

Hydraulic Lab Simulations

Reference Document

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Lab #1

HYDRAULICS LAB #1

STEPS

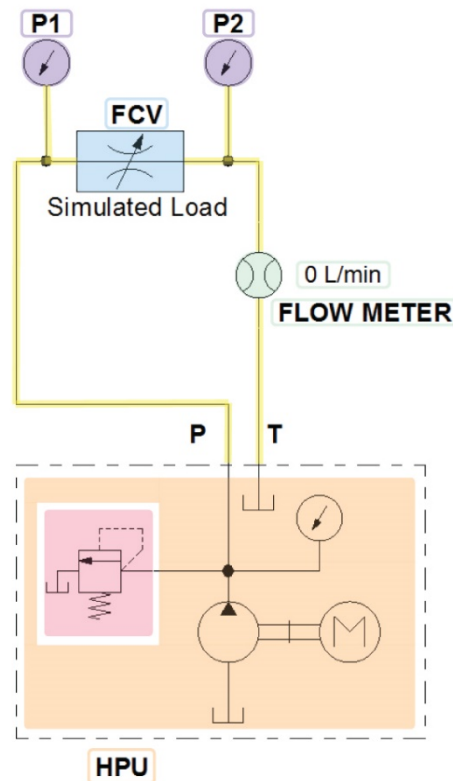
1. Build on the trainer circuit and connect all components

2. Initial setup:

- Fully close FCV, and fully open the pressure relief valve on power unit.
- Start power unit
 - Slowly adjust pressure relief valve until pressure gauge P1 reaches 50 bar.
 - Let unit run for a few minutes, adjust if necessary.
- Do not adjust pressure relief valve for remainder of the lab.
- Fully open the FCV.

3. Test:

- Record pressures P1, P2 and flow rate.
- Slowly turn FCV, adding simulated load to the system. When P1 reaches 15, stop and record pressure and flow rate.
- Repeat turning FCV, adding simulated load to the system in increments. Record max pressure with FCV fully closed. Changes in tone of sound from the power unit will be affected as the load (pressure) is increased.

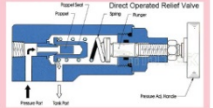


Flow Control Valve (FCV)

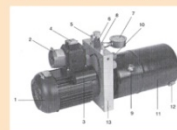


rotate

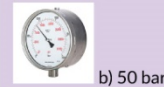
Pressure Relief Valve (PRV)



Hydraulic Power Unit



Pressure Gauge



Flow Rate Meter



Model image source from PowerPoint Intro to Fluid Power and Automation

- User connects components
 - Simulate hose connecting hardware i/o
- User rotates control valve
 - Rotational feedback from model
- User turns on power unit
 - Animated feedback on button being pressed
- User observes measurement readings
 - Simulate flow meter and pressure gauge response
- User observes power unit response
 - Audible feedback from system

Lab #2

HYDRAULICS LAB #2

STEPS

Part A

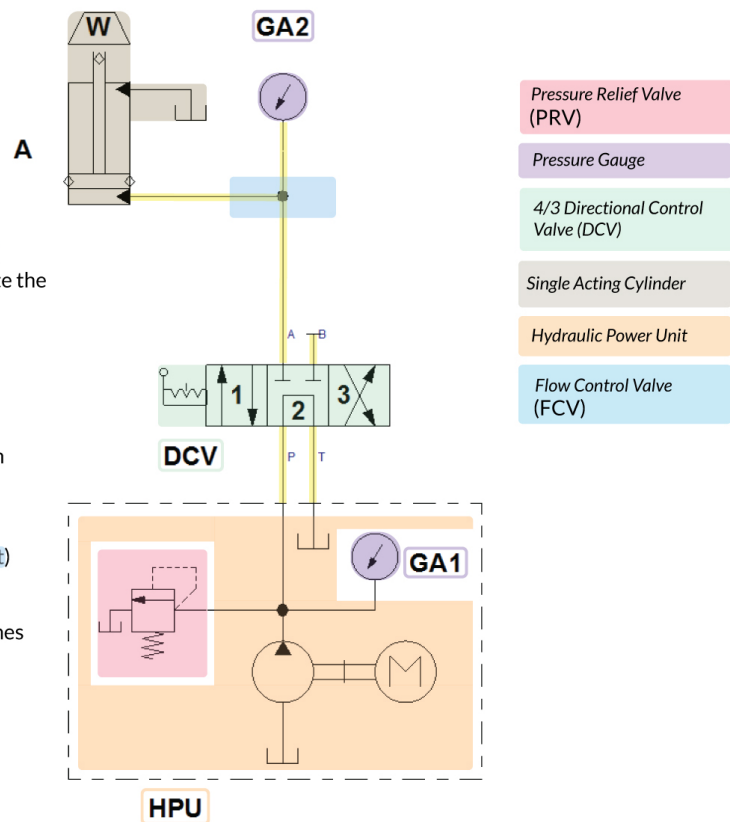
1. Adjust the relief valve to 20 bar (GA1).
2. Connect components.
3. Cycle control valve back and forth - note action of cylinder. User will move the handle between 3 positions, to change the directional pressure flow which will operate the cylinder, and distribute output values to the GA2 pressure gauge.

