



Above: Gates' Quick-Lok connectors
Below: Chesteron's breakthrough ram seals in operation

Would hydraulics and pneumatics feature in a futuristic Star Wars setting? Either way, innovations are ensuring that more of the force is with you, as Dr Tom Shelley explains

Improvements in the design of fluid connectors, seals and hoses have done much of late to improve reliability and reduce leaks on a very wide range of hydraulic systems. Pneumatics, too, have benefited, but whereas the issue here is essentially saving waste and hence energy, leaks of fluid – especially hydraulic oils – are also potentially hazardous, so rather more important.

So what are the highlights? Something of a breakthrough in large hydraulic ram seal design has recently been made by AW Chesterton. According to Dr Brian Gilmer, a seals expert with UK agent William G Search in Leeds, the organisation's 11K EZ stack pack is made of two split seals that are more durable than earlier technology. Gilmer says his company recently supplied a 23-inch diameter set to replace a Chevron stack – greatly reducing

seal was replaced on a scheduled overhaul, even though there was no leakage when the equipment was stripped". And with the new seal set available in various material combinations to accommodate new or used equipment in the range 6–1,320mm, with solid rings as well as split available, we're looking at a useful addition.

But there are other ways to eliminate leaks – in both new and reconditioned equipment – and to do the installation work faster than with conventional screw-up nut connectors. Quick-Lok connectors, developed by Gates, for example, harness adaptors pre-installed in ports, such that hoses can be pressed in securely by hand.

Tim Bull, regional sales manager for the Fluid Power Division, explains: "A rubber ring moves back and allows a clip ring to move into a groove

May the force

friction (since the new set has only two seals, compared with the previous six-to-eight) and improving lifetime from four months to 50-plus.

Usable life may be longer, he explains, "but the

to effect the locking action." He reckons the couplings are suited for one or two wire braided hoses (where it can withstand at least 600,000 impulse cycles), and that the push-in force required is high enough to know a connection has been made, but low enough for easy assembly. What's more, there are two variants: QLH, which connect permanently in sizes up to one inch, rated to 350bar; and QLD, which can be removed with a special tool and are available in sizes to half inch, rated at 280bar.

However, there are always special cases and, if even the slightest hydraulic leak has to be avoided, you may need a different approach. For example, the concertina roof on Wimbledon's Centre Court was originally to be moved using hydraulics, but designers went for an electromechanical solution, for fear of hydraulic oil falling on the sacred turf and/or spectators. Nevertheless, there are hydraulic

You get what you pay for

Today's hydraulic equipment endures tough operating conditions, often running under extreme pressures, at increasing speeds and working harder than ever. In addition, the trend towards smaller reservoirs places more stress on equipment and increases temperatures. Also, with a smaller reservoir, air and heat do not escape as easily, water may not separate as effectively and contaminants may accumulate faster.

Thus the rate of oxidation increases, along with the risk of sludge build-up. Even with good filtering in place, excessive sludge plugs filters, increases equipment wear and can seriously damage hydraulic pumps. In addition, sludge means high varnish potential – starting off as resinous matter, and then forming hard deposits on components.

