WHY LOCKOUT AND TAGOUT DOESN'T GUARANTEE HYDRAULIC SYSTEM SAFETY

Presented by
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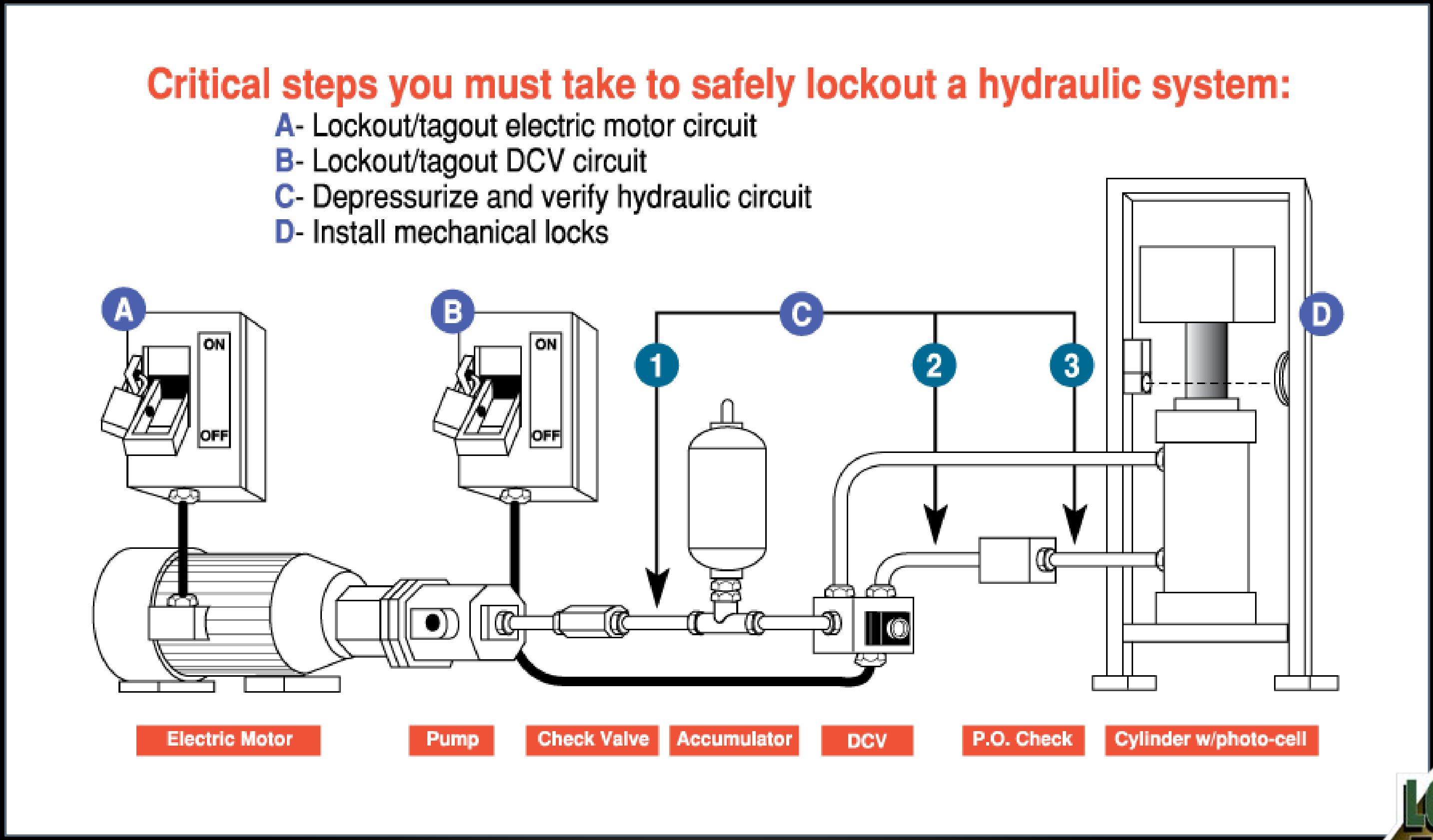
ALL FORMS OF ENERGY HAVE TO BE BROUGHT TO A ZERO MECHANICAL STATE



LOCKOUT/TAGOUT PROCEDURES

The OSHA-established procedures cover the following six steps. These steps should be performed in sequence.

