

Toolbox Talk

High-Pressure Fluid Injection Injuries

This toolbox talk discusses the potential harm that can result from 'pinhole' leaks in high-pressure hydraulic systems.

Background

In January a Supervisor suffered a serious injury when a hydraulic hose burst and injected hydraulic oil into his hand. The Supervisor needed emergency surgery in hospital to treat the injury.

This is not the first incident of its kind. A few years ago a quarry operative suffered a fluid injection injury from a 'pinhole' break in a hydraulic hose. On that occasion the operative did not realise he had been injected and did not seek immediate medical attention. It was several hours later, when swelling and pain appeared, that medical attention was sought. By that time he also needed to undergo emergency surgery in Hospital.

It is likely that the circumstances, which led to both these injuries, have occurred many times on sites. It is only by good fortune that they did not result in fluid injection injuries to persons working close by.

Introduction

High-pressure equipment such as hydraulic lines, high-pressure grease guns and high-pressure fuel injection systems, has the potential to cause serious injury or even death, if not properly used and properly maintained.

Fluid in this type of equipment is under pressure ranging from 600psi to 12,000psi (4MN/m² to 83MN/m²).

The velocity of fluid forced through a pinhole break in a hydraulic hose can be in excess of 250 metres per second (600ft/s). This is close to the muzzle velocity of a rifle, and is sufficient to drive fluids through protective clothing, including protective gloves.

Penetration of the skin can occur at pressures as low as 100psi (700kN/m²).

Skin penetration can occur up to 100mm (4") away from the fluid source.

Why are high-pressure injection injuries so serious?

High-pressure injection injuries usually require emergency surgical treatment.

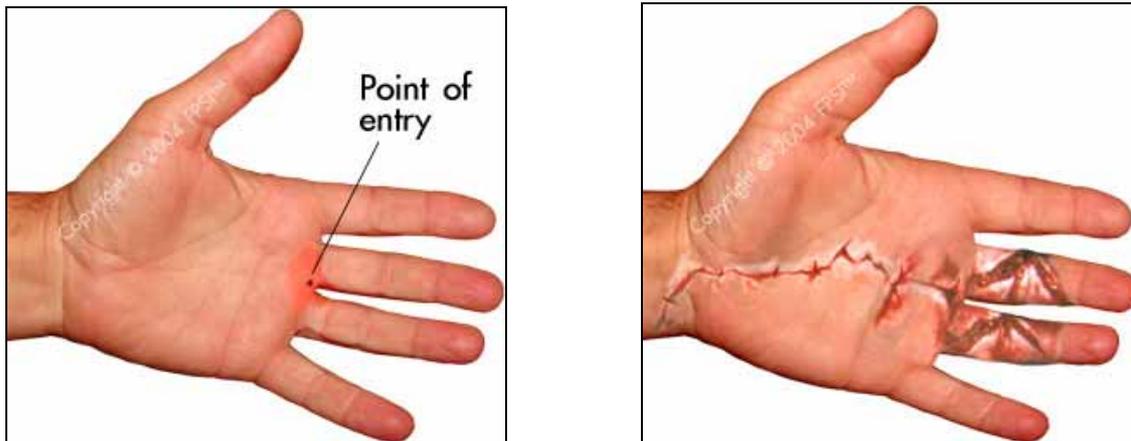
When fluid enters the body it begins to kill tissue. Gangrene can set in if the injury is not treated promptly. There is also a risk of blood poisoning and bacterial infection. Surgery is usually required to remove the dead tissue and clean out the injected fluid from the wound.

Failure to act quickly may result in the need to amputate fingers and limbs.

Risk of amputation significantly increases if the wound is not treated within 10 hours.

Unfortunately, fluid injection is often painless and the point of entry through the skin is usually very small and has a harmless appearance (see photographs below).

Pain and swelling may not appear for several hours after injection (sometimes it can take a couple of days before pain and swelling are experienced)



Photographs showing the innocuous appearance of a fluid injection wound and the extent of the surgery needed to treat it.
(Use of photographs by kind permission of Fluid Power Safety Institute, Salt Lake City, USA)

The severity of the injury depends upon several factors:

- Type of fluid injected into the body
- Amount of fluid injected
- Pressure of fluid injected
- Presence of toxins or bacteria within the fluid
- Degree of spread of injected fluid within the body
- Time between injection and surgical treatment. (This is the most important factor – the sooner the surgical treatment the less long-term disability will result)

What to do if someone is injected with high-pressure fluid (or you suspect they have been injected)

Get the injured person to the nearest Hospital Accident & Emergency (A&E) Unit immediately.

Tell the Hospital staff that the injury is a fluid injection injury, or you suspect it to be so. The nature of the injury may not be apparent to medical staff from its appearance and it could be misdiagnosed.

Take the material safety data sheet for the fluid with you. It contains important information to help Hospital staff treat the injury properly. Make sure you know where to find the COSHH data sheets on your site.

How to avoid the risk of a fluid injection injury

High-pressure fluid injection injuries often occur when checking for leaks in the system. Leaks are often difficult to locate and are only apparent because fluid is evident near by. Unable to see the leak, someone may run a hand or finger along the line to find it. When the pinhole is reached, the fluid can easily be injected into the skin as if from a hypodermic syringe.

Most leaks can be located without a need to pressurise the system.

If the system has to be pressurised to find a leak, then stand well away from the line and wearing strong protective gloves, long sleeve overalls and full-face visor run a piece of cardboard or wood along the line, ensuring your hand is at least 300mm (12") away from the high-pressure line.

Pressure systems must be safely locked off and de-energised before maintenance work is carried out. However, beware, some systems stay pressurised even when locked off!

Pinhole bursts often occur where there is already surface abrasion damage to the hose (see photograph). To prevent chafing and abrasion damage all hydraulic hoses should be suitably positioned, supported and given sufficient physical protection to prevent such damage occurring in the first place.

Formal inspection and maintenance regimes for hydraulic systems should be in place to ensure hoses remain in a safe and serviceable condition. Do you have such a regime on your site?

All non-injury high-pressure ruptured hose incidents should be reported as 'Near-Hits' and be thoroughly investigated to establish the cause of failure.



Remember

- Because the injection entry wound is small the severity of the injury can easily be underestimated.
- Failure to treat the injury immediately can result in amputation of fingers and limbs.
- It is important to avoid a fluid injection injury. However, it is equally important to know precisely what do if you have one.