HAVING A FIT OVER YOUR FLUID CONNECTOR FITTINGS?

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HERE'S WHAT'S OUT THERE, AND WHAT YOU CAN DO TO STOP LEAKS.

IN THE FLUID CONNECTOR INDUSTRY, the term "standard fitting" is practically a paradox. Perhaps the only thing that those associated with fluid power connectors can agree upon is that they can't agree on a single type of fitting for worldwide use. SAE (Society of Automotive Engineers), DIN (Deutsche Industrial Norm), ISO (International Standards Organization), and JIS (Joint Industrial Conference) are a few of the more widely accepted fitting designs, and JIS fittings producers don't even agree on a common design.

Because so much mill machinery depends on fluid power, maintenance, repair, and overhaul (MRO) personnel must become experts in fluid connector system design and assembly. Toward that end, here is a rundown of the ports, tube fittings, hoses, and hose fittings that are common in a paper mill and a recommendation on what can be done for a leak-free fluid power system from port to port.

LEAK POINTS

Fittings connect hoses and tubes to ports in pumps, valves, cylinders, and similar components. Since hoses and tubes are unlikely to leak unless they are misused, damaged, or corroded, it is understandable that most leaks spring from fitting to port and fitting to hose or tube connections. In fact, the number one fluid power system design rule is fewer joints equals fewer leaks.

There are several types of ports: pipe thread, tapered pipe thread, and straight thread. Tapered ports and pipe thread ports are becoming obsolete. To form a seal, they rely on the metal interface of threads crushing against one another, sometimes aided by a sealing agent. As hydraulic operating pressures have increased, they have been replaced with straight thread ports.

Straight thread ports rely on fittings with elastomeric O-rings for sealing. There is general agreement that a straight thread port with a conical groove for an O-ring provides the most leak-free performance; three of the five kinds of ports in wide use today by equipment manufacturers incorporate this sealing technology.

COMMON PORTS

- SAE straight thread ports have inch-sized UN (Unified National) or UNF (Unified National Fine) parallel threads and are most common in the United States and Canada.
- ISO 6149 ports feature metric parallel threads. Along with SAE straight thread ports, they feature conical grooves for an O-ring seal. They are the preferred port for all new designs.
- DIN 3852, which is common in Germany, also features a conical groove and metric parallel threads similar to ISO 6149, but DIN 3852 allows other sealing variations, too.
- British straight thread ports have British Parallel Pipe Threads and are widely used in the United Kingdom and British Commonwealth countries as well as in France, Scandinavia, and Japan. Their sealing concepts include an integral elastomer seal set into the fitting body as well as separate sealing washers with or without an internal O-ring.
- Four-bolt split-flanges use an O-ring in a flange head for sealing and are used worldwide, especially for connecting lines that are 1 in. in diameter and larger and for severe service applications.

COMMON FITTINGS

Fittings generally have two working sides: the tube end and the port end. On the port end side, there are two types of straight thread fittings: positionable and nonpositionable. Plugs and straight connectors are nonpositionable fittings, and Ts and elbows are positionable fittings.

- *Nonpositionable fittings* have a flanged annular area that squeezes an O-ring to seal the port end connection.

- *Positionable fittings* use a lock-nut and washer to squeeze the O-ring, allowing them to be oriented toward hose or tubing. In either case, sealing is reliable if the fitting or lock-nut is torqued to the proper value.

On the tube end side, there are many popular types of connections. Without a doubt, the most leak-free connections are provided by two fittings that utilize elastomeric seals: the O-ring face seal fitting and the metric 24° cone flareless fitting with integral elastomer seal.

- The *O-ring face seal fitting*, which is garnering worldwide recognition for its ability to stop leaks, seals by compressing an O-ring that is captured in a groove against a flat body surface. It is easy to assemble and has a very high tolerance to over-torquing, which is critical when you consider that most fluid power leaks result from improper assembly. O-ring face seal fittings can accommodate inch and metric tubing by changing only the sleeve.
- The *metric 24° cone flareless fitting,* which is most common in Europe, has a tapered throat and a nut that, as it is tightened, drives a ferrule into a tube. While the original 24° cone flareless design seals metal to metal, there is a version that adds an elastomer seal. Designed for medium-duty and high-pressure applications, it offers excellent sealing reliability.
- The *37° flare* is probably the most common fitting-to-tube end connection in use today, especially in the United States and Canada. It seals with metal-to-metal contact and, like the O-ring face seal fitting, it can accommodate inch and metric tubing by changing the mating sleeve.
- The *60° cone end* connection is used mainly in Japan and the United Kingdom. It seals by the metal-to-metal contact of a tapered cone and tube.

HOSE VS. TUBE

Tubing is made from both metal and plastic, but, in high-pressure applications such as those found in a mill, tubing here refers to rigid metal tube. Generally speaking, tube has a tighter bend radius, handles higher pressures and ambient temperatures, and dissipates heat better than hose.

In the past, the biggest drawback to plumbing with tubing was that fittings had to be brazed or welded. Flames, fumes, and line contamination were a common problem in this costly, labor-intensive operation. However, new flanging technology makes the fitting-to-tube assembly operation much easier and faster. Portable flanging machines can be transported easily to mill maintenance spots, and there are versions capable of producing 90° flat-face flanges for use with O-ring face seal fittings.

Hose is used in fluid power applications where movement, shock, and vibration occur. Because vibration is a major factor leading to fluid power system failure, hose and hose/bent tube assemblies are frequently used to counteract shock and vibration.

Hose also is used to compensate for misalignment and in difficult routing and installation applications. Its flexibility makes it easier to route around obstacles. As hose manufacturers produce stronger, more flexible, and thinner hose, the gap is closing on metal tubing's bend radius, heat dissipation, and high-pressure advantages.

A LEAK-FREE SOLUTION

Even with all the different fitting end connections in wide use today, there is a best available technology (BAT) for leak-free fluid power systems. The key is elastomeric seals.

Whether during routine maintenance or equipment overhaul, whenever a choice is possible, replace fittings that rely on metal-to-metal seals with those that use elastomeric seals—O-ring face seal fittings in the United States and Canada and the metric 24° elastomer seal version in Europe. Though pipe thread and tapered ports on older equipment cannot be changed, specify new equipment with straight thread ports that are designed for elastomeric O-ring seals. Because improper assembly is a leading cause of fluid power leaks, the ability for elastomeric seals to offset assembly torque variances cannot be overstated.

Select tube and hose for their best performance attributes in each application—pressure, vibration, bend radius, operating temperatures, routing ease, and alignment. Also, the importance of acquiring new crimping and flanging equipment for efficiently and effectively making hose and tube assemblies cannot be diminished. TJ

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