Predicting Hydraulic Hose Failure: Monitoring Tools vs Visual Inspection
The advantage of proactive hydraulic hose maintenance

It’s often thought that hydraulic hose failure can’t be predicted, and as a fairly inexpensive component, many Production Managers accept failure as unavoidable. Equally, it’s common for hydraulics users to pre-emptively replace hoses which are still in safe working order, wasting unnecessary time and money. While the low cost of a hose itself belies the considerable expenses associated with oil clean-up and replacement, adopting a ‘run-to-fail’ policy also fails to take into account the significant health and safety hazards associated with burst hoses. For these reasons, it is important to take a proactive approach to hydraulic hose maintenance. In fact, there is always an indicator that a hose will fail, enabling maintenance engineers to act in time.

By Terry Davis, National Technical Manager, Brammer

Hydraulic systems can contain as many as 2,000 litres of oil which, due to high pressures, can completely drain out of a damaged hose within just 20 minutes. Even a small pinprick-sized hole can quickly compromise an entire system. Add to that pressures exceeding 100 bar, or even 200 bar, and a tiny hole can split or expand to the size of a golf ball within a very short period of time. While many modern hydraulic systems sit within a bund to collect waste oil, bursts can be unpredictable. The oil may spurt out at an angle, missing the bund altogether and damaging surrounding equipment or worse – causing significant, potentially life-changing fluid injection personal injuries.

Due to these factors, the cost of a leak is not limited to the price of the replacement hose, which could be as little as £10. Replacing 2000 litres of oil alone could run up to £1000 or more – a task that may not be accomplished immediately, as few lubricant suppliers keep the necessary volumes in stock. Not to mention, oil from different sources should not usually be
mixed. One must also take into consideration the cost of downtime, as well as clean-up and safe oil disposal costs. Should oil escape down drains, environmental fines may also apply. Finally, there are the cost associated with compensation or fines, in the event of personal injury resulting from a leak. All things considered, it becomes easy to imagine how the £10 cost of a replacement hose can easily spiral into several thousands of pounds, making ‘run to fail’ neither an economic or a safe option.

**Monitoring technology**
Failure can be predicted however, either by calculating usage through the use of monitoring tools or through visual inspection. Most hoses will last for approximately a million cycles, and so by analysing the run time of a piece of machinery, the average life span of the hose can be easily calculated. Alternatively, various monitoring systems exist which can be installed within a hydraulic hose assembly to detect dangerous levels of wear and send an alert at the point at which a replacement is required. Often based on Radio-frequency Identification (RFID) or infrared technology, monitoring systems offer a high degree of reliability. As they are not based solely on calculations, they have the ability to account for unpredictable wear caused by misuse.

**Visual inspection**
Where monitoring technology is not used, a combination of calculations and visual inspection should be implemented. Before undertaking full inspection – either planned or as a result of spotting a potential fault – the hydraulic power pack should be shut off and depressurised.

**Braid condition**
A hydraulic hose typically consists of an inner metal braid, connected to the ferrule at either end via a robust crimp, and protected by an external rubber sleeve. Should the braid be visible due to rubber wear, the hose should be replaced, as this could be indicative of damage to the inside of the hose, leaving the braid susceptible to rust and abrasion. This can also be caused by excessive pressure exerted on the hose, from being driven over by a forklift or trapped under other machinery, for example – all common occurrences on a work site.

Blistering or swelling of the outer coating are both tell-tale signs that while the rubber casing
remains intact, the inner braid is damaged. In these instances, oil is seeping through the braid and travelling between the braid and the sleeve. When this occurs, it is only a matter of time until the rubber housing gives way. Another cause of blistering is incompatibility between the hydraulic fluid and the hose material. This once again points to necessary replacement.

**Sleeve condition**
A hard, brittle rubber casing indicates that the hose’s maximum operating temperature is being regularly exceeded and should be replaced with a more suitable product. Conversely, a tube exposed to temperatures that remain below its optimum level will remain soft and flexible, but may display hairline cracks. This indicates that either the system temperature should be raised or the hose replaced.

**Crimp condition**
Fras or loose wires at either end of a hose point to excessive hose movement, which may be the result of vibration or pressure surges, or an indication that the hose is too short. If vibration can be identified as the cause, then clamps or dampers may be required to support the hose if re-routing is not an option. It should be noted that some slack should always be allotted to the hose, as assemblies shrink when pressurised. Also, hoses should always specify a higher maximum operating pressure than the system itself, in order to account for surges. Spiral reinforced hoses are also available specifically for severe pulsing applications if necessary.

**Support fittings for hydraulic hose**
Hoses often need to be supported by fittings, not only to prevent them from kinking, but also as a means of additional support at weak points. Fraying can occur as a result, exposing parts to corrosion, wear or rust. On the other hand, it is not uncommon to see typically very heavy hoses of six to eight meters in length and one inch in diameter, left unsupported, putting enormous pressure on the crimp and fitting, at one end or both. Persistent pressure can distort and break a crimp, and oil drips can quickly become a jet stream under normal operating conditions. Therefore, when installing supports for hydraulic hoses, it is recommended to replace the hoses at the same time to account for previous wear and tear when unsupported. Any twists or tight bends should be inspected for damage and, in the case of twists, care should be taken not to over-tighten the fitting as this in itself can cause unnecessary pressure.

**Hose replacement**
When considering hose replacement, engineers should always ensure that the hose is within its ‘best before’ date. Products should display the date of manufacture of all components, along with the date of assembly. All hoses have a shelf life. For instance, a nitrile rubber casing loses its effectiveness after approximately five years with UV exposure. Care must be taken to ensure the hose is within date and professionally swaged, to ensure optimal performance and reliability.

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**ABOUT THE AUTHOR:**
Terry Davis is the National Technical Manager at Brammer. Established for more than 20 years, Brammer’s Fluid Power Solutions Team has extensive experience in the inspection, design and repair of hydraulic hose assemblies. With its National Distribution Centre located in Wolverhampton (West Midlands), England, Brammer is an authorised distributor of fluid power products, including more than 1500 leading global manufacturers, including brands such as Festo, IMI Precision Engineering, SMC, Parker Hannifin and Bosch Rexroth. Some additional Brammer services include auditing, improvement, monitoring and refurbishment of existing systems as well as specking and product-management for the design and commissioning of bespoke system.