Pilot Operated Pressure Relief – pilot and drain ports

Fundamentals

Pilot operated pressure relief valves can be extremely versatile if we utilize the X (remote pilot) and/or Y (drain port) as part of a pilot circuit to control the overall valve setting.

The two main principles defining pressure in the hydraulic circuit are as follows:

1) Oil takes the path of least resistance (parallel resistances)
When we place a control or pilot relief valve in the X-port we are working on this principle. This means that the spring setting of the main relief will act as a maximum pressure limiter. If the pressure at the P-port rises higher that this main spring setting then the valve will open safely relieving any overpressure to the tank. Therefore the pilot operated pressure relief valve will have a pressure setting equal to either the pressure at the X (remote pilot) port **or** the pressure which is set via the pilot operated relief valves adjustment spring.

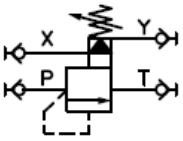
2) Resistances in series are additive or accumulative (series resistances)
Any back pressure in the Y (drain) port will add to the overall pressure setting of the pilot operated relief valve. This means that any pressure in the Y (drain) port will **add** to the pressure which is set via the pilot operated relief valves adjustment spring.

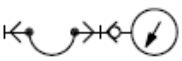
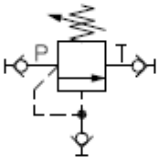
Description of exercise

In this experiment we will observe the effect of pressure being present at the X (remote pilot) port and the Y (drain) port of a pilot operated pressure relief valve.

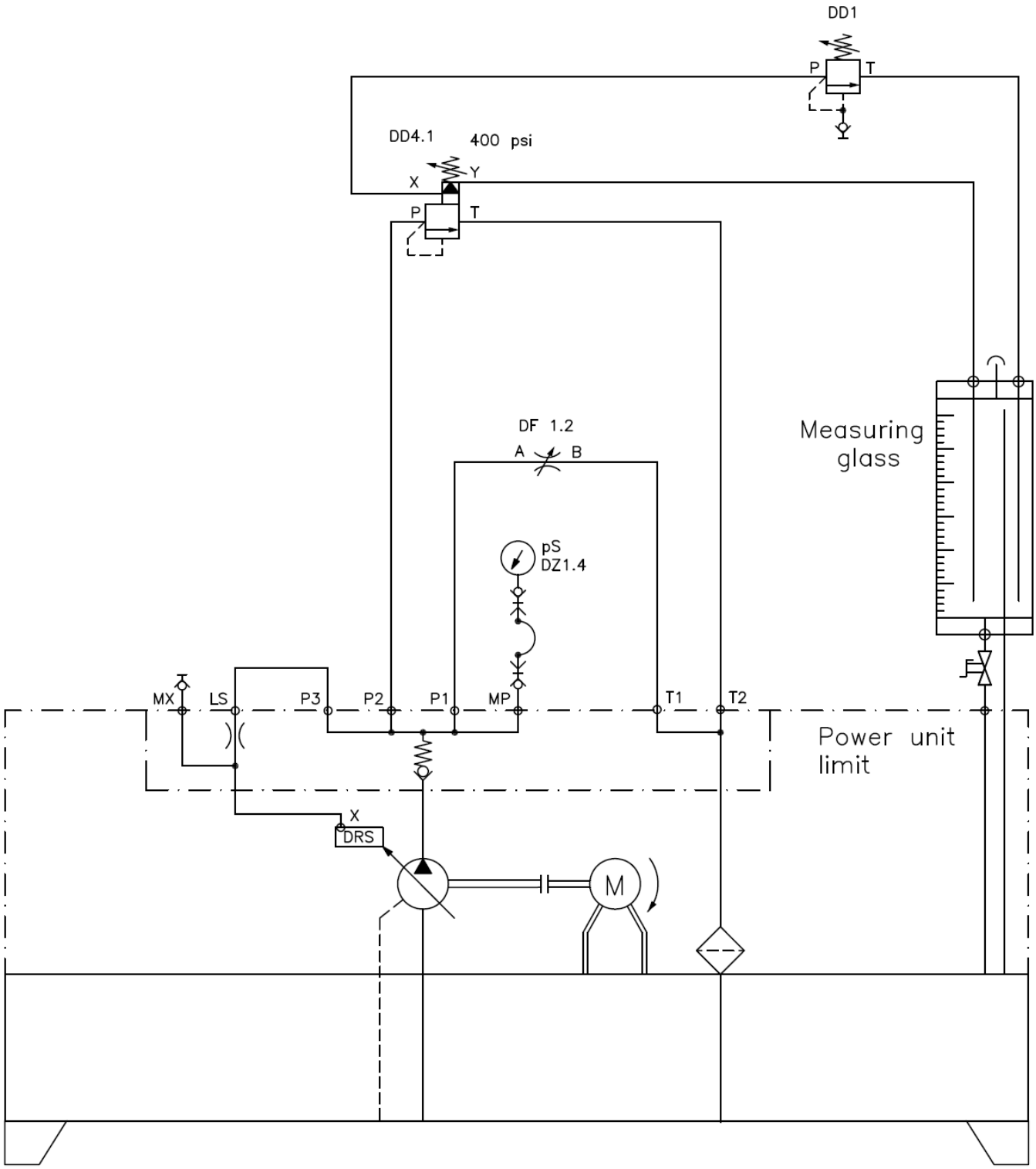
Components:

