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Lockout valves

Manifolds

Making the grade

Construction equipment aims for higher precision

Air valve selection basics

Readers debate fittings and leakage

While reading Scott Harlan's analysis of O-ring face seal (ORFS) fittings, I had a quiet chuckle to myself. The long and the short of Mr. Harlan's article could be summed up with the phrase, "ORFS fittings are not capable of being treated to as much abuse as traditional fittings. If you allow your equipment to be compromised by many different practical considerations, then this fitting is not for you."

Having been involved in sealing around the world for 20-odd years, it no longer amazes me that engineers assume that because they got away with poor praxes with one product, if another product cannot be treated with the same contempt, it has design flaws.

Derek Duncan
Cleveland

In response to Mr. Harlan's comments in the February 2002 issue of *H&P*, I have been working at the other end of the pressure spectrum. We manufacture vacuum instrumentation, and we use many ORFS fittings. We are consistently able to leak check systems on a helium mass spectrometer in a range of $<1\times10^{-9}$ sccm. As Mr. Patel responded, the correct use of any fitting is all in the training.

Eric Engstrom
junior manufacturing engineer
BOC Edwards

I am a Professional Engineer with 30+ years experience in heavy mobile equipment design. As such, I've designed my share of hydraulic systems. I periodically read articles in your publication and others relating to hydraulic system leakage and adapter types. I've been a strong proponent of getting pipe threads out of high pressure hydraulic systems for my whole career. Certainly things are better now than 30 years ago, but there's still a long way to go.

Consider, for example, two common components: the pressure gauge and the hydraulic quick coupler. Every pressure gauge I own or ever used has a ¼-in. male NPT thread on the end. I've tried many times, unsuccessfully, to find gauges with SAE J-1926/1 O-ring ports or JIC 37° male threads. As a result, every gauge I've ever used had an NPT to JIC adapter "Loctited" onto the gauge. This seems ludicrous for 5000-psi systems, or any system for that matter.

Recently, I designed a fast track hydraulic system that required numerous #12 hydraulic quick couplers. I specified the plumbing out, thinking I could get the quick couplers with O-ring ports. Think again! I ended up using couplers with ¾-in.NPT ports. When the system was up and running there was one leak. Guess where it was?

These are just two examples. There are still way too many valves, pumps, cylinders, and other components with NPT threads. Component manufacturers should be more proactive by making standard components with O-ring port bosses, not NPT. Sure, the backyard mechanic will be mad because he can't get the part with pipe threads, but isn't it better to pull him up a notch, rather than hold everyone else to his level?

"Engineers assume that because they got away with poor praxes with one product, if another product cannot be treated with the same contempt, it has design flaws."

Phil Quenzi, PE
Atlantic Mine, Mich.

I now have my own management outsourcing company and am writing in that capacity. However, I was previously the Asia Pacific General Manager for Aeroquip and enjoyed 22 years experience in the industry with that company.

I have seen many instances where JIC joints started to weep after some time — despite having been installed correctly. These weeps usually occurred weeks or months after installation and were caused by vibration, pulsing, or minor imperfections in the 37° faces. Warranty issues and disputes increased expenses for manufacturers and suppliers alike.

There now appears to be a complete system that removes a lot of the variables involved in this type of installation. The combination of designed ridges in the Flaretite seal and pre-applied sealing compound combats at least two common areas of potential trouble.

However, the torque wrench system, combined with a visual ink jet, ensures two other key variables are tackled effectively. One is operator inconsistency in the tightening process; the other is the lubrication qualities that allow applying higher installation torque and prevent galling damage at the critical metal-to-metal sealing surfaces.

To achieve Class 0 sealing, some kind of external seal is usually required, such as O-rings. But the JIC joint, which is so common, has continued to rely on metal-to-metal sealing. I intend to offer this solution to my customers in the future.

Andy Phillips
managing director
A & C Development Solutions
Rouville, Australia

Leakage is a big concern in our operations [steel mills], so information on new devices or techniques that help to build leak free-systems catch my interest. So did the *Reader's Forum* column in your February 2002 issue.

No doubt, ORFS fittings are an important contribution for building leak-free hydraulic systems. However, we install 37° flared JIC fittings in many of our hydraulic systems and have to prevent leaks in our continuous caster operations.

A new product we read about in *H&P* last July sounded promising because JIC 37° flared fittings perhaps could be elevated to "no-leak" performance simply by inserting a Flaretite seal. Since then, we have installed quite a few of these cone-shaped washers. They offer us the following benefits:

- We avoid the previously frequent replacement of stainless steel JIC fittings.
- A sealing element clips onto the male portion of the flared fitting, thus eliminating concern about it staying in place during assembly (which was a problem Scott Harlan experienced).
- The mating flared surfaces are sealed by a baked-on Loctite coating to ensure sealing wherever the contact surfaces mate, even when slightly misaligned (another of Scott's experiences). I'm considering installing them in all hydraulic systems of our tun-dish cars, which are loaded with JIC fittings.
- The Loctite coating prevents metal-to-metal galling when fittings are over-torqued.
- Fittings assembled to only hand tight do not temporarily appear to be properly installed. This avoids another problem Scott had.

Bruce Schlegelmilch
supervisor, continuous caster operations
Bethlehem Steel,
Burns Harbor, Ind.

From toys to machine tools

Your frustration [with assembling the Cozy Coupe police car, March 2002 editorial] is common when dealing with inexpensive items manufactured in low-income countries.

