frictional heat from the interface of the shaft and packing. A measured flow of cooling water at a rate of about a few drops per minute helps to assure effective cooling and lubrication.

Q. *What is a lantern ring?*

A. The lantern ring is incorporated into the stuffing box vis-à-vis the cooling water entrance to ensure proper distribution of the cooling water to all packing rings, as well as to keep the stuffing box clean of contaminants. It usually consists of a round, two-piece assembly with numerous holes. Bronze, carbon steel, stainless steel and PTFE-carbon are often used for pre-molded rings. PTFE and ultra high molecular weight PE strips are popular off-the-shelf ring material. The lantern ring may be located in an XXX-L-XX fashion, XX-L-XXX, or sometimes L-XXXXX for high solid content applications.

Q. *Why is it so difficult to seal knife gate valves?*

A. Most knife blades have square corners, while stuffing-box bores are round. Therefore, it is difficult to evenly tamp the packing rings to press against all surfaces and achieve an initial seal. Also, the blade tends to have a non-symmetrical movement as it closes, compressing the packing unevenly. To circumvent these encumbrances, choose packing with a low coefficient of friction and a medium density to obtain a good seal with minimal compressive load.

Next Month: Flange type and pipe alignment do matter when installing nonmetallic expansion joints in pump piping systems.

Sealing Sense is produced by the *Fluid Sealing Association (FSA)* as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs and reps.

The *Compression Packing* division of the *FSA* is one of six with a specific product technology focus. As part of their mission, they develop publications such as the joint *FSA/ESA Guidelines for the Use of Compression Packings* and *Pump & the Valve Packing Installation Procedures* pamphlet. These are primers intended to complement the more detailed manufacturer's documents produced by the member companies. In addition to English, they are available in a number of other languages, including Spanish and German.

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