

SEALING SENSE

Q. How do you choose between all the various TYPES of gasket materials?

A. Many variables affect the selection of a gasket for a pump or piping system. One is the gasket design itself; another is the type of material or materials used in the specified design.

Gaskets are produced from a wide array of materials including rubber (elastomers), compressed fiber (CNA), PTFE, flexible graphite and metal. Metal can also be combined with one of the above non-metallic materials to reinforce the gasket.

Each material, or combination of materials, offers specific properties essential to effective sealing under a given set of operating conditions. These include temperature, pressure, and nature of the fluid being sealed. The operating conditions dictate which material will provide the best service in the application.

So how do you choose which gasket is best for the pump or piping system?

OEM Design Compatibility

There are conditions under which many of the gasket types listed above will seal adequately, but selection is restricted to only one or two because of the pump or piping design.

The first factor to consider is the type of seal installed by the pump manufacturer. A pump designed with an O-ring groove limits the design and choice of materials that can be used. For example, it is very difficult to switch from an elastomeric O-ring to another material. O-ring flange designs typically use a deep groove, a surface that does not work well with flat sheet gasket materials. Raised face and full-face flanges are much more universal, allowing the user to apply materials and seal designs that yield specific benefits in the application.

The finish applied to the sealing surface by the manufacturer, as well as field conditions, should also help determine the selection of materials and designs. A coarse or rough surface finish (above 250 RMS) requires the use of a more conformable, non-reinforced material to fill flange voids and imperfections. More rigid or reinforced materials can be utilized in conjunction with smoother flange finishes. In any case, the original OEM design should be considered as the baseline for duplication or improvement.

Flange Design

Bolting and flange designs vary from pump manufacturer to pump model and have a significant impact on the performance of the chosen seal design.

The quantity, size, grade, lubrication and spacing of fasteners used to apply load to the gasket should be considered when selecting gasket materials and designs. Thin, less rigid flanges and/or flanges designed with minimal bolting might yield improved performance with a non-metallic or non-reinforced gasket due to its better conformance under low load.

On the other hand, tongue-and-groove flanges with heavy bolts can apply very high gasket stresses, potentially damaging soft gasket materials *that are not designed for extreme loads*. Minimum, Effective, and Maximum Stress calculations should be performed to determine the gasket suitability for the application. Gasket manufacturers can provide information regarding these values for a specific material to aid in the decision-making process.

Pressure and Temperature

Pumps and piping systems can operate at a very high temperature and/or pressure. These conditions eliminate some of the choices.

While specific chemical resistance advantages and improved conformance to surface irregularities can be realized with some products, introducing elevated temperatures will increase creep and creep relaxation of these materials. Metal gaskets or reinforcements such as expanded steel, perforated or "tang," and corrugated core can offer more stability at elevated temperatures, pressures and thermal cycling.

Elevated temperatures and increased pressures have individual degrading effects on sealing materials. These negative effects increase exponentially when both conditions are present simultaneously. Most gasket manufacturer recommendations are based on collective consideration of all the variables. However, those who specify should use these recommendations as guidelines and make decisions based on experience and safety factor requirements.

Chemical Resistance

The nature of the fluid being sealed is another important factor in gasket selection whether gas or liquid. The gasket material must be chemically resistant to the medium to be sealed.

There are many resources available to determine chemical resistance of a selected material and whether it is compatible with a given process. However, these recommendations are usually very general and do not take into consideration factors that can impact the level of compatibility such as temperature, pressure and gasket exposure in a flanged application.

Final selection is best made when based on application history, available chemical compatibility testing, or recommendations from the gasket manufacturers.

Value vs. Cost

The total value of the gasket should be considered, rather than purchase price alone.

Purchase price is typically small when compared with the cost of equipment, installation labor, down time due to gasket failure, or lack of equipment availability. The true value of any given gasket is best measured by its reliability in the intended application, not purchase price exclusively.

Conclusion

There are many options to consider when selecting gasket materials and designs for pump applications. Many of these factors are interdependent and effected or amplified by other variables.

In cases requiring an improvement over the existing OEM design, materials and designs are available from gasket manufacturers to solve specific problems. Gasket design and material choice have a significant effect on equipment reliability. Proper selection and specification require the designer to achieve a balance between the process conditions, loading variables, and operating parameters to select a material and design that yields the optimal benefit.

Next Month: What is the best wear face material for my mechanical seal?

*We invite your questions on sealing issues and will provide our best efforts to answer based on FSA publications. Please direct your questions to: 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 technology issues on rational Total Life Cycle Cost principles.

The **Metallic Gasket** and **Nonmetallic Gasketing** divisions of the FSA are two of six with a specific product technology focus. As part of their mission they develop publications such as the *Metallic Gasketing Technical Handbook* as well as joint FSA/ESA publications such as *Guidelines for Safe Seal Usage — Flanges and Gaskets and Gasket Installation Procedures*.

These are primers intended to complement the more detailed manufacturer's documents produced by the member companies.

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