6-STEP SHUTDOWN PROCEDURE:

1. Before Shutdown

The **authorized employee** must know the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy. The authorized employee must notify all **affected employees** of the lockout.

2. Shutdown

The **authorized employee** shuts down the machine or equipment by use of the normal stopping procedure (pressing the stop button, moving the switch to the “OFF” position, etc.).

3. Isolation

The main power switches, circuit, or other sources of energy are moved to the “OFF” position or otherwise rendered inoperative.

4. Lockout

Locks are placed on switches or other energy sources in the “safe” or OFF” position. During a groups lockout, all members of the group must add their own locks to the lockout. Warning tags should be placed with each lock.

6-STEP SHUTDOWN PROCEDURE:

5. Energy Release
All potentially hazardous stored or residual energy (such as that in springs, elevated parts, rotating flywheels, **hydraulic systems**, electrical systems, and air, gas, steam, or water pressure, etc.) is relieved, disconnected, or otherwise made safe by repositioning, blocking, **bleeding down**, etc. (if there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists).

6. Testing
After ensuring that no personnel are exposed, and as a check on having disconnected the energy sources, the **authorized employee** operates the push-button or other normal operating controls to make certain the equipment will not operate.

CAUTION**:** Return operating control(s) to **"NEUTRAL"** or **"OFF"** position after the test.

The equipment is now locked out.

Exhausting oil to atmosphere can cause severe injury, death, or substantial property damage -

Apparently, it's a well-recognized problem!

"Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high-pressure fluids. If an accident occurs see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere and Company Medical Department in Moline, Illinois, U.S.A."

John Deere® 643G and 843G Feller-Buncher Operation and Test Manual
"Safety Information" section (reference 9000-01-1) under the sub-heading; Avoid High-Pressure Fluids:

Caterpillar® too, offers a stern warning about the consequences of exhausting pressurized oil to atmosphere, stating that it can, quote, "result in serious injury."

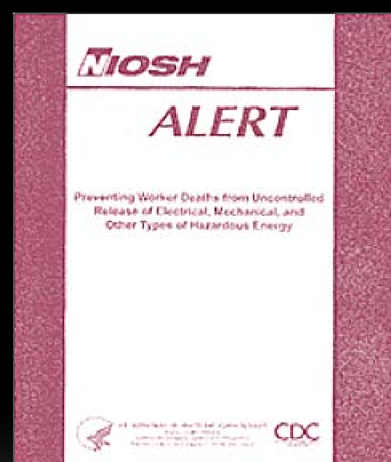
Caterpillar® PM 565 Cold Planer Service Manual "Troubleshooting" section.

WARNING - Use caution when dealing with hydraulic fluid under pressure. Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury. This fluid may also be hot enough to burn. Serious infection or reactions can develop if proper medical treatment is not administered immediately."

Sauer-Sundstrand® Series 90 Axial Piston Pumps and Motors Service Manual
"Introduction" section, paragraph 1.2 Safety Precautions

LOCKOUT & LIVE

The problem is serious enough that NIOSH published an article in which they asked for assistance in preventing the death or injury of workers exposed to the unexpected or uncontrolled release of hazardous energy: including hydraulic energy



http://www.cdc.gov/niosh/docs/99-110/

The problem is not easy to fix because hydraulics is apparently the ugly stepsister of an industry that no state, federal, or private safety organization seems to want to have anything to do with from the point of view of safety, at least none of the following organizations:

- Occupational Health and Safety Administration (OSHA)
- Mine Safety and Health Administration (MSHA)
- American Society of Safety Engineers (ASSE)
- National Fluid Power Association (NFPA)
- Federal Aviation Administration (FAA)

When it comes to hydraulic safety it's a NO-win situation:

