SEALING SENSE

Q. *What are the best pump packing installation techniques?*

A. Installation and break-in procedures for pump packing are documented in FSA publications and in the *Compression Packing Division* member companies' literature specific to their products. The *Pumps & Systems* April 2005 *Sealing Sense* column also provides some installation tips.

Some characteristics of the pump stuffing box itself play an important role in the determination of packing performance, so these are also important considerations for packing installation.

One is whether the stuffing box has a flush system and, if so, what part does (or can) it play in packing performance. Given an existing flush system, one key to effective installation of any pump packing is proper use of flush water. The main reasons flush water is added to packed pumps are to:

- *Prevent packing deterioration caused by the sealed media.* When the pressure in the flush is higher than the pressure in the stuffing box, the pumping media is kept out of the stuffing box. Solids from slurries that are not flushed out of the stuffing box can embed into packing and cause reductions in packing life and sealing efficiency. Also, solids embedment could cause shaft damage by creating a grinding wheel effect as more force is applied to the gland bolts, thereby causing the solids to be pressed against the shaft with consequent damage.
- *Cool the packing and sleeve, and lubricate the assembly.* High temperature caused by the media itself, or by friction, can damage the packing. A flush cools the stuffing box and packing and prevents deterioration.

Over the last ten years, many advancements made in pump packing technology now allow packing to handle higher temperatures than before.

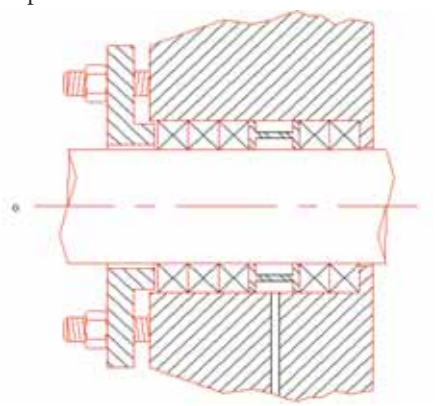

Figure 1. Diagram of a typical packing stuffing box flush system.

One question often asked about pumps that use mechanical packing as the sealing device is, "what should the flush water pressure be?" The general recommendation is that flush pressure should be adjusted to one bar (14.5-psi) over the stuffing box pressure. The stuffing box pressure can be directly determined by using a pressure gauge mounted onto the stuffing box, or indirectly by using an approximation formula:

~ Stuffing Box Pressure =
Pump Suction +
25% of the Total Dynamic Head

One reason the flush water pressure is sometimes adjusted higher than one bar is that the pumping system can have a varying head pressure. This varying pressure can be caused by moving media from one area of the plant to the other. As the head decreases because of this movement, the inlet pressure on the pump will lower over time. However, the flush system must deal with the maximum head that the system sees. So the best approach to these types of situations is to keep the flush pressure one bar over the *maximum* stuffing box pressure.

A major concern with pressurizing the flush port to greater pressures than one bar is over-compressing the packing and thereby shortening mean time between failures (MTBF). Packing applies a force against the shaft and stuffing box wall that is greater than the pressure it seals against. If the flush water pressure is too high, the packing needs to

Figure 2. Packed pump with excessive flush pressure.

be compressed much greater, thereby shortening life. Excessive flush pressure can also lead to severe leakage of the flush water itself, as illustrated in Figure 2. The flush water pressure *must* be controlled so it does not exceed the maximum stuffing box pressure experienced by the pump.

Diluting of the media being sealed is another issue with excessive flush water pressure that is not seen at first glance. Higher pressures cause higher flow rates. In many industries there is a cost to remove this flush water down stream. Cost savings are easily achieved by reducing flush water pressure.

The pressure is often increased on flush lines because that flow is being monitored, instead of pressure. One design flaw of flushing arrangements is that the bottom packing rings need to "fail" to allow flow into the system. If the bottom packing rings are properly installed and compressed to seal the stuffing box, then flush pressure needs to be increased significantly to get positive flow into the system.

When using a standard flush arrangement, excessive lantern ring movement can occur and result in a ring of packing moving directly under the flush port. This creates a situation opposite to that desired by having flush media moving down the outside diameter of the stuffing box, instead of down the inside diameter. This OD leakage can also create a "spraying" effect, symptomatic of this mode of failure. Good maintenance practices avoid such failures.

The quality of the flush water can also cause flush arrangements to be less effective. If the flush water contains solids, it will shorten packing life by solids embedment – the exact problem the flush should prevent. If the flush media is not clean, a better seal would be created *without* using a flush altogether. Ensuring that only clean, solids free, flush water is used is crucial.

One alternative to a pump with the standard flushing arrangements might be to remove the flush system altogether. If the sealed media does not contain any solids, many modern packing materials can handle sealing issues without a flush.

Create a flush review program to effectively enhance overall sealing efficiency and ensure the best packing installation. Some principles of this type of program include reviewing each pump that has a flush port for the following:

- Is the flush clean?
- What is the flush pressure relative to the stuffing box pressure?
- Does the sealed medium contain solids?
- Does the pump need a flushing system?
- Is the lantern ring properly aligned with the flush port?

Next Month: *How important is chemical resistance for selection of a pump packing?*

We invite your questions on sealing issues and will provide best efforts answers based on FSA publications. Please direct your questions to: sealingquestions@fluidsealing.com.

P & S