

# Fluid Power Design Data Sheet



REVISED SHEET 10 - EVOLUTION DESIGN DATA FILE

## TWO-HAND SAFETY CONTROL OF AIR AND HYDRAULIC CIRCUITS

When cylinders are operating mechanisms that might present a safety hazard to the operator, dual controls may be provided. These require the use of both hands to start the cylinder and to keep it in motion. Dual controls are also used on large presses, which require two operators. Each operator has a control; neither can start the press until the other is ready. Usually only one direction of cylinder motion is hazardous, so dual control circuits usually work in only one direction. In some applications, the circuit does not need to be "unbeatable" as long as it offers some degree of protection. Where an "unbeatable" circuit is necessary, the final circuit on the opposite side of this sheet is offered.

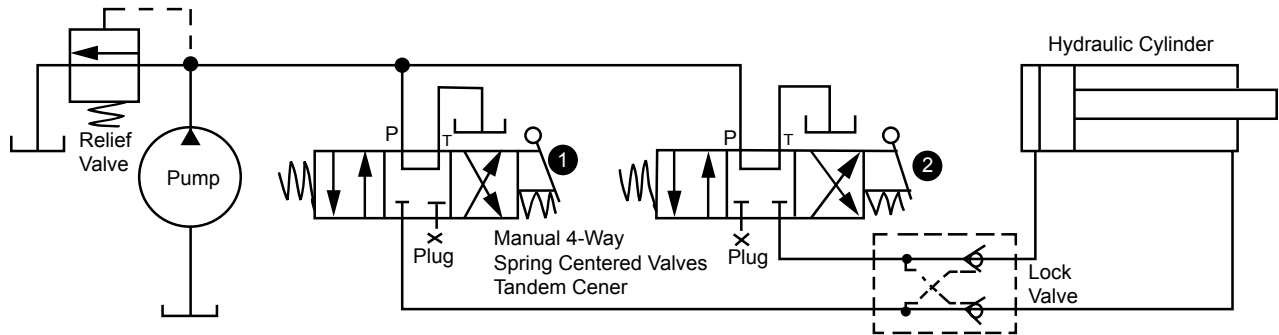


Figure 1. Manually operated 2-hand control for hydraulic cylinder for oil volume less than 30 GPM.

### MANUALLY-OPERATED HYDRAULIC CYLINDER

**Figure 1.** The operator must shift both Valves 1 and 2 to get the cylinder to move. If only one of them is shifted, the pump oil will simply by-pass to tank through the spool of the other one. This circuit gives 2-hand control in both forward and reverse. The lock valve prevents the cylinder from drifting or sagging if only one of the control valves is shifted.

**Figure 2.** For high volume circuits, over 30 GPM, this circuit is less fatiguing to the operator. Control valves 1 and 2 may be 1/4" miniature size with open center spools. Valve 3 is the main directional control and may be as large as needed for the circuit.

Pilot oil for operation of Valve 3 comes from the remote control (RC) port of the pilot-operated relief valve. With control valves 1 and 2 in center position, vent oil from the relief goes to tank and the pump remains unloaded. If both manual valves are shifted, vent oil from the relief flows into one of the pilot caps on Valve 3, shifting its spool to a side position. The orifice is optional and may be omitted. Its purpose is to increase the shifting speed of Valve 3 by adding a small amount of supplemental pilot oil taken directly from the pump line. Normally it should be very small, perhaps 1/32 to 1/16" diameter.

This circuit gives almost shockless shifting because the pump pressure does not build up until the 4-way valve has been shifted to a side position.

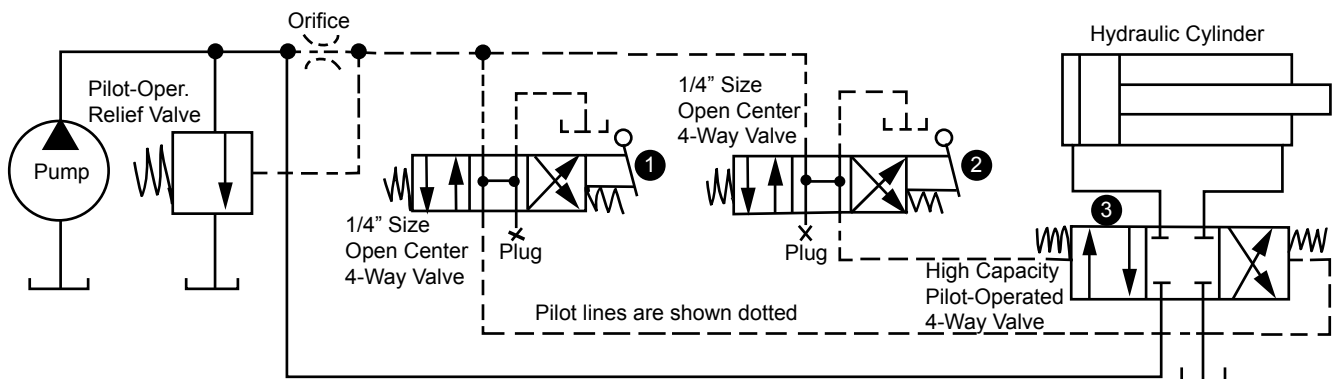


Figure 2. Manually operated 2-hand control for handling high volume to hydraulic cylinder.

