

Pipeline Preferences: Adjustability vs. A Perfect Fit

Source: JCM Industries, Inc.

Because many pipe connectors and repair fittings are similar in look and adjust well to nominal pipe sizes, they can trigger an “interchangeable” or “one size fits all” mentality. The underlying problem with the “one size fits all” approach, however, is that it often means “...*but not very well.*” Here is a checklist of considerations for finding fittings that are closer to a perfect fit for pipeline applications.



- **Design/Construction Considerations.** Knowing what’s behind the design elements, and why that is important, can make all the difference between an installation lasting the rest of your career vs. one having to be dug up again in the next year. Key factors can include:
 - **Hoop Strength.** In some cases, fittings need to reinforce the hoop strength of the PVC, HDPE, asbestos concrete, or cast-iron pipes being connected. Fittings that provide a broad area of evenly distributed support around the full circumference protect against stresses being concentrated at specific points of the fitting junction.
 - **Structural Integrity.** Look for structural design and reinforcement features that help to accommodate the special needs of semi-rigid PVC and HDPE

piping, or brittle asbestos cement and aged cast-iron pipe. Those types of fixtures are especially important for applications that require better support than that provided by concrete thrust blocking alone.

Do not substitute fittings designed for another material just because it fits the same pipe diameter. Old-style fittings that use U-bolts to clamp a saddle to the pipe concentrate stresses, creating a point load capable of crushing cast iron pipe or deforming PVC pipe.

- **Pressure Ratings.** It is important to understand how pipe size, operating pressure, and gap opening factor into working pressure (Figure 1). For pipelines subjected to high working pressures or surges, be sure to specify accordingly. (See Barlow’s Formula.) Know when to choose a fabricated repair sleeve instead of a repair clamp for larger high-pressure pipelines. Recognize, too, that different zones in a single water distribution system might require different operating pressures relative to changes in elevation.

Nominal Pipe Size (In.)	Outside Diameter	Area of 1/4" Break	Stress/Force on Clamp at 100 PSI
12	13.20	10.37 sq. in.	1,037 lbs. PSI
16	17.40	13.67 sq. in.	1,367 lbs. PSI
20	21.60	16.96 sq. in.	1,696 lbs. PSI
24	25.80	20.26 sq. in.	2,026 lbs. PSI
30	32.00	25.13 sq. in.	2,513 lbs. PSI

Chart courtesy of JCM Inc.

Figure 1. As pipeline diameters increase, the stress/force on a traditional pipe repair clamp rises dramatically. At higher pressures and larger pipe sizes, consider the capabilities of a fabricated repair sleeve tailored to the specific requirements of the application, instead.

- **Material Quality.** Don’t be impressed by a colorful paint job. Know what’s beneath it. When evaluating parts from new vendors — foreign or domestic — take the time to compare body and bolt materials, ratings, and coatings, as well as gasket materials, high- and low-temperature operating ranges, and resistance to water, salt solutions, and mild acids or bases. Also look for compatibility with appropriate ANSI, ASTM, and AWWA standards.

- **Gasket Fit.** The underlying gasket's thickness, how it is designed, and how it compresses around the pipe being installed or repaired are all critical to long-term performance in the field. Evaluate gaskets by their ability to provide a watertight fit, complement the required hoop strength, and restrict unwanted movement, yet maintain a good seal as pipelines flex or pressures increase.

Consider, for example, that as pipe diameter grows larger, the characteristics of an outlet seal design (Figure 2A) make it easier to create a good seal at up to twice the pressure that a full circumferential gasket design (Figure 2B) can deliver.



Photos courtesy of JCM Inc.

Figures 2A and 2B. As pipe diameter and line pressure increase, the force required to seal the larger surface area of a full circumferential gasket (left) is higher than that required to seal the smaller surface area of the narrow contour outlet seal (right) indicated by the red arrow.

- **Tolerances.** In high-pressure applications, close-fitting pipe fixtures generally provide better performance. Look for component designs that are tailored to minimize unnecessary stresses from pipeline pressures, dynamic forces, or ground movement.
- **Functionality.** Choose appropriate fitting designs according to the nature of the installation involved. For example:
 - **Specify sufficiently long designs** for joining adapters to ensure that there is at least a 1-1/2" overlap of the coupling on the end of the pipe, even if a hastily cut pipe leaves a wider than necessary gap. Put a mark on each pipe a known distance back from the end, to ensure a solid frame of reference for ample coverage on each pipe end when the coupling is finally positioned.

- **Use stiffeners with high-density polyethylene (HDPE) piping** to ensure that pipes do not move enough to run away from the gasket over time.
- **Evaluate special designs for misaligned pipe**, including offsets or joints deflected more than three degrees. While it is possible to force misaligned pipes into a conventional straight fitting, stresses and movement in the ground can eventually create a gap in the gasket seal (Figure 3). Properly fitted restrainers, or restrained fittings with built-in collars, enable longer tie rods to draw the two pipe ends together in applications where joints are under risk of moving during or after installation.

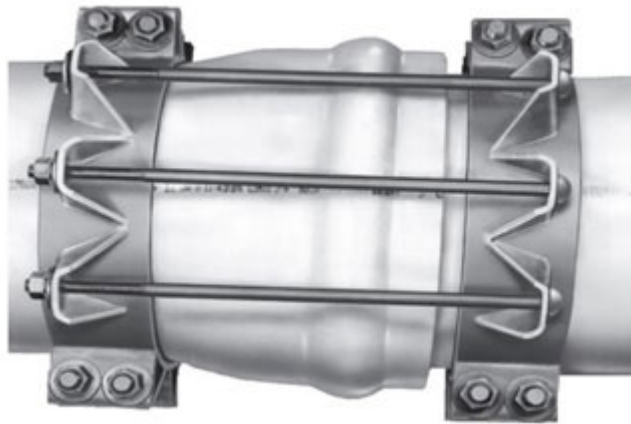


Photo courtesy of JCM Inc.

Figure 3. Long bolt restrainers protect the integrity of gasketed PVC bell fittings and fused joints by drawing and holding the two pipe ends together to resist flexing and loosening during installation or ground movement.

- **Installation Environment.** A perfectly good fitting for one location can actually increase the risk of failure in another. The soil profile at an installation site can have a lot to do with long-term success or the need to choose a more robust design to withstand the following challenges:
 - **Cold weather climates** that subject the ground to freeze/thaw cycles increase concerns about stressed or shifting pipes.
 - **Unstable soils**, sandy soils that don't compact well, or clay soils that shift between wet and dry cycles, can also stress joints and cause pipes to shift.
 - **Soil conditions** such as natural acidity, alkalinity, and coastal areas exposed to salt water environments can all impact the life expectancy of pipes and

fittings. Look for appropriate construction features (e.g., stainless-steel fasteners, epoxy coatings, or 316 SS vs. 304 SS construction, gaskets, etc.), as demanded by the environment. Also be aware of electrical conductivity or naturally occurring ground current in areas such as glacial moraines (e.g., Great Lakes areas).

- **Recognize The Difference Between “Equivalent” vs. “Approved Equal.”**

For all the personal experience, online resources, and product literature an experienced water professional might have, sometimes the single most important thing they need to know is the phone number of someone who can walk them through their most challenging field experiences.

A high-profile emergency is not the time to assume that all pipe fittings of a given design are equivalent or to start evaluating specialty pipe fittings. Evaluating multiple component designs from reputable manufacturers to designate “approved equal” designs before an emergency requirement pops up can pay dividends in the long run.

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