

# SEALING SENSE

## Are you overlooking packing as a sealing solution?

Compression packing is not only the oldest sealing method in the industrial world, but it is arguably the simplest alternative to mechanical seals for many services.

Packing is most prevalent in the agriculture, power, petrochemical, oil and gas, and water filtration industries, where it is found in pumps, valves, mixers, agitators, expansion joints, soot blowers and other equipment.

Typically designed for rotating equipment, compression packing must be resilient – when inserted into the stuffing box, it should deform and expand against the shaft and stuffing box, creating the necessary seal. However, packing suffers from the stigma that it is dirty, difficult to store, and can damage equipment surfaces.

Furthermore, when used on pumps, packing must leak. Until now, packing was considered the least desirable sealing solution, typically selected only for older equipment. But with advances in material technology, particularly fibers, packing is experiencing a rebirth as a viable solution for modern applications.

### Today's Packing

The earliest packing consisted of cotton, oakum or other fibrous waste that was literally stuffed in the enclosure – hence the term *stuffing box* – and then lubricated.

Most conventional packing is braided with or without an extruded core, or braided and then molded into various cross-sections. The braid may be fabricated of a single material or a combination of materials best suited for the application.

The majority of packing is available in two general forms: Continuous lengths or ropes of braid rolled on a spool that must be cut and bent around a rod/shaft and compressed into



Figure 1. Cross section of a typical pump stuffing box installation.

a suitable shape; or molded packing which is already shaped into the required size for installation.

Braided packing may be formed as square braids, braid-over-braid, and twist or laminated, wrapped and/or crimped. Compression packing is typically utilized in devices with rotating, reciprocating or oscillating motion. However, it also can be used as a static seal. Square-braided packing is used on pumps and valves in low-pressure operations, while braid-over-braid constructions are generally used for high-pressure applications, especially in valve stems and expansion joints. Braid-over-core constructions, however, are used for applications where greater resilience is required, such as those in nuclear power plants.

### Reasons for Packing's Rebirth

Significant advancements in material technology have been made during the past decade, and the scope of packing applications is widening.

These advancements will likely accelerate, driven by the rapidly emerging fiber material science. They have already resulted in these outstanding properties of current compression packing:

- High pressure and vacuum capability
- High and low (cryogenic) temperature capability
- Outstanding chemical resistance, particularly in most concentrated acidic media
- Virtually non-abrasive to mating surfaces
- High dimensional stability as a ring or rope form

Most of today's high-performance packing was developed for applications involving extreme operating conditions such as high temperature, speed, pressure and chemical aggressiveness. For instance, depending on other application criteria such as temperature, pressure and media, modern packing exhibits an excellent heat dissipation characteristic that has led to application at surface speeds in excess 4,000-fpm (16 to 20-m/sec) with no to low lubrication.

The use of compression packing continues to rise with the introduction of these sophisticated technologies and the superior properties of these modern materials. For example, packing design can now be tweaked to incorporate the same performance feature that mechanical seals provide.

Packing manufacturers can also further enhance the



**Figure 2. Typical high-performance braided and molded packing.**

performance of these new materials by adding proprietary lubricants and other additives to enhance lubricity, pliability, sealability, and ensure maximum service capability

## The Future

To function correctly, packing must be carefully selected and properly installed. The packing selection process requires consideration of the overall condition of the equipment and its application conditions.

Nowadays, most compression packing can function without the injection of additional lubricant and/or cooling fluid, and most of the lubricant required for satisfactory performance is inherent in the raw material and the braid.

General application guidelines for typical uses of packing include:

- *General service:* For water, oil, mild acid and alkalis with mid range PH – temperatures to 500-deg F use acrylic packing.

- *Abrasive service:* For wastewater, salt water, acids and mid-range caustics – temperatures to 500-deg F use polyimide or aramid packing.
- *Chemical services:* For dry or lubricated applications with pH 0 to 14 use PTFE based packing
- *Pharmaceutical and food service:* For PTFE-based materials, use FDA compliant lubricants or non-lubricated PTFE filament yarn.
- *Valve packing services:* In most valve and slow rotating, slow reciprocating and/or slow oscillating equipment applications, use a combination of die-molded middle rings of flexible graphite and braided graphite end rings.

After selecting the right packing, proper installation is the key. (Packing installation was discussed in the April 2005 issue of *Sealing Sense*).

Future designs will likely include cartridge packing that installs as easily as a mechanical cartridge seal. Beyond easy installation, the design of modern packing will ensure high performance in wet and dry running conditions and be maintenance free for extended periods, versus the typical three to six months now experienced with conventional materials.

Packing was once considered by many to be the least desirable sealing solution. Not any more. As material technology continues to advance, packing will continue to grow as a viable solution for modern applications.

**Next Month:** *When and how do I use API Flush Plan 54?*

*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](mailto:sealingquestions@fluidsealing.com).*

**P&S**

## Fluid Sealing Association

*Sealing Sense* is produced by the **Fluid Sealing Association** as part of our commitment to industry consensus technical education for pump users, contractors, distributors, OEMs, and reps. As a source of technical information on sealing systems and devices, and in cooperation with the **European Sealing Association**, the FSA also supports development of harmonized standards in all areas of fluid sealing technology. The education is provided in the public interest to enable a balanced assessment of the most effective solutions to pump systems technology issues on rational Total Life Cycle Cost principles.

The **Compression Packing** division of the FSA is one of five 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 the *Pump & Valve Packing Installation Procedures* pamphlet. These primers are intended to complement the more detailed manufacturer's documents produced by the member companies. In addition to English, these are available in a number of other languages, including Spanish and German.

The following members of the **Compression Packing** division sponsor this *Sealing Sense* series:

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