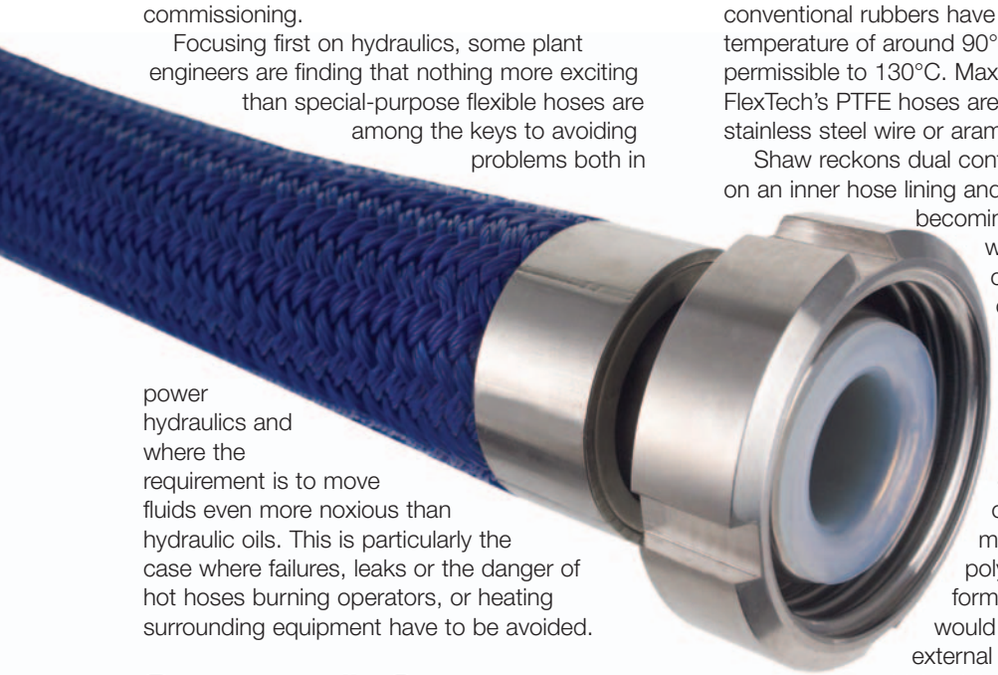
Hoses and pumps

Although hydraulics and pneumatics are very mature branches of engineering, Dr Tom Shelley finds useful developments involving, for example, specialist hoses and air pumps

When it comes to the tough end of hydraulic equipment, getting designs right, and selecting the correct hoses, couplings and collars, are among the keys to safe and effective operation – along with ensuring professional installation. Meanwhile, with pneumatics, issues for the more difficult applications tend to revolve around pump technology, and again competent installation and commissioning.

Focusing first on hydraulics, some plant engineers are finding that nothing more exciting than special-purpose flexible hoses are among the keys to avoiding problems both in power hydraulics and where the requirement is to move fluids even more noxious than hydraulic oils. This is particularly the case where failures, leaks or the danger of hot hoses burning operators, or heating surrounding equipment have to be avoided.



Cost or quality?

Gary Shaw, director of FlexTech Hose Solutions, which manufactures a wide range of bespoke hoses, says that buyers have, in the past, been "driven by cost at the expense of long life and quality". And that is despite the fact that failing hoses not only result in costly downtime, but also cause major contamination problems in the food, pharmaceutical and chemical industries – and can injure or even kill, if they fail under pressure.

FlexTech's hoses now range from intricately corrugated PTFE (polytetrafluorethylene) constructions to others with outer containments or outer layers that are thermally insulating, with heat-resistant thermoplastic cuffs, so that the oil inside may be very hot, but the hose surface remains cool to the touch.

