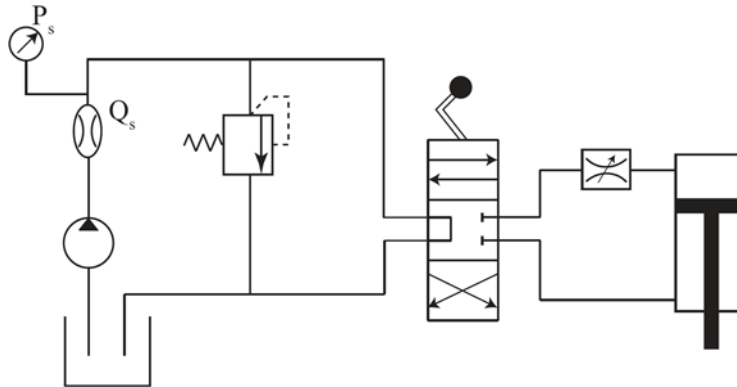


ME 4232: Fluid Power Control Lab
University of Minnesota
Prof. Perry Y. Li

Lab 8: Check valves & Pilot operated check valves

Objective

Check valves are one-way directional valves i.e., allow free-flow in one direction and block the flow in the other direction. They are used to prevent reverse flows and also to bypass components. Pilot operated check valves differ from regular check valves due to the fact that, in addition to the free-flow in one direction, they will allow reverse flow when the pressure signal to a third port is higher than a certain value. In this lab you will study the utility of both these valves and also characterize the pilot-operated check valve.



Actuator speed control circuit

Pre-lab – Due as a hardcopy at the beginning of lab

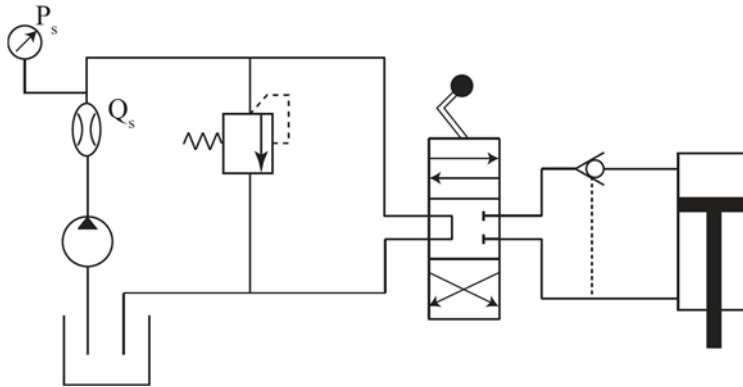
- **Analogy to electrical circuits** – Write a one-paragraph summary on how the hydraulic variables (pressure, flow and orifice area) can be qualitatively related to the electrical variables (voltage, current and resistance). Lab 3 (needle valves) will provide some useful insight into this. Also, draw and describe a basic voltage divider circuit from your electrical engineering course. Draw and describe how you could build a pressure divider circuit.

Procedure

Component bypass – In the circuit shown above, the needle valve is used to control the speed of the cylinder. Suppose that we are interested only in controlling the extension speed, and we would like to maximize the retraction speed. Where would you add “regular” check valves to the above circuit to achieve this goal?

Cylinder locking – Suppose that we only want the cylinder to extend and not to retract, discuss about the possible locations and orientations in which you can use a “regular” check valve? (*note that such a circuit would operate only once and is not of much practical use*). It is just used to illustrate the idea and motivate the next component.

- Perform experiments to validate your hypothesis for the **component bypass** and the **cylinder locking** cases. NOTE: Add a closed needle valve in parallel to your check valve to allow you to unlock the circuit for disassembly.
- Your TA will explain the operation of a Pilot-operated check valve.
- Hypothesize and verify the operation of the circuit shown in the next page.
- Based on the internal construction of a pilot operated check valve, what condition needs to be satisfied to ensure proper operation of the circuit?
- Design a circuit to obtain the pressure-ratio of the pilot operated check valve. (Hint : The “strange” question in the pre-lab was specifically intended for this)



Application using a pilot operated check valve

Report

Your report should include the following

- The various hypothesis and the conclusions obtained from the experiments that were prescribed to you.
- A detailed explanation of the operation of the second circuit (including the conditions that need to be satisfied to ensure proper operation).
- Detailed description of the experiment you designed to identify the pressure ratio of the pilot-operated check valve.
- Data from the above experiment and the results interpreted.