

There is more to operating a hydraulic machine than pushing and pulling levers - What operator's don't know about hydraulics could kill them!

by Rory S. McLaren

A tow-truck driver, seeing hydraulic oil dripping on the floor beneath his truck, climbed aboard to search for the leak. He focused his search directly above the area where the oil was dripping to the floor.

Initially, he thought that he would be able to find the leak without starting the vehicle's engine and running the hydraulic pump. However, there was no visible sign of a leak while the engine was shut off so he decided to start the engine.

With the engine running the oil leak was still undetectable, so he asked a colleague to activate the directional control valve and "dead-head" the cylinder. The term "dead-head" means that the directional control valve is held in the activated position while a cylinder rod is stopped at the end of its stroke. Since the rod is unable to move, the pump flow is forced to discharge across the pressure relief valve which maintains full system pressure in the circuit.

The high-pressure caused the oil leak to re-appear. The driver focused his search for the leak in the area directly above the growing puddle of oil on the floor. In the vicinity of the leak there were numerous hoses bundled on top of one another. Since the leak was not visibly detectable he decided to carefully separate the hoses in an effort to expose the leak. He progressed slowly from one hose to another.

While separating one of the hoses he experienced a sharp, burning sensation in his right hand, and instantly released the hose. His initial impression was that hot oil had penetrated his leather gloves. However, upon removing the glove, he found a "pinhole" size wound which was located on the palm of the hand between the two middle fingers. There was also a small protrusion in his glove.

However, the wound did not appear to be serious so he continued with the task of replacing the defective hose.

While waiting for a colleague to pick-up a new hose, his hand became quite irritated and began to throb relentlessly. He also began to experience a feeling of numbness and tenseness in his hand. He finally decided to report the incident to his supervisor who recommended that he report to the emergency department at the local hospital, where he immediately underwent surgery - the benchmark for treatment of an injection injury.

His supervisor was stunned at the fact that an injury, no larger than the size of a "pinprick," could result in an eight month lost-time injury, and, a bill for approximately \$70,000.00 for hospital and doctor consultations, surgery, and, exhaustive rehabilitation.

NOTE: Figure 1 shows the extent to which a hand can be mutilated as the result of an oil-injection injury. This victim was injected with aircraft mineral oil. In another instance, a backhoe operator, seeing a sudden discharge of hydraulic oil from a hole in a hydraulic hose, which was located within arm's reach, tried to stem the flow of oil by placing his hand over the "hole" in an effort to prevent oil from spraying into his face.

He too suffered an injection injury, which was misdiagnosed by the emergency physician - a very



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common problem with emergency room physicians. His post-injection injury story was much the same as that of the tow-truck driver.

In yet another instance, a machine operator, attempting to bleed hydraulic oil from a cylinder through an air bleed valve (identical to those found on brake master cylinders), suffered a severe injection injury - oil injected deep into his arm (Figure 2).

He wasn't as fortunate as the others - he never returned to work and died some ten years later as a result of complications brought about by the injury.

It is my very strong opinion that every person who works on and around hydraulic systems **MUST** receive proper training, if for no other reason than safety.

Not only are the vast majority of maintenance personnel and machinery and equipment operators absolutely naïve about hydraulic safety, but so too are supervisors, safety personnel, and, OSHA/MSHA.



Here are just a few of the reasons why you could suffer an injection injury due to no fault of your own:

1. Hose failure due to:

- a) Hoses laying on top of one another caused by poor engineering – **HUMAN ERROR!**
- b) Hose coupling failure due to the fact that the vast majority of people who make hose assemblies are not properly trained – **HUMAN ERROR!**
- c) Improper pressure rating – **HUMAN ERROR!**
- d) Pressure intensification – poor engineering – **HUMAN ERROR!**
- e) Exceeding the bend radius of hose – lack of proper training – **HUMAN ERROR!**
- f) Adding hydraulic components in series (power beyond) – **HUMAN ERROR!**

2. Discharging oil to atmosphere:

- a) “Cracking” a connector to de-energize a hydraulic system – 99.9% of hydraulic systems **DO NOT** comply with OSHA’s lockout standard – **CANNOT BE SAFELY DE-ENERGIZED!** – **HUMAN ERROR!**
- b) Removing a transmission line and “testing” hydraulic components to atmosphere – a procedure recommended by the vast majority of equipment and machinery manufacturers. Read, and obey, their safety warnings – their so-called “test” procedures are in direct conflict with their warnings! **HUMAN ERROR!**



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- c) Improper pressure rating – **HUMAN ERROR!**
- d) The vast majority of system/component air-bleeding is **HUMAN ERROR!** done by discharging hydraulic oil to atmosphere. Once again, read the manufacturer's warnings about the consequences of discharging hydraulic oil to atmosphere – there is direct conflict!

To avoid this type of injury there are a few basic rules you MUST follow:

1. NEVER "crack" a hydraulic connector to search for pressure, flow, or, to de-energize a hydraulic system.

NOTE: Less than .01% of the hydraulic systems in operation today conform to OSHA's lockout standard with respect to de-energization and verification. IF YOU CANNOT SAFELY DE-ENERGIZE A HYDRAULIC SYSTEM WITHOUT "CRACKING" A CONNECTOR, GIVE IT BACK TO THE MANUFACTURER/ENGINEER. DON'T LET THEIR INABILITY TO DESIGN SAFE MACHINES BE THE REASON WHY YOU MIGHT SUFFER THE SAME FATE AS THE VICTIMS IN THIS SAFETY ALERT!

2. NEVER "test" a hydraulic system or component to atmosphere, partially open a transmission line, or completely vent a transmission line to atmosphere!

3. NEVER air-bleed a hydraulic component or system to atmosphere - "crack" a connector!

4. Specify Safe-T-Bleed® on ALL hydraulic systems. Safe-T-Bleed is the only safety device in the world, which is designed for the sole purpose of: de-energizing a hydraulic system; verifying de-energization; and, air-purging a hydraulic component or system, without discharging oil to atmosphere (www.safe-t-bleed.com).

Remember, if you so much as get sprayed with hydraulic oil while executing a manufacturer's written or verbal procedure YOU HAVE SUFFERED AN ACCIDENT! It is imperative that you fill out a "near-miss" accident report and discuss the incident with your supervisor and safety personnel – if you didn't get hurt this time, you, or a colleague, might not be so lucky the next time!

It is the strong opinion of the Fluid Power Safety Institute that everyone who works on and around hydraulic systems without proper safety training is at risk of suffering this, or other types, of injuries, or worse, death!

The irony is that EVERY company in America, with a handful of exceptions, permits people who have absolutely no training in hydraulics whatsoever, to work on and around hydraulic systems - this while OSHA, MSHA, and, your own safety personnel "look the other way!" This practice extends to elevators, cranes, aerial lift equipment, forklifts, amusement park rides, aircraft industry (all equipment with the exception of aircraft), etc.

Remember! ***"Fluid power safety doesn't just happen, it has to be pursued."***

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