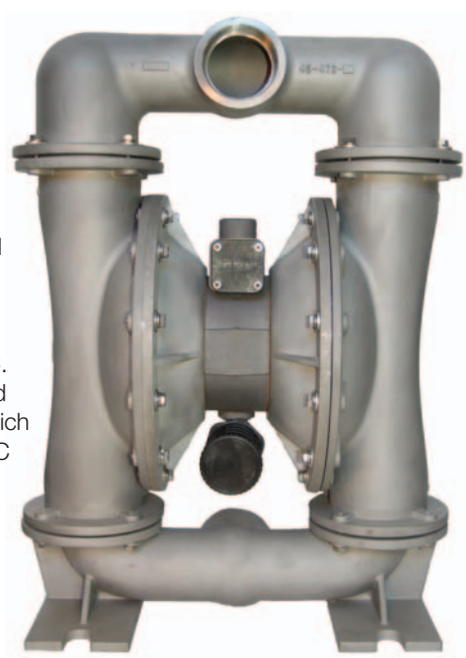
For example, at its immaculate new workshop in Slough, the company manufactures a helically corrugated PTFE hose with stainless steel fittings, which has the inner PTFE tube flared out at the ends to make the seals. The result is that all wetted parts are PTFE. Shaw says that, apart from the chemical resistance of PTFE and its suitability for the food, pharmaceutical and chemical industries, it is possible to use the material at up to 260°C working and 400°C peak temperature, whereas conventional rubbers have a maximum working temperature of around 90°C, with peak excursions permissible to 130°C. Maximum pressures for FlexTech's PTFE hoses are 550 bar, if contained in stainless steel wire or aramid fibre braiding.

Shaw reckons dual containment hoses (based on an inner hose lining and an outer jacket) are becoming more common for use with "really aggressive chemicals". Constructions can be extremely complex – for example, some are built with a PTFE lining inside stainless steel braiding, inside another composite hose consisting of seven or more layers of different polymers, in sheet or film form. In this case, there would be an external cover, which might be polypropylene, plus an external wire layer to contain and protect against abrasion.

FlexTech also makes thermally insulated hoses capable of handling oil at 250°C, with specially designed end connections made from PEEK (polyetheretherketone), which has a maximum service temperature of 260°C and a melting point at 340°C. Shaw says that he has also supplied hoses for electric furnace doors, which have to resist temperatures of 550°C for short periods of time, while also remaining electrically insulating. And he claims to supply high pressure hoses for salt water for desalination

Pointers

- Surprisingly, perhaps, hoses, couplings and collars remain key to improving highly stressed hydraulics
- Special purpose flexible hoses are advancing for power hydraulics
- Innovative designs can handle aggressive media and high temperature
- In pneumatics, the key challenge remains pump selection and installation
- Compressed air-driven vacuum pumps can move up to 30m^3 per hour of mud, powders and slurries
- Extreme application pumps are emerging, using a variety of technologies

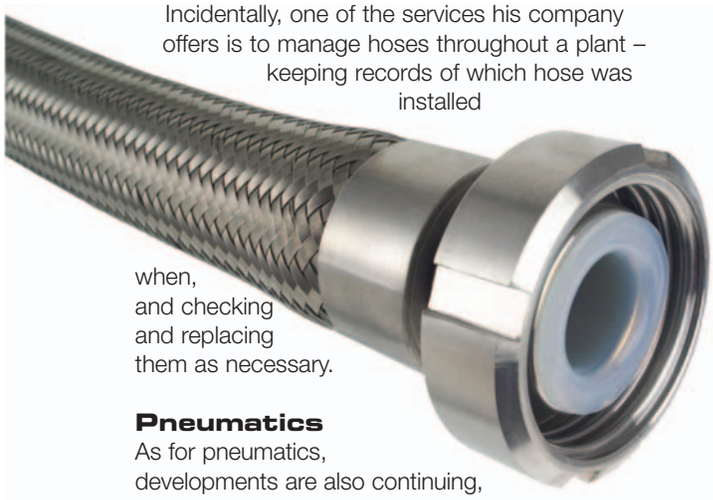


plants, and other hoses for carrying deionised cooling water for power electronic applications.

To maintain quality, all FlexTech hoses are also pressure checked on computer controlled equipment, with samples tested to destruction. As for why some engineers are now specifying these extreme hoses, Shaw speculates it's because they "don't want to be fined".

And he adds: "There are thousands of companies out there making hoses, but not many do it properly. I have seen so many failures, either because of bad design and assembly or bad installation – often because of a pressure pulsations making them rub against something."

Incidentally, one of the services his company offers is to manage hoses throughout a plant – keeping records of which hose was installed when, and checking and replacing them as necessary.