Part B

1. Install FCV between pressure gauge and DCV.
2. Cycle the control valve back and forth - note the action of the cylinder.
3. Note the effect between speed and FCV adjustment. (Similar process to Part A, but with the added component)

Part C

1. Remove FCV and connect the cylinder so that it becomes double acting.
2. Note relative speed of extension compared to retraction.



- User operates Directional Control Valve by handle
 - 3 positions to switch between
- User drags and drops components onto board
 - Ability to connect additional ports (per spec) and remove when complete
- User observes physical movement and audible cues from system operation
 - Speed adjusted in accordance of calculated values
- First position DCV fills bottom of the cylinder (piston end)
 - Third position DCV empties the piston end (to tank)

Real World Application: Dock Leveller

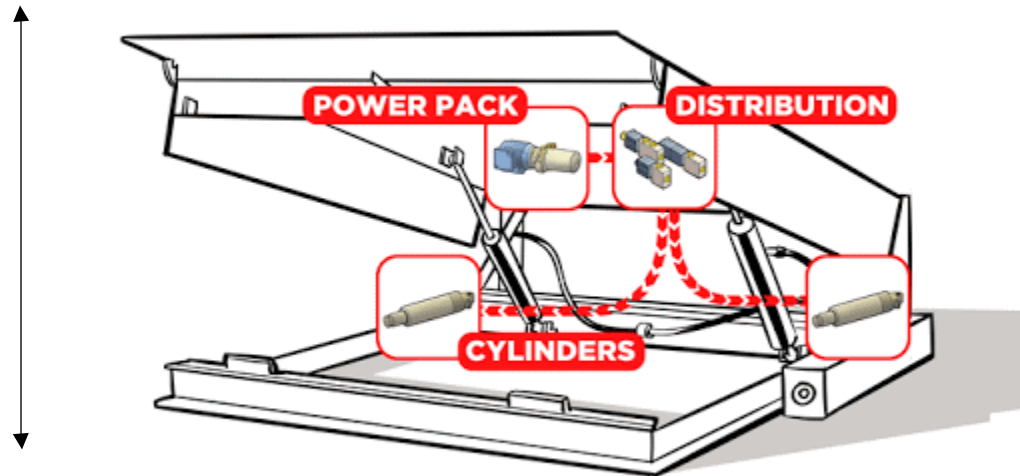
Manually controlled by pushing a lever, thus extending a hydraulic single acting cylinder. When lever is moved in the opposite direction, the cylinder retracts. If lever is released, the cylinder will stop.

See next page

Component Visualization

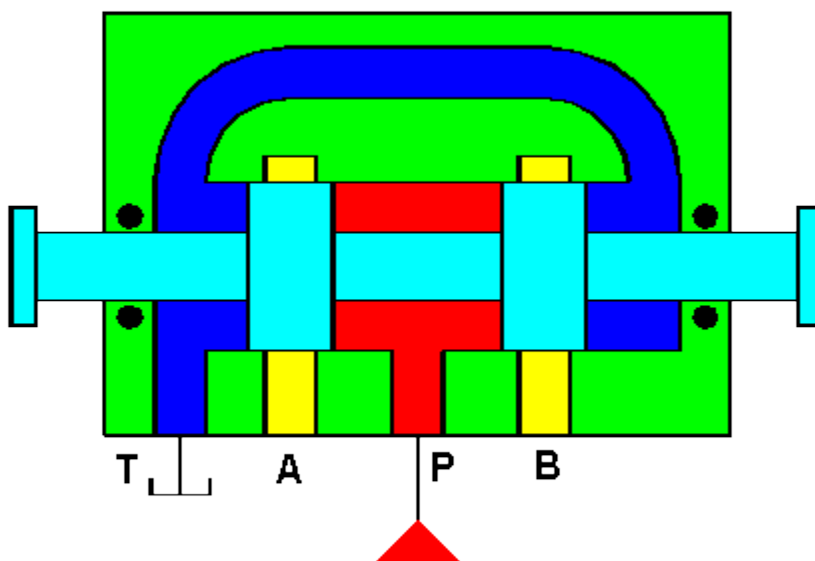
Dock Leveller

[View Animation / Source](#)