- No Federal or State oversight
- No emphasis on safe design from the fluid power industry
- No safe design training for engineers
- No safe design standards
- No safety training required for people that work on and around hydraulic systems
- Over 80% of the people working on and around hydraulic systems have never received any training in hydraulics at all.
- Less than 1% of hydraulic systems have the means to (after they are locked out in accordance with OSHA's lockout guidelines):
  - Safely and reliably determine if the system is energized
  - Safely and reliably de-energize the system

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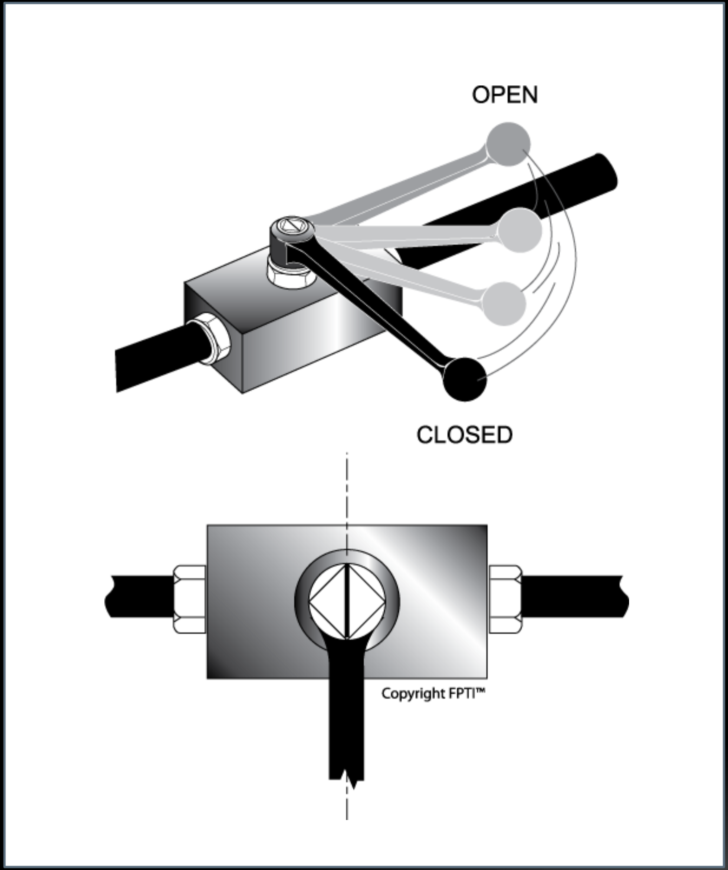
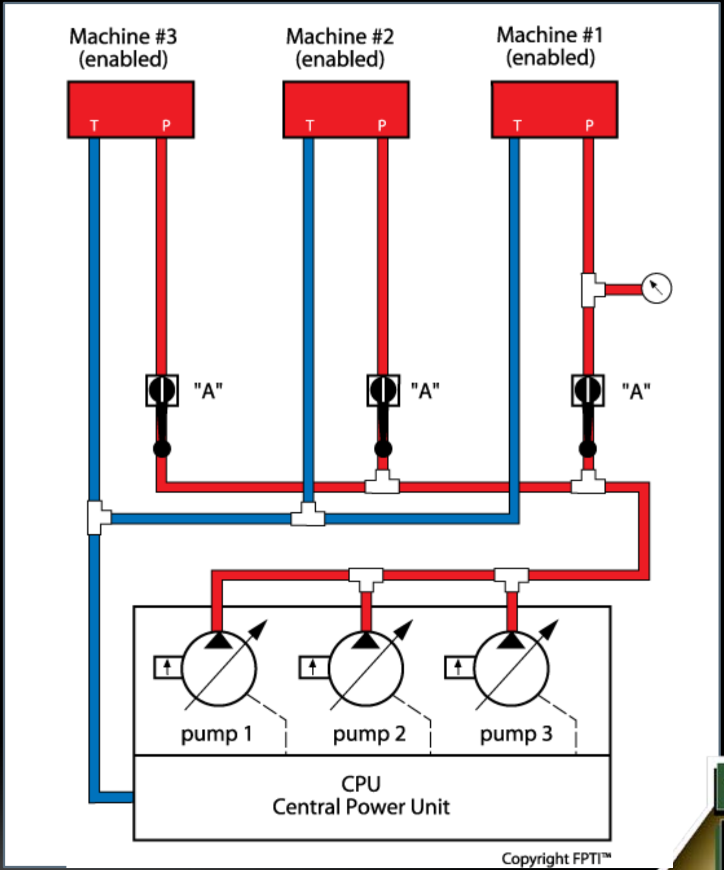
What workers do after a hydraulic system is "safely" locked – and presumably safe to work on – after performing a lockout and tagout procedure as set forth by OSHA:

- Loosen a connector and allow stored energy to dissipate to atmosphere.
- Open a valve, e.g. ball valve and drain stored energy to the reservoir: typically with no means of verifying. Most workers rely on "noise" to determine if, and when, stored energy is internally released.
- A time triggered valve releases stored energy with typically no means to verify the process of de-energizing occurred.
- Remove a cartridge valve "slowly" and release the stored energy to atmosphere. This reckless suggestion generally applies to load-holding valves, e.g counterbalance and pilot-operated check.

Here are examples of questionable lockouts currently employed in hydraulic systems:

Typical isolation for a multiple pump, parallel circuit operating two, or more, machines:



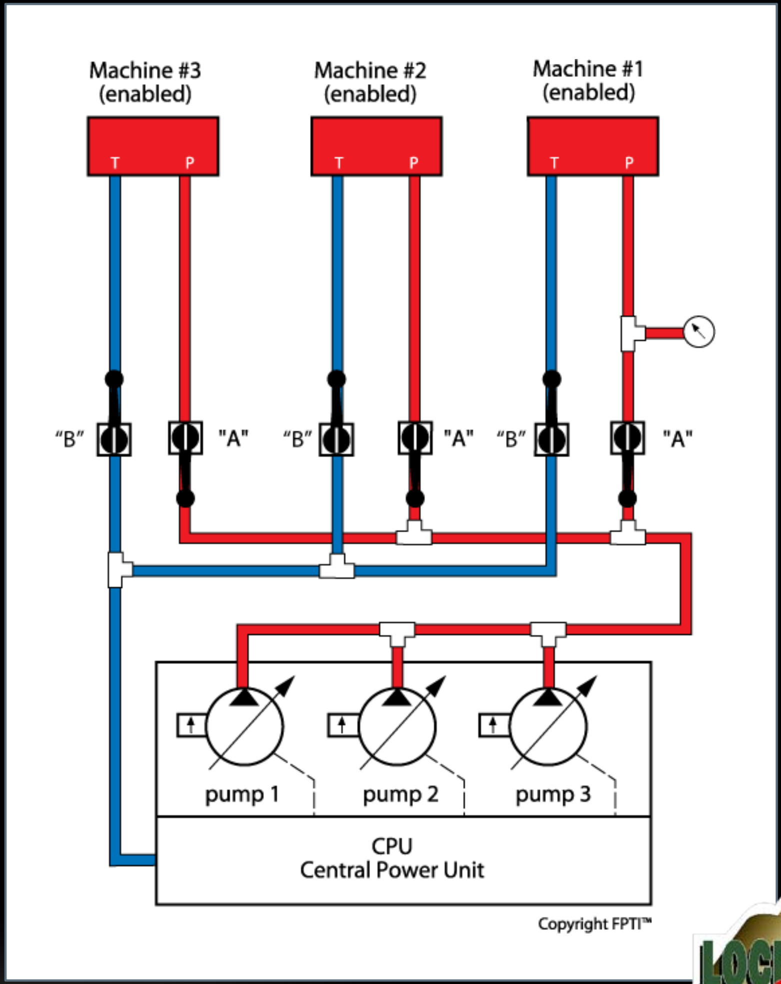


Problem:
A ball valve is not a fail-safe device: no redundant safety

Incorrect procedure:
Multiple machine lockout

Here is an extremely hazardous hydraulic lockout technique:

The designers of this type of lockout believe total isolation is the safest solution. Problem is, if the seat of the ball valve on the pressure line leaks, it will pressure up the system. Without a drain, the pressure will cause double-acting, single rod cylinders to extend unexpectedly.