Pneumatics

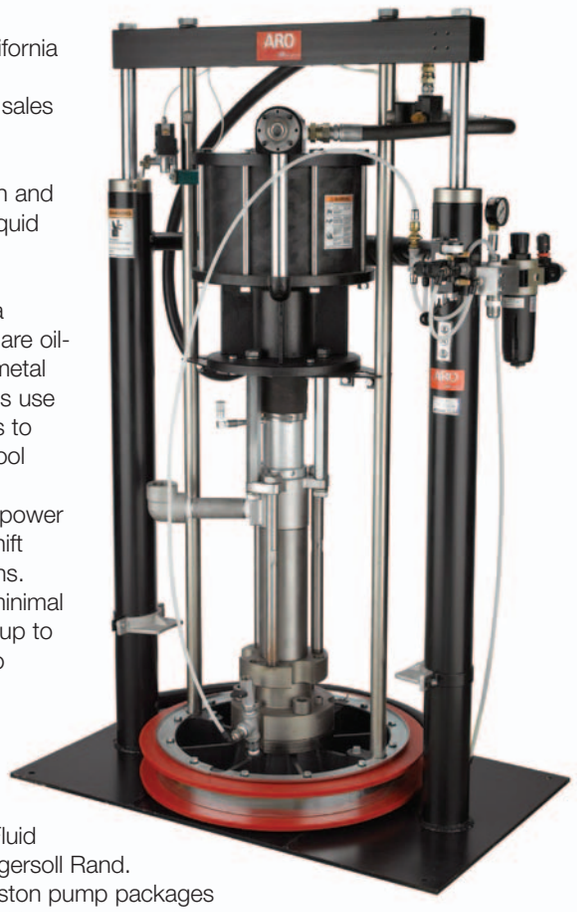
As for pneumatics, developments are also continuing, but mostly where the equipment is required to accomplish otherwise almost impossible tasks, such as pumping mud, slurries or very viscous liquids, or to power machines laying pipes underground. The other common requirement is when equipment needs to be intrinsically safe, from an explosion hazard perspective – where compressed air based systems score highly.

Peter Jex, proprietor of Kings Lynn-based plant hire firm Jex Plant, talks of compressed air-driven vacuum pumps that can move up to 30m^3 per hour of mud, powders, heavy liquids and slurries. These pumps can be located up to 50m from the work area and either deposit material in holding tanks or spread it on land up to 1,000m away.

The pumps look like those made by Supavac of Queensland. Australia, and use a venturi to suck material into a holding tank, whose contents are then blown out under pressure before they have time to settle and compact. Timers regulate the suck and blow cycles, which last 10 to 15 seconds each. Pump sizes range from the 10,000 litre/hour SV60 to the 25 to 40m^3 per hour SV400. These pumps recently saw service in the Gulf of Mexico oil spill cleanup.

Other compressed air-operated pumps that can handle slurries and very viscous fluids are air-operated diaphragm types, exemplified by those made by Price Pump in California and sold in the UK by BSS Manchester's AMS national sales centre, in Salford.

These have suction and discharge manifolds, suction and discharge ball valves, and liquid and air chambers. The air chambers are separated by diaphragms connected by a common shaft. The pumps are oil-less and have no metal-to-metal contact. Air valve assemblies use modified fluorocarbon resins to reduce friction. The pilot spool provides a continuous high pressure signal to the main power spool, assuring a positive shift under all operating conditions. Maintenance is said to be minimal and the pumps can handle up to 50m^3/ hour of fluids of up to 50,000cP viscosity.



One company especially noted for its pneumatically-powered pumps for viscous liquids is the ARO Fluid Technologies business of Ingersoll Rand. Its new 65:1 chop-check piston pump packages can handle fluids with viscosities in excess of 1,000,000cP and pressures to 515 bar. The company recently brought out a pump specially designed to handle UV inks, which crystallise very easily. Its new pump keeps shear and thermal input to a minimum, and is the result of more than three years of R&D. The same company also makes its own, well established range of air-operated diaphragm pumps. PE

Air-operated super mole

Innovation in pneumatically-operated devices is best illustrated by the technology behind Kent-based Geo-Mole's ground source heating pipe laying machine.

Proprietor Mark Brice observes that laying pipes for ground source heating is usually expensive – and hence his firm's development of a device claimed to halve that cost. Its unit consists of a penetrator that drives itself into and through the ground under the action of a reciprocating piston, in turn driven by compressed air.

At the end of each stroke, the hammer force is 28tonf. As it proceeds, it tows behind it one compressed air and one exhaust line. When a suitable length, typically 100m has been laid, the two lines are joined, and become the heat extracting circuit for the heat pump.

The penetrator is cheap enough to be left where in situ. An additional innovation is that grout laid around the pipes is not sand but recycled, mixed coloured glass. This reduces friction on the pipes, is 15% less dense than sand and has good thermal conductivity.

Progress proceeds at about 1m/minute, which means that 100m of pipes can be inserted in 1h 40min. Brice says he had been using the base technology to lay pipes in horizontal holes for years, so he knows it works.