You will require the following components

	Hose assembly	
1X	Throttle valve DF1.2	
1X	Pilot operated pressure relief DD4.1	

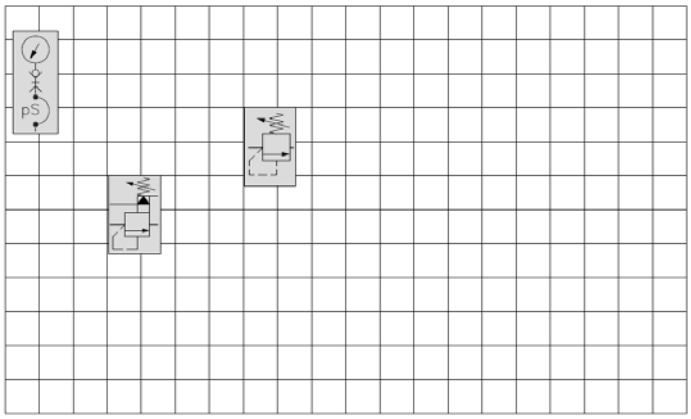
1X	Pressure gauge DZ1.4	
1X	Pressure relief valve DD1.1	

Part I – X-port control - Parallel resistances



Before beginning the experiment read the **Rules for hydraulic trainer operation** sheet.

Setting up the experiment
Set up the circuit observing the following points:
1. Make sure the pump is switched off and the hydraulic circuit is not pressurized.
2. Mount the required components on the grid and lock them
3. Connect the separate units with pressure hoses according to the connection diagram. Take care that the connection hoses are not kinked or under undue stress.



Experimental procedure
Steps in the experimental procedure:
1. Has your instructor checked the constructed circuit?
2. Check again that all connection hoses are firmly coupled. (pull/turn to test)
3. Back out the setting of the pilot operated relief valve DD4.1 completely (CCW)
4. Adjust the direct operated relief valve to maximum pressure setting (fully CW)
5. Open the shut-off valve on the measuring glass to allow it to drain to tank.
6. Ensure the red E-STOP button is not engaged on either of the starters. (rotate the button to reset)
7. Switch on the pump via the green START push button

Experiment part I
X-port control - Parallel resistances

a) With the throttle valve DF2.1 completely closed (CW) adjust the setting of pilot operated pressure relief valve DD4.1 to 400 psi. This pressure can be read on gauge pS.
b) Adjust direct operated pressure relief valve DD1.1 and record the range of adjustability which is available.

Minimum pressure at pS = 210 psi

Maximum pressure at pS = 400 psi

Do not change these pressure setting of pilot operated valve DD4.1

Experiment part II
Y-port control - Series resistances

Shut off the pump and change the circuit to match the schematic diagram on the following page

a) Re-start the pump
b) Adjust direct operated pressure relief valve DD1.1 and record the range of adjustability which is available.

