



PUMPS THAT EXPERTS SELECT.

Gasket Standardization: Why and How

Nonmetallic gaskets for piping constitute an especially attractive target for standardization

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With competitive pressure mounting, companies in the chemical process industries (CPI) have sought to adopt new operating methods and simplify their procurement processes. One result is a growing effort to standardize on parts and on process-consumable materials, so as to simplify manufacturing and maintenance and reduce inventories. As that effort has been trickling down from the more expensive items, one effect has been increased attention paid toward the feasibility and attractiveness of gasket standardization. This trend is especially noticeable with respect to nonmetallic gaskets, because the number of different types is greater than that for metallic gaskets.

At some CPI firms, a reduction in the number of gasket types bought and inventoried is already under way. According to late-2002 market research by the author's employer over the leading North American chemical processors, 80% of the gasketing experts interviewed feel that standardization is a highly important objective, and almost 70% already have a gasket standardization effort in place. (For firms that have not yet begun standardizing, the box on the next page provides useful guidelines for getting started.)

In an ideal world, full gasket standardization would imply the availability of one type of gasket that could be used in virtually all applications. In most instances up to now, however, companies have standardized on a specific gasketing material for each of the three main types of CPI piping categories, namely, steel, glass-lined, and fiber-reinforced plastic (FRP), while acknowledging that there are some unusual applications that require exceptions.

The focus is on piping

Gasket standardization is more easily achieved with process piping than with process equipment.

For one thing, process equipment presents a greater diversity of "trouble-mode applications," in which an engineer on the scene must decide what kind of gasket (not necessarily a conventional type) will solve the problem without need to replace the equipment itself. Similarly, there are more flange sizes associated with this equipment, extending to 84 in. and larger, as well as flanges in non-standard sizes and specialty designs.

Piping-system flanges, on the other hand, are typically in standard sizes, most being 1/2 to 24 in. And there are far fewer problems with the sealing of piping, because piping can more readily be replaced.

In short, most plant managers and maintenance managers can accept the fact that piping-system gasket standardization is possible while equipment gasket selection will remain specialized to the individual pieces of equipment and their specific needs. Most procurement specialists also realize this limitation and don't see it as an impediment to developing gasket standardization for piping systems.

But even as they seek to achieve piping gasket standardization, CPI plants today are confronted with a proliferation in gasketing options. Each comes with its own chemical-resistance, pressure, and temperature capabilities. Aside from the resulting complexity and potential confusion, this proliferation is costly: there are procurement and inventory costs, technical testing and evaluation costs, management costs and, of course, failure costs. It is that situation that brings the attractiveness of piping gasket standardization into focus.

Standardization means inventory savings, fewer mixups during ordering, less time spent in specification development and material testing, and fewer failures due to installation of the wrong gasket. Standardization also encourages better procurement procedures, such as centralized purchasing, and more-competitive cost bidding packages. All of these attractions promise cost savings, and several promise to boost plant safety.

The American Production & Inventory Control Soc. has estimated that the cost of administering a single purchase order runs from \$75 to \$150. Beyond that, total inventory-carrying costs can range from 20 to 36% of the total cost of any particular purchase. Published data and other inputs from some of the author's employer's customers have shown that a well-conducted gasket standardization program could reduce inventories up to 60%. Furthermore, ongoing carrying costs could be reduced significantly, and merely reducing the frequency of placing orders could alone produce savings of up to 3%. And if a plant were to standardize on one gasket for all non-metallic gasketing needs, it could manage with an average inventory of 15% to 20% of annual usage. This percentage is much lower than the current inventory levels at most chemical-process plants.

Beyond the numbers, the technological benefits of gasket standardization promise to be significant for plants in terms of process simplification and standardization. Gasket simplification should unlock system-wide standardization across the three piping classes mentioned earlier, while reliability and safety should both rise. A study from the mid-1980s showed that the average plant experienced 180 leaks per year, of which 2% were as serious as the other 98% (combined) in terms of cost and unplanned manpower with 1 leak (per "average" year) resulting in process shutdown or worse. As the primary causes of leaks are improper installation of gaskets and use of the wrong gasket for the

service, one can readily appreciate the positive impact that gasket standardization promises for installation effectiveness and quality.

Multiple hurdles

Even so, the gasket-standardization goal confronts hurdles on the customer (i.e., CPI-plant) side. While the cost savings cited above are impressive, they are industry-average values based on surveys, whereas the manager of a given CPI plant is more likely to insist on savings projected for his or her own facility. The procurement cost savings at the facility may be relatively simple to predict, but the savings that result from reductions in inventory bins, less testing and specification development and less management oversight may be harder to quantify. CPI firms cannot judge the total benefits inherent in gasket standardization until they do become able to get a good handle on such costs.

There is also a different kind of challenge on the customer side. The typical major CPI plant has at some time put itself through an arduous and costly exercise to develop gasketing specifications (predicated on the use of multiple types of gaskets). The plant engineers and personnel have bought into such specifications, and may well be reluctant to abandon them — especially during a period when technical personnel are stretched thin.

Meanwhile, on the gasket-supply side, while advances are being made in gasket technology, there is still no single material available that meets all the criteria for standardization. Such a gasket material would need to have a very broad operating window.

For instance, whereas about 95% of all process piping systems operate at under 450°F and 1,000 psi internal pressures and can be sealed with a nonmetallic gasketing material, some steel piping systems run as high as 1,200°F and up to 5,000 psi and would require a metallic material; a “universal” nonmetallic pipe-gasketing material would have to accommodate 600°F and 3,000 psi. It must allow minimal or no emissions, offer maximum safety against blowout, and high resistance to creep. It must work well across all three piping classes, while supporting acidic, caustic, and low-stress-to-seal systems. And, the material must be reasonably priced and cost-effective to use.

In addition to this broad operating window, any technically advanced gasket material must have the widest “safe-installation window.” For one thing, the material must achieve a bolt-load retention that emulates that of graphite, perhaps the best material in this regard. Furthermore, when all of the various gasketing materials on the market today are examined in terms of the gasket stress required to achieve a gas-tight seal (namely, a Pressure Vessel Research Council / Materials Testing Institute T3 seal), each material has its own safe-installation window, defined by the minimum stress needed to obtain the seal and the maximum stress above which further torquing will not improve the seal. Compressed synthetic fiber (CSF) and ceramic-filled polytetrafluoroethylene (PTFE) have the narrowest safe-installation windows, while expanded PTFE has the widest. However, for any gasket material to be considered for piping-system standardization, its safe-installation window needs to be even wider.

Pursuing a quest

On the supply side, nonmetallic-gasket standardization boils down to finding a technically advanced material that will fit virtually all piping classes under all application parameters below 600°F and 3,000 psi, at a competitive price. At the author’s employer, this quest is called the “New Value Proposition.”

Up to this point, gasketing personnel have only been able to obtain by piping class the lowest-cost product that is technically acceptable. No gasketing material has spanned the classes, nor could become the performance leader at the lowest price. But we feel that this situation is about to change, and that a new paradigm in gasket standardization is not far off. Meanwhile, the information in the box on the previous page offers the user guidance for taking the first steps toward the gasket-standardization goal.

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