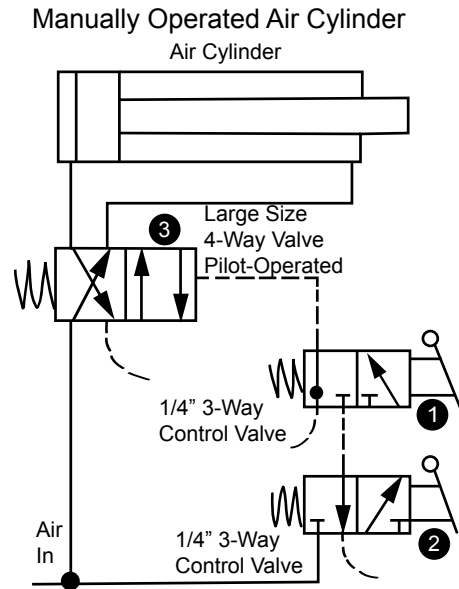


Figure 3. 2-Hand Manual Operation of Air Cylinder.

**Figure 3.** The preferred method of 2-hand control on an air cylinder is to use a large 4-way valve, pilot-operated, for directional control of the cylinder. Two small 3-way air valves, 1 and 2, control pilot pressure to the main valve.

Because of the compressibility of air, the circuit of **Figure 3** is considered to be better and safer than other circuits, which place Valves 1 and 2 directly in the cylinder lines, one connected to each cylinder port. In the latter case, if only one valve should be actuated, a reactionary load might cause the cylinder to move out of position, or a vertically mounted cylinder might drop under force of gravity.

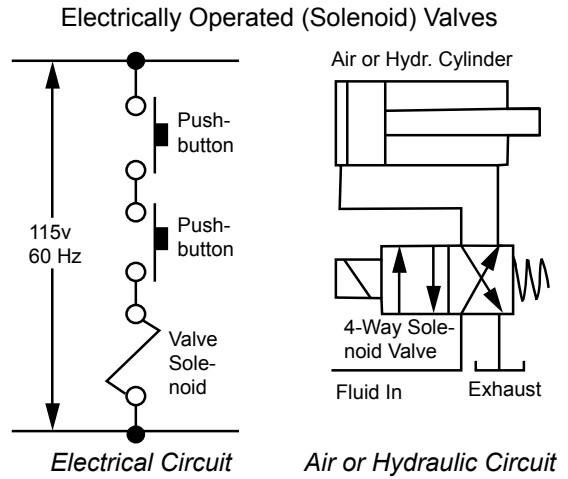


Figure 4. Pushbutton Circuit for Solenoid Valves.

**Figure 4.** On electrically operated machines using solenoid valves, it is relatively simple to wire two pushbuttons in series. The operator must hold both buttons down before the valve solenoid can be energized. In this circuit, if the operator should release either button while the cylinder is traveling forward, the cylinder will immediately reverse.

To make it more difficult for an operator to tie or weight down one button, recessed pushbuttons should be used and mounted on a vertical surface. When "unbeatable" controls are required, use the electrical circuit of **Figure 5**.

Series push buttons may be used on both air and hydraulic cylinders. On hydraulic circuits using double solenoid valves, the pushbuttons are usually wired to de-energize both solenoids and allow the 4-way valve to center, thus stopping the cylinder motion rather than retracting it.

### NON-TIE-DOWN ELECTRICAL CIRCUIT

This is the standard circuit used on solenoid valves when maximum protection is needed to prevent the operator from tying down one pushbutton. Both pushbuttons, 1-PB and 2-PB, must lie pressed at the same time within a time difference of 1 second, in order to energize the valve solenoid coil.

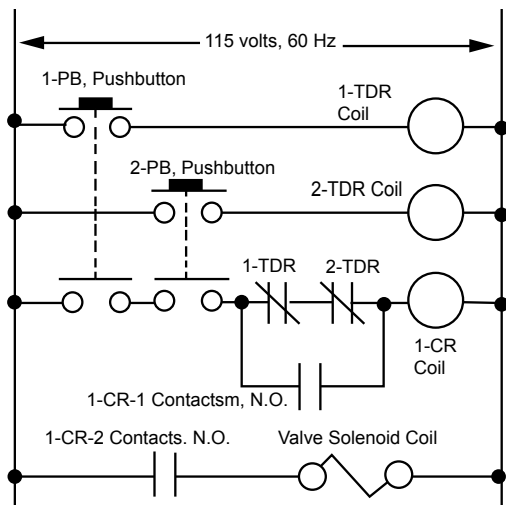


Figure 5. Non-tie-down electrical circuit using two dashpot relays. Shown for a single, solenoid valve; can be adapted for control of the oil or lubricant double solenoid valves.

Two time delay relays, 1-TDR and 2-TDR, each with one set of normally closed contacts, are used. They are adjusted for the contacts to open 1 second after the coil is energized. If one pushbutton should be tied down, or if both buttons are not pressed within a 1-second interval, relay coil, 1-CR, although it may momentarily pull in and energize the solenoid valve coil, will drop out again. After false operation, to restore the circuit, both pushbuttons must be released. When either or both pushbuttons are released, Relay 1-CR will drop out, de-energizing the solenoid valve coil through the opening of Contacts 1-CR-2.

The time delay relays are industrial relays with dashpot to delay contact action when the coil is energized. Your regular electrical supply house can furnish them. Relay 1-CR is a standard industrial relay with 2 sets of normally open contacts. Push buttons have two sets of normally open contacts.