Minimum pressure at pS = 420 psi

Maximum pressure at pS = 725 psi

Part II – Y-port control - Series resistances

Conclusions

1. Series resistances in a hydraulic circuit are additive

2. When resistances in a hydraulic circuit are in parallel oil will take the path of least resistance.

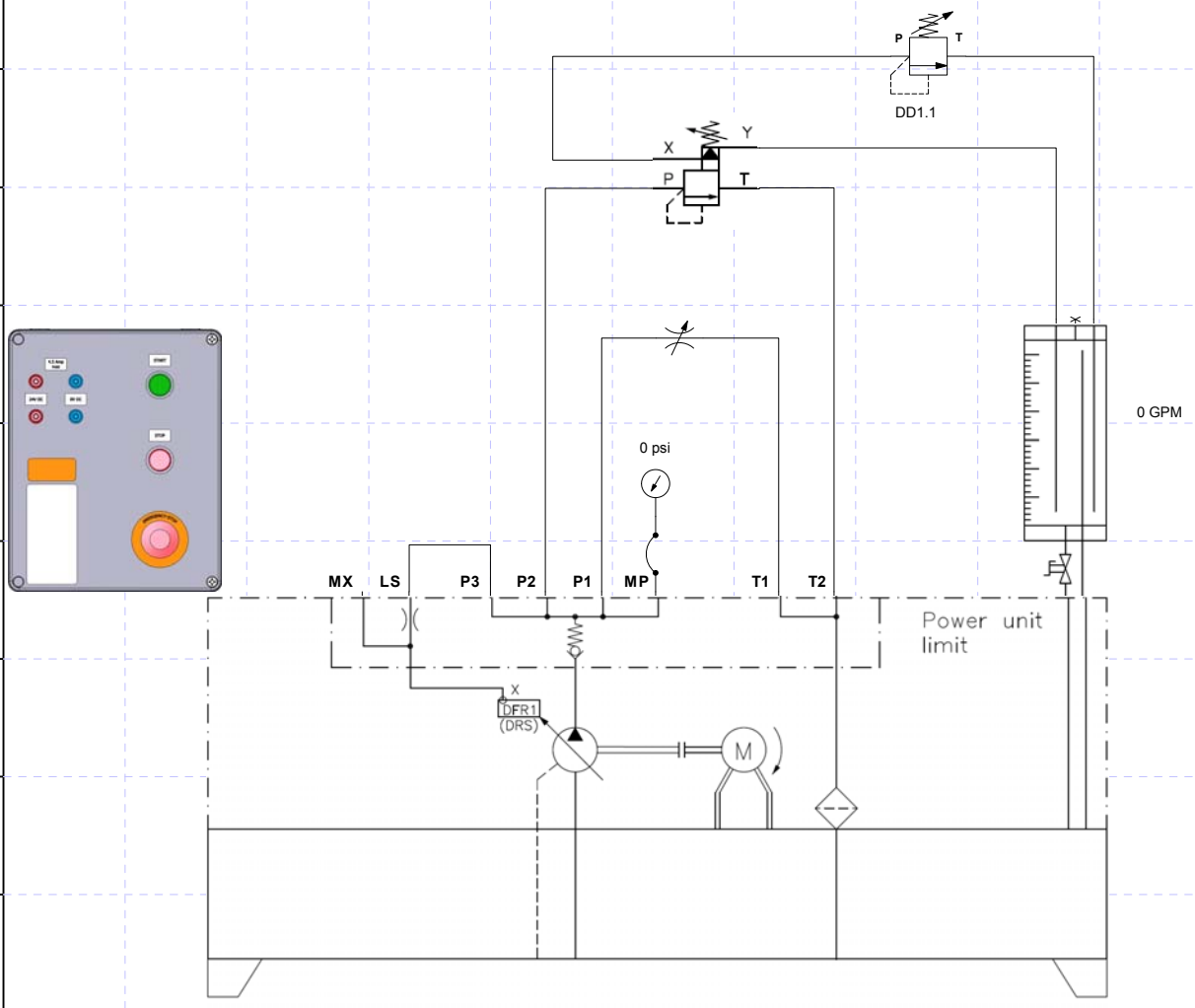
4. Explain what you observed with regards to the achievable pressures in part I vs. part II of the lab experiment.
   In part I we were