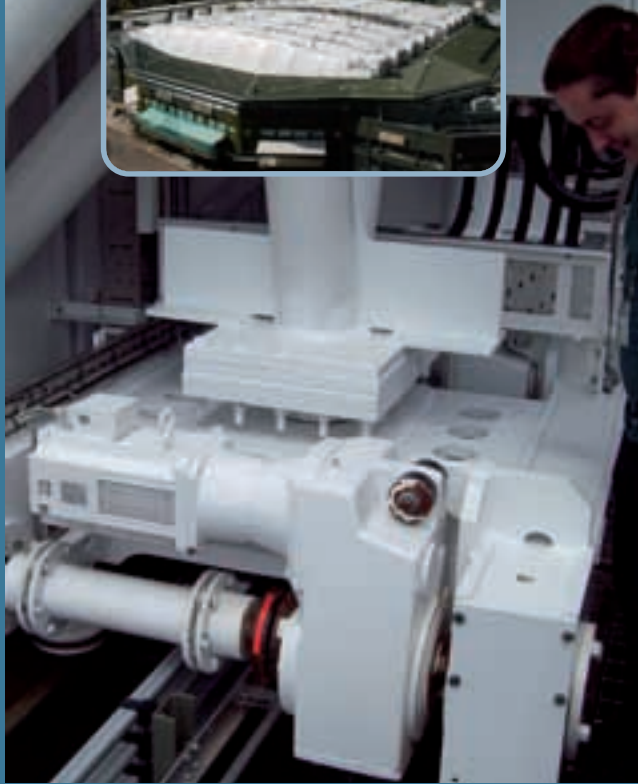
Canadian firm Petro Canada makes the point that hydraulic fluids "don't always get the attention they deserve", yet this is a key element for system maintenance to maximise equipment uptime. "The purpose of a high-performance hydraulic fluid is to ensure optimal productivity, while saving you money," says the firm.

So, how do you pick the right one? Petro Canada suggests starting with base oil that's free of impurities. Checking purity, it says, gives insight into its resilience – resistance to oxidative breakdown. The purer the base stock, the more it retains its fresh oil properties and the longer it is likely to perform.

Oxidation tests are another tool. Not all hydraulic fluids are created equal, so it is important that tests prove your choice is capable of reducing sludge formation, especially at extended operating hours.

The bottom line: prolonged fluid life means fewer change-outs, less downtime and increased operating efficiencies. As a result, it can save not only time, but also money. In other words, the fluid works harder, so your machinery doesn't have to.





Left: Wimbledon's sliding roof – engineers didn't risk hydraulics
 Right: Festo's air leak analysis service can save thousands of pounds

be with you

solutions, even where no fluid escape is essential. For example, Parker-Rectus, now the Quick Coupling Division Europe of Parker Hannifin, launched quick connect and disconnect devices for low pressure fluid lines at this year's Hannover Fair, with a leak-free version. Its KL range, which is suitable for up to 15bar, exhibits the lowest coupling and decoupling force of any standard product on the market.

Practical connectors

The leak-free versions are available in nominal diameters of 4, 6 and 9mm, and are easy to work single-handed with gloves. They also have minimal dead space, which not only eliminates airlocks during connection, but only leaves a very thin film of the transport medium on the valve bodies during disconnection. 'O' rings are available in FKM, NBR, EPDM and FFKM for both 316L stainless steel and nickel or chrome-plated brass versions.

Beyond these, Parker's Fluid Systems and Connectors Division, formerly Legris, has also launched a range of leak-free, push connect fittings for use, for example, in water and beverage applications. In this case, the body and base of the connectors, designated Liquifit, are made of polyamide from castor seeds. Approvals include: FDA, NSF 51, 61C-HOT and 58 at working temperatures to 95°C.

What about hoses? Even components that have been around for decades are showing

advances. Parker, for example, recently launched: PowerLift 477, a medium-pressure hose with two steel wire braids for cranes and lifting equipment; RemoFlex 412, a pilot line hose running up to 12MPa (120bar, 1,740psi); Push-Lok 801, a self-grip hose; and Cergom, a lined hose for transporting abrasive solids in an air stream, whether under vacuum or pressure.

What's new? PowerLift hose is interesting because it offers a combination of higher working pressure, smaller outside diameter, tight bending radius and light weight. In addition, its nitrile inner tube means better chemical resistance for bio-produced oils, while its outer cover improves abrasion resistance. Meanwhile, RemoFlex 412 has only one high tensile steel wire braid, yet is extremely flexible for use in mobile hydraulic control

Gates' Quick-Lok leak-free connectors are almost child's play



Hydraulic hybrid has BMW humming

Electric hybrid cars require more energy to manufacture and raise issues in terms of recyclability, especially of the batteries. So one company that says it is time for a rethink is Artemis Intelligent Power, based in Loanhead, near Edinburgh – and its proposal centres on hydraulics. “The underlying advantage of hydraulics is that the power density is significantly higher than electrical machines,” comments Dr Win Rampen, a director at Artemis.

