Place Gaskets

The best choice depends on your application

What Causes Gasket Failure?

It’s easy to point fingers when a joint won’t seal, or when a sealed joint begins to leak. Usually, the gasket gets the blame. In reality, while the gasket plays an important part in the seal, other factors more often actually cause the failure. The *Post Mortem Observations & Findings* research study, commissioned by the Pressure Vessel Research Council (PVRC), documents why seals fail, and the causes that occur most often: &#149Improper installation: 26% &#149Flange damaged: 25% &#149Gasket defective: 22% &#149Loose bolts: 15% &#149Flange misalignment: 12%

The PVRC research study underscores why it’s so important for maintenance personnel to familiarize themselves with the range of ways that sealing system components can affect the integrity of a connection. Many leak problems can be solved by simply adhering to basic installation and proper bolting practices &#151 lubricating the load bearing surfaces of the nuts, bolts, and washers, applying the appropriate bolt torque through the use of a torque wrench or other tensioning device, and following an appropriate bolt torque pattern. In general, three objectives need to be met to successfully seal the joint: &#149Transfer the load developed during bolt tightening to the gasket. &#149Make sure that the bolts are perpendicular to the gasket, and the load is uniform. &#149Ensure sufficient pre&#151load to counter any relaxation, hydrostatic end thrust from internal pressure and/or external forces which may act upon the joint. None of these steps is particularly complicated, but properly training your installers is important to eliminating any potential problems. Today more than ever, manufacturers and suppliers are working with plant engineers to help them evaluate gasketing materials, and then support their maintenance personnel to ensure that the gaskets are installed properly.
Sidebar two:

Choosing the right gasket wisely

[1]

Whether you decide to use a gasket cut from sheet goods or a form&#151in&#151place ePTFE gasket, choosing the best product for your needs can be difficult because so many of the product choices often “look and feel” the same. However, products that are not fully expanded have less fibril structure, are generally weaker, and can present a greater risk of creep problems over the long term. To ensure that your gasket will provide reliable performance over time, focus

on the following factors: &#149Consider third&#151party test results and recommendations. Product test data generated by unbiased third parties is a more effective comparison tool than in-house generated data. &#149Pay attention to the product’s reputation and track record of success in other plants. &#149Evaluate supplier expertise and product availability, especially for fulfilling emergency needs. Local support from a competent distributor can be an invaluable resource when you suddenly need support.
By Kevin E. Dove

The world of fluid sealing is more complex than many plant operations managers may realize. Selecting a gasket for a common or routine application is one thing, but what about the oddball application? Or to fix &#151 once and for all &#151 that troublesome flange that has leaked for years?

Expanded PTFE (ePTFE) gaskets are often a good starting point. Compared to rubber gaskets, synthetic fiber gaskets, composite material gaskets, or PTFE gaskets that have fillers or other additives, ePTFE gaskets can greatly simplify the question of whether the gasket will withstand the media to be sealed. That’s because ePTFE material has all of the chemical resistance properties of standard PTFE (polytetrafluoroethylene), while its enhanced strength and creep resistance under high loads and temperature makes it an ideal material for industrial flanges. (The few areas of chemical protection weakness for ePTFE involve molten alkali metals or instances where a significant degree of elemental fluorine is present.) Once you’ve determined that ePTFE makes sense as the sealing material, your next question might be whether to use a pre-cut gasket versus a form&#151in&#151place gasket. Each gasketing option has its own particular advantages, and the key is to select the one that best fits your specific application.

The first fundamental question to ask is: How big is the application? Unlike precut gaskets, form&#151in&#151place gasketing material comes in long lengths on a spool that can be customized onsite to any flange size and complex pattern needed. On a large&#151diameter flange (greater than 12 inches in diameter), form&#151in&#151place gasketing is often easier and less costly to install than a cut gasket, since you’re not paying for the scrapped material that is often lost with a large pre&#151cut gasket. If a flange has a complex pattern (a good example is a heat exchanger splitter box gasket with a rib), a form&#151in&#151place gasket can often be the best solution from a time, cost, and inventory savings standpoint. Similarly, if the sealing equipment needs to be completely disassembled in order to install a precut gasket, installation costs could be dramatically reduced by using a form&#151in&#151place product. [Insert Photo A.] A good illustration of this is a large reactor with a mixing shaft. Using an envelope or cut gasket may require the reactor cover to be completely removed, and the mixing shaft disassembled from the motor. Installation might possibly require a crane, and take days to complete. Using form&#151in&#151place gasketing for this application would eliminate the need for specialized labor and equipment, while reducing installation time to a matter of hours &#151 thereby dramatically lowering the total costs associated with the installation. [Insert Photo B.] By contrast, smaller

applications (flanges less than 12 inches in diameter) are typically better suited for using standard ring or full&#151face cut gaskets that are available as finished goods. Alternatively, you could cut standard industry&#151sized sheet gasketing (5’ x 5’) to the necessary size. Sheet or precut gaskets can also be the best solutions for large or complex applications where there is limited room to utilize a form&#151in&#151place gasket.

