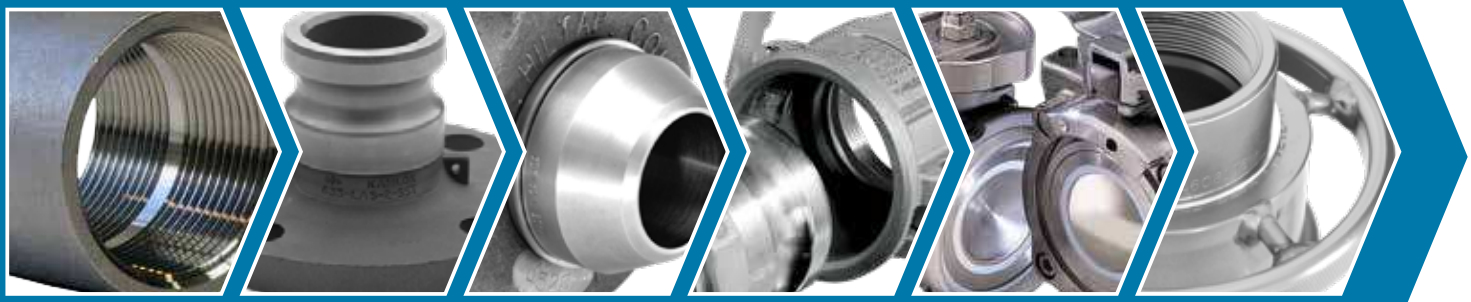
Are You Selecting the Right Coupler for Your Application?

By Dave Morrow, Director of Product Management, OPW Engineered Systems

As the chemical industry has evolved, so have the needs for advanced transfer solutions. The landscape of today's modern chemical industry requires connections to meet high safety and regulatory standards, while delivering the best performance for a wide range of applications with varying operational temperatures and pressures.

Couplers are the critical connection point between the plant and the transportation of the chemical to the next segment of the supply chain. The importance of selecting the right couplings cannot be overstated and customization cannot be overlooked.

THE EVOLUTION OF COUPLINGS



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The Evolution of Couplings

The realities faced by today's chemical and petroleum industries demand innovative, carefully engineered coupling technologies that are built to handle a wide range of applications. These can range from the most extreme hazardous fluid-transfer application under high pressures or temperatures to the most basic.

These are the type of chemicals that plant safety and manufacturing professionals are most interested in containing because contact with people or the environment can be disastrous. Chemicals like this include flammable products, explosive products, toxic products and carcinogens.

The evolution of coupler and fittings technology has happened quickly and has introduced countless options and variations to consider when investing in your process safety program.

Let's take a look at the evolution of coupling technology that will help you decide the path you need to take when selecting the right fitting or coupler to protect your product, your people and our environment.

Threads

National Pipe Tapered (NPT) thread is the American standard for all piping and valve threads. Unlike threads found on a typical bolt, which is a straight thread, tapered threads will actually pull tighter, increasing torque and wear on the threads. These are easy to assemble on various types of piping or hoses, and it takes little training or special tools to work with it. However, these types of connections tend to wear out over time and must be properly monitored. In addition, the connections are prone to leaks if not sealed with Teflon® tape or sealant.

If maintenance and replacement are neglected, the risk for a serious accident increases. Threaded connections are very good for low-pressure, low-stress piping, especially in small sizes like 1-1/2" and smaller. In high-pressure applications, those with vibration or other possible mechanical loading, threaded connections are more problematic.

Another complication with threaded connections is the aspect of brute force when using pipe wrenches and cheaters, which becomes a safety hazard and ergonomic issue. It's often needed when connecting and disconnecting threaded connections. When more force is used at connection, the stronger that connection is. However, on the flip side, the connection becomes harder to remove, which increases the risk that damage and leaks might occur.

Flanges

Flanges are another widely used connection that are generally used for high-pressure, non-repeated connections. Some indications would make flange connections superior to NPT due to seal quality. Each of these connection types are tried and true, and have proven themselves worthy over many years and across numerous industries.

Flanged connections are made using two flanges and a select number of stud bolts and nuts, with a gasket between them to secure a seal. These connections, too, are common and time consuming, but can be susceptible to leaks for many reasons, including at the gasket and due to faulty installation. Additionally, flanges can be subject to thermal distortion and shock.

More space is needed for flanged pipe systems and they are more expensive to install. Because the systems are heavy to handle, flanged connections are time consuming to connect and require pipe fitters in plants that can require more than one operator. Based on the number of bolts (4, 8, 16, etc.) and size of the flange, it can take enormous amounts of time to unbolt and rebolt.

Flanges have a place but aren't ideal for repeated or repetitive connections because they take a lot of time to connect. The introduction of unions was a big improvement for many higher-pressure, repeated connection points.

Unions

Unions have the nickname "hammer unions" because you have to use brute force to get them to seal. Due to the flat-gasket construction, the flat gasket can easily be crushed when force is applied. There's always the risk of emissions because the seal is always in question. Typically, operators will have spare gaskets readily available, as they are prone to leak. Hammer unions, being high pressure, have been mismatched (or cross-matched) causing uncontrolled releases of potentially hazardous fluids that can result in injury. Because of these hazards, unions can be risky, expensive and unreliable.