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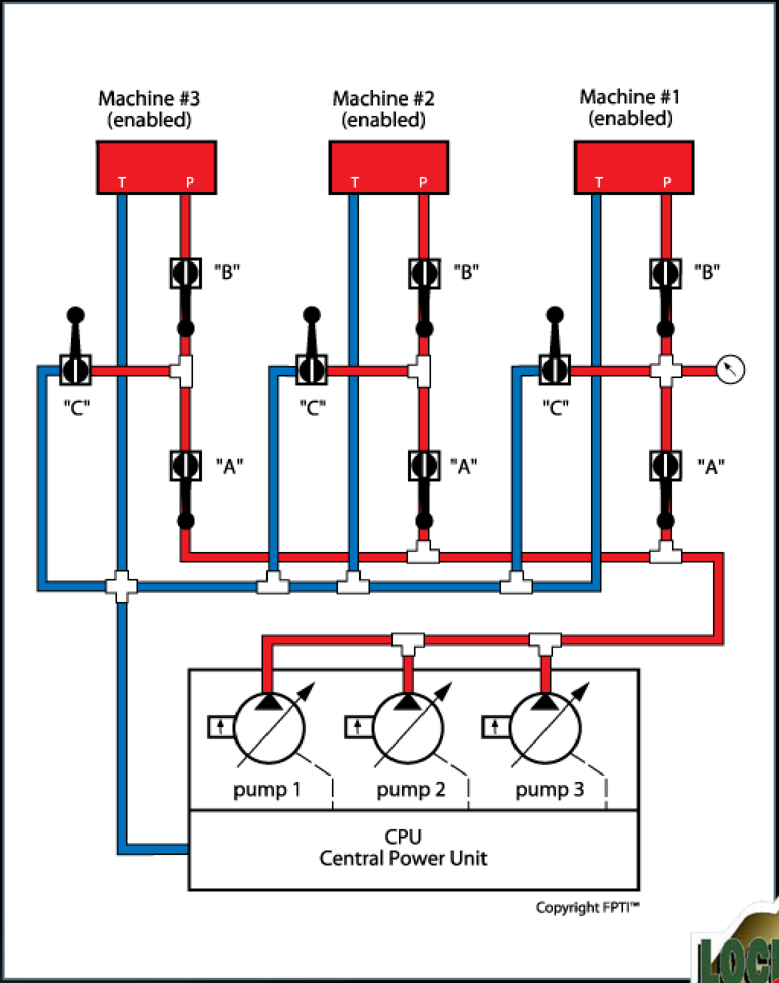

Correct procedure:
Double block and bleed

Hydraulic systems present unique challenges with regard to insuring they are safe to work on:

- Hydraulic systems have the inherent capability of storing energy when the pump is shut off.
- A single hydraulic system can store multiple “pockets” or “zones” of stored energy.
- Activating, for example, a directional control valve does not always release stored energy.
- Pilot-operated and two-stage directional control valves typically don’t function when the pump is shut off.
- Load holding valves, like counterbalance, pilot-operated check, and velocity fuses, don’t function when the pump is shut off.

There are two ways to make this possible:

1. Install small bleed valves at every actuator port with micro-bore lines terminating to nearby return lines. The bleed valves must be able to facilitate a pressure gauge for energy status verification.

2. Install Safe-T-Bleed® valves at each actuator port. Safe-T-Bleed®'s Energy Control Module is used to connect under pressure to the valve, and check for stored energy. If stored energy is detected, it can be safely removed by connecting a special conduit from the Energy Control Module to a Safe-T-Bleed® connector in a return line.

The only way to insure a hydraulic system is safe to work on, after the prime-mover has been locked out, is for a worker to have the ability to verify if there is stored energy, and remove the stored energy if necessary, at the point-of-work.

This will only be possible if the hydraulic system is specifically designed and built to facilitate "point-of-work" verification and de-energization.

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