Dimensional Stability Factors

An additional factor to be considered when choosing an expanded PTFE form&#151in&#151place gasketing product is the need for dimensional stability in the gasket. The gasket’s resistance to change in linear dimension will influence the gasket’s stress retention capability and thus improve the seal reliability. Expanded PTFE form&#151in&#151place gaskets are available in three different variations. The first and original form of ePTFE is the cord&#151type Joint Sealant, which is uniaxially expanded, or expanded only in the length direction. The expansion of the PTFE in the length direction enhances the tensile strength and creep resistance of the material in that direction only. However, there is very little enhancement to the properties in the width (radial) direction of the cord material. With no expansion in that direction, the PTFE is prone to cold flow in the width direction, resulting in the spreading of the gasket when it is compressed between flanges. This spreading increases the surface area of the gasket and decreases the effective stress on the gasket. Spreading of the gasket can also result in the splitting of the gasket when high spots (areas of intense stress concentration) exist on a flange surface.

Uniaxially expanded PTFE is also available in a flat tape. This rectangular shaped form is commonly known as gasket tape. Depending on the manufacturing process, gasket tape can have some significant tensile strength in the width direction, even though the expansion occurs only in the length direction. In this case, these gasket tapes would have better dimensional stability than round cord joint sealants. In applications where dimensional stability and cut&#151through resistance of the gasket is a critical concern, such as in glass lined steel flanges, the best solution is a biaxially expanded PTFE gasketing product. Biaxially expanded PTFE tapes are the most dimensionally stable of the three forms of ePTFE form&#151in&#151place gaskets. They are available in flat tape form, and are expanded in both the length and width directions of the tape. The expansion in the width direction provides enhanced tensile strength in that direction, resulting in a gasket with very little cold flow. As such, these gaskets will stay tight longer, increasing the reliability of the seal. [Insert Photo C.]

Overlapping Material Does Not Cause Leaking

One common misconception about form&#151in&#151place gaskets is that

because the material is not a continuous one&#151piece unit, it is apt to leak at the overlapped section. However, the performance record of the product demonstrates that the overlapped section of the joint sealant, which is soft and malleable before compression, “meshes” with itself upon compression in the flange, thereby forming a thin, wide, and continuous seal. The malleable nature of the material allows the gasket to fill in all areas of micro&#151deviation across the flange surface, creating a very tight seal. In fact, according to independent test results performed by the Tightness Testing & Research Laboratory (TTRL), ePTFE form&#151in&#151place gaskets were deemed the tightest sealing out of nine different materials evaluated. [Insert Chart 1.] In cases where elevated operating temperatures over 600&#176F exist, ePTFE sealing solutions may or may not be your best option. Indeed, with increased temperature and/or pressure, the task of sealing becomes more difficult for *any* gasket type. Because of this, the need for everything else to be “right” is important in these situations. And, while the gasket is nearly always the scapegoat when a flange does leak, the real root cause is often found elsewhere. That’s because many other factors also play a role in determining a successful seal &#151 chief among them are the installation techniques you employ, the bolting hardware you use, as well as the washers and lubricant you select.

Kevin E. Dove is the technical leader of the Industrial Sealants division of W. L. Gore & Associates, Inc. During his 10 years at Gore, he has developed numerous patents on sealing products, including the GORE™ Universal Pipe Gasket. He has a B.S. in Mechanical Engineering from Drexel University, and has served as the division chairperson for the Fluid Sealing Association Non-Metallic Gasketing Division. He can be reached at 410-392-3200 or through sealants@wlgore.com. W. L. Gore & Associates, Inc. is a creative technology company employing more than 6,000 associates in 48 plants, in 16 countries throughout the world. For over 35 years, Gore’s Sealant Technologies Group has developed innovative PTFE gaskets, seals and other fluid-sealing products for both standard and unique sealing and pumping applications. For more information on the full line of innovative sealing products, call toll-free (800) 654-4229, or visit www.gore.com/sealants.

Links:
[1] http://www.chem.info/ProductImages/0606/231_lrg.gif