Like an electric hybrid, when the car brakes, the system is designed to capture and store energy that would normally be lost – which is then used when the car accelerates. Artemis’ Digital Displacement Hybrid Transmission involves mounting a pump on a standard internal combustion engine, hydraulically connected to hydraulic motors and coupled to the wheels. The engine



drives the pump, which sends its output power, via hoses, to two motors driving the rear wheels.

“Hydraulic machines typically suffer from poor part load efficiency and indirect controllability,” says Rampen. “But what our technology brings is all the good things

associated with hydraulics, plus the advantage of controllability. That removes hysteresis, while keeping parasitic losses to a minimum.”

When the team recently trialled a modified BMW 5-Series at Millbrook Proving Ground, the result was a 50% reduction in fuel use. A computer controller meant the vehicle was able to switch between stored energy in the hydraulic system and the petrol engine. It also ensured the engine operated at its most efficient speed.

BMW has promised support for the project and, critically, enabled the team to integrate its technology into a rear wheel drive car. “The space provided by rear wheel drive vehicles means the whole conversion can be done without the need to modify the subframe, or anything else structurally,” says Rampen.

In terms of a retrofit, Artemis says it is currently looking at producing replacement transmissions for commercial vehicles. Although many may keep the same engines for more than 20 years, it is not unusual to replace the transmission after, say, 10 – opening a window of opportunity for the new hydraulic technology.

“We are talking about parts which are machined or cast out of steel or aluminium and are mass produced relatively cheaply to known automotive production methods. And they have much better recyclability,” concludes Rampen.

Above: BMW 5 Series with hydraulic hybrid engine technology
Above and below right: Parker's guarded hose and push-fit developments

systems. It, too, has an abrasion and ozone resistant cover and a nitrile inner tube. Then Push-Lok 801 looks after low pressure applications to 2.4MPa (24bar, 348psi) where assembly without tools or clamps is important.

As for Parker's Cergom, this Italian product incorporates hexagonal alumina plates on its internal bore, to resist abrasion, embedded in a blend of natural and polybutadiene rubber. Over traditional steel pipes, they offer not only better wear resistance, but also flexibility and reduced noise and vibration. Think of applications in steelworks, thermoelectric power plants, cement plants and the mining industry.

So much for hydraulic devices; when it comes to pneumatic air leaks, the issues are less about direct environmental problems, and more around expense and indirect waste. Festo reckons UK companies spend about 1.5p to compress one cubic metre of



air to 7bar. For a medium-sized manufacturing company consuming 50 m³ per minute, 24 hours per day, that's £394,200 per annum.

Looked at like that, Festo's air analysis service, offered through several energy-saving consultancies, which aims to cut consumption or compressed air, looks very worthwhile. As Daniel Winkler, managing director of Oxford-based LeekSeek, says: “The average cost of a leak survey is less than 10% of the leakage cost, and the cost of repair is also less than 10%. Also, once improvements have been carried out, the savings are immediate, which means that most projects have a payback of less than six months.”

And he adds: “Many pneumatic delivery systems and automation components we encounter have problems caused by compressed air contamination. This factor is eliminated during the air quality analysis. Obviously, this helps manufacturers reduce air consumption, but it also helps them reduce maintenance costs and machine downtime.”

Sludge solutions

Incidentally, the hydraulic equivalent of leaking air is sludge – hopefully removed by filters, but liable to get into valves and equipment, if the filters are not changed and start running on bypass. While some sludge gets in as a result of external contamination (such as dirt getting



into quick-release connectors), most of it comes from oxidising oil over a period of time. Canadian firm Petro Canada recommends its Hydrex AW46 hydraulic fluid, claiming that it is still good after 2,685 hours, despite oxidising conditions. However, much the same can also be said of other higher quality oils from other sources. Generally, you get what you pay for and cheap hydraulic oil, from a supplier without a reputation to protect, is liable to cause trouble. 