My frustration is with the machine tools I am using. The VMC that I have on a 36-month lease was billed as able to do anything the competitor could do. This new machine won't even run a ¼-in. end mill in steel as well as a worn out Bridge-

By **P. J. Heney**, senior editor

Manifolds simplify systems

Manifolds provide a convenient means for installing multiple valves in a centralized location. Benefits include lower cost, more compact design, less leakage, and simpler maintenance.

Manifolds come in two basic types. One is a single-piece design which supports all necessary valving and contains all the passages for an entire system. The other is the modular-block design. Each modular block usually supports only one valve and contains internal passages for that valve's functions as well as flow-through provisions. It normally is connected to a series of similar modular blocks to make up a complete system.

Both types have their advantages. Which is best suited for your system will depend on a variety of factors, such as application, specific function, cost, space, and system longevity.

Some manifold manufacturers supply only manifolds; others provide manifolds that go only with their valves; still others supply manifolds and valves, but are willing to sell you their manifold and permit you to select valves of your choice. As more valves are built with standard mounting patterns, interchangeability becomes feasible for more and more systems.

Single-piece manifolds

These are available in two basic designs: laminar and drilled metal block.

Laminar design — In a laminar-type manifold, several layers of metal have appropriate passages machined or milled through them. These plates, usually steel, are stacked or sandwiched with the various fluid paths determined by the shape of the overlapping passages. Solid-metal end pieces are added, and the whole stack is brazed together.

Because the internal passages can be cut in contoured shapes and as large as necessary, nearly any flow rate can be accommodated with virtually no pressure drop. Because the stack is brazed together, these manifolds can handle pressures to 10,000 psi, and there is no limit to the number or size of the valves

Fig. 1. Free-standing drilled-block manifolds accept numerous valves.

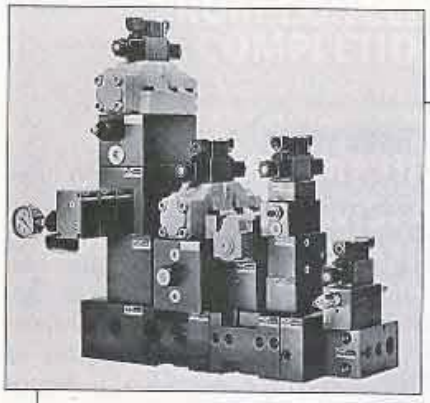

Fig. 2. Compact modular manifold system includes directional, sequence, and relief valves, plus other control components.

greater the number of drillings, the greater the chance for leakage to occur. Additionally, the choice of sealing plugs is a key factor for reliability and leakage prevention. The chosen plug must be able to withstand severe cyclic pressurization, vibration, temperature extremes, and the thermal expansion of the parent manifold.

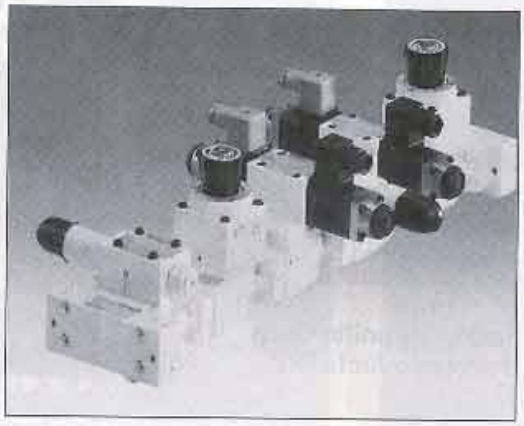

Fig. 3. Horizontal manifold stacking system can mount directly on tank with integrated filter and pressure-relief valve, includes 5 symmetrical channels, adaptable to any type of circuit. Valve-mounting patterns conform to DIN standards.

which can be mounted on such manifolds.

Laminar manifolds are custom-designed. Valves and other connections can be located where appropriate for a specific application. But because of the permanently shaped flow passages and brazed construction, this type manifold cannot be modified easily if future circuit changes become necessary.

Drilled metal-block design — Drilled metal block manifolds, Figure 1, also can be custom-designed for specific applications. Usually made from a slab of steel, aluminum, or cast iron, the blocks are drilled to provide flow passages for design requirements. This network of drilled passages also enables you to locate valves as desired, with some limitations because the drilled passages must be straight.

Other drilled-block manifolds accept cartridge valves into cavities drilled into the manifold surface. Interconnecting flow passages travel through the manifold from the valve cavities. Some cartridge valves have threaded bodies that hold them in threaded cavities; others slip into smooth cavities where they are retained by plates fastened to the manifold surface.

Blocks may range in complexity from a simple 2-valve circuit to one that may incorporate 50 cartridge valves. Modern CNC machinery allows very complex and intricate manifolds to be made easily and consistently. This enables the design of sophisticated circuitry into a compact layout.

Manufacturers try to keep the number of interconnecting plugged drillings to a minimum. The

Modular manifolds

Modular manifold systems, Figures 2 and 3, allow relatively easy modification of existing manifold designs. This erector-set approach to manifold construction consists of cast iron, aluminum, or steel blocks that permit you to design and build your own manifold. They also can be ordered ready-to-install. Most modular systems can be bench-assembled horizontally and stacked vertically.

End plates usually seal the ends of the assembled manifold, but these plates also can be drilled for pump and tank connections. Interconnecting, divider, and spacer plates are usually installed between the basic building blocks. Interconnecting plates divert flow from one passage to another between blocks, or stop flow between blocks by plugging a passage. Divider plates allow flow to continue or to be blocked by plugging. Spacer plates serve to increase dimensions between basic blocks when an outsized valve must be accommodated on the exterior mounting surface.

The tops of the basic modular blocks are ported and drilled to accept subplate-mounted

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Fig. 4. Low pressures in pneumatic systems allow manifolds to be made from easily shaped materials such as clear acrylic.