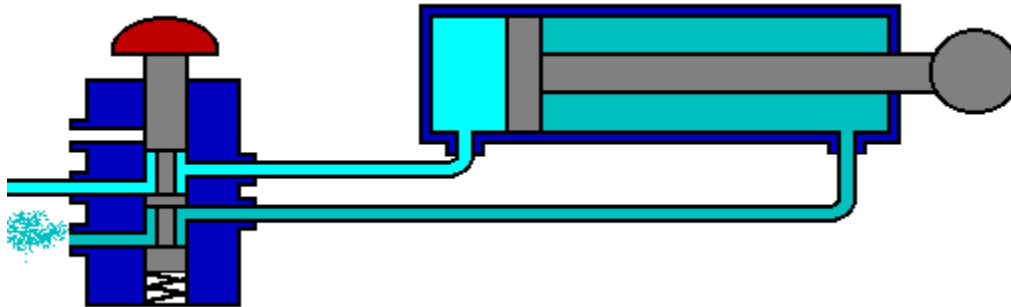
Directional Control Valve (DCV)

[View Animation / Source](#)



Single Acting Hydraulic Cylinder

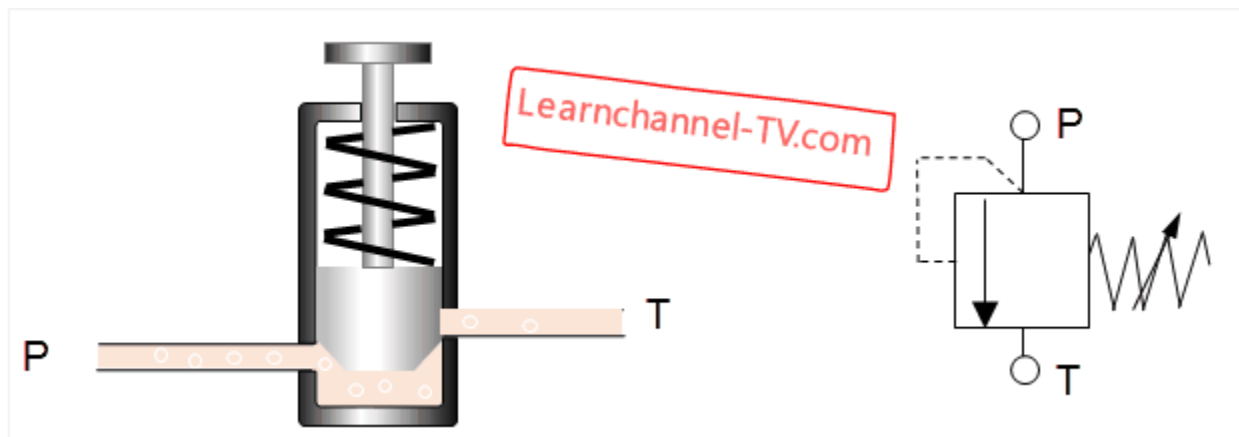
[View Animation / Source](#)



Pressure Relief Valve (PRV)

- *Function is similar to Flow Control Valve (FCV)*

[View Animation / Source](#)



Supplemental Details

Functional Requirements & Qualities

Flow Control Valve (FCV)

- Interactive knob
 - Clockwise and counterclockwise interactive rotation
 - Visual stopping point after certain amount rotation (Upper/Lower Bounds)

Pressure Relief Valve (PRV)

- *See Flow Control Valve (FCV)*

Hydraulic Power Unit (HPU)

- Interactive Pressure Relief Valve (PRV)
- Pressure Gauge (for Lab #2)
- Interactive power button
- Audible feedback from system interaction

4/3 Directional Control Valve (DCV)

- Handle that operates between three directions for user interaction
- User can view the changing directions (movement of schematic block)

Pressure Gauge

- True-to-life range of pressure gauge measurements
- Animated measurement dial to display **bar** values

Single Acting Cylinder

- Animation of cylinder movement for student observation
- Audible feedback (extension/retraction) for student observation

Flow Rate Meter

- True-to-life range of flow rate measurements
- Animation of flow rate changes