Kam & Grooves

Kam-and-groove technology provides a faster, lower-pressure quick connection. Designed for operators that make repeated connections, it was really the beginning of quick connects. Due to the pain points of threads and flanges, there was the demand for a robust, quick-connect coupling.

The result was an auto-locking twin-arm design that is used to lock one hose or fitting into place with another one. The female connector has two "cams" as part of the assembly. The male connector has a shape that allows the cams to "lock" into place. All kam-and-groove fittings should be dimensioned to U.S. Military specification A-A59326 (effective 9/25/1998).

There have been incremental improvements to kam and grooves over the years. The most significant improvement has been the development of auto-locking cam arms that minimize the risk of accidental releases of products that can be caused by arms not remaining in a locked position.

Kam and grooves are widely used across all industries. However, it's important to keep in mind that these connections are limited by pressure (generally, less than 250 psi) and should not be used in any compressed-gas service, including steam or air.

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Despite their widespread adoption and use, there was still an issue with kam and grooves - they leak. Whatever residual product is left in the line will spill when uncoupled. In many applications the lines are blown down to minimize this risk, but the reality is that these open connections posed a risk and the market wanted more. Additionally, if these connections are opened while under pressure, bodily harm can be caused and/or hazardous materials could be released.

The Birth of Dry Disconnects

People started to combine kam-and-groove technology with a ball valve, placing a ball valve behind the adaptor and another ball valve right behind the coupling to minimize drippage. This method was essentially the first dry disconnect. Combining a valve with a kam-and-groove, dry disconnects were born.

The dry disconnect has been around for many years and over that time, improvements have been made and other versions have been manufactured. While operators adopted the dry disconnect, there was a demand for even better flow and less drippage. In an effort to achieve both, larger versions have been introduced to the market. These were designed to be a more robust coupler for heavy industries with the ability to offer broader chemical compatibility.

The other main type of poppeted dry disconnects, NATO-style, twist-to-connect coupling technology, was created in Europe because there was a demand by European companies to standardize connections for tank trucks and ISO tank containers. These couplings are manufactured in accordance with NATO STANAG 3756.

It's an easy connection with the simple twist-to-connect, and the broad standardization acceptance has driven the abundance of adaptors at sites and machines across Europe. Additionally, the twist-to-connect method doesn't have an operating handle, making it compact and ideal for small spaces.

But no matter where you were on the planet, operators still wanted even better flow and even less drippage.

Non-Poppeted Dry Disconnects

What's acceptable to one user might be completely unacceptable to another. And when transferring high-hazard or high-value products, product loss is not an option. The development of non-poppeted dry disconnects evolved from the demand for optimum flow and the least possible drippage.

Non-poppeted dry disconnects are the most advanced and most expensive dry disconnects but are frequently the best choice because of the protection they give businesses and the environment when securing high-value and high-hazard products. The elimination of the poppet that is a component in traditional dry disconnect results in virtually zero pressure drop, with superior fluid-loss prevention upon disconnection.

These couplings were engineered with an innovative double ball-valve system, which delivers a tactical balance of unrestricted flow path and double shutoff reliability. Because of this unique double ball-valve ball system, no product is trapped in the cavity or lost at disconnection.

When dealing with high and low temperatures, operators need to get a little more extreme.

Extreme Safety Connections Beyond Dry Disconnects

Extreme quick-connect safety connections are engineered for the toughest high- and low-temperature and high-pressure applications.

These connections serve global industries to provide safe transfer solutions for some of the most difficult and demanding liquid and gas applications. Extreme connections vary from compatibility with extreme cold to extreme heat, with each offering its own unique product design challenges. From extreme temperatures, to extreme pressures, industry demands have driven coupling manufacturers to develop solutions to meet these needs.

Extreme safety connections are vital to preventing chemical or gas leakage while flowing, reducing fugitive emissions of VOCs in extreme temperatures, from cryogenic to 400°F (204°C), and pressures, up to 15,000 psi, are added to the equation. One example would be couplings designed for use with Liquefied Natural Gas with operating temperatures of -260°F (-162°C). Connections made at a wellsite could be in the thousands of psi. These applications push the limits of design and engineering, but the industry has stepped up to the challenge by providing safe, reliable connections to meet nearly any application.

What would happen if the truck or railcar that you've connected left unexpectedly? A potentially catastrophic issue. Safety Breakaway Couplings have been developed to minimize this risk. Many types and styles are available depending on the needs of the specific application. The important note here is that these are engineered solutions and should be specified and installed per manufacturer guidelines. Systems cannot be installed in a vacuum, without considering a host of criteria including the specific media being handled, the system pressures and temperatures, the angle of pull, and the amount of supported weight.

Prepare for the Unpredictable

Choosing the right coupling technology can be a very difficult process if you're doing it on your own. With regulations to follow and countless variables to consider including flow, drippage, price, pressure and ergonomics, operators can rely on companies like OPW Engineered Systems that have been ahead of the curve in developing innovative coupler technologies. By going through a personalized process, operators will be able to assist in selecting the perfect coupler that protects product, people and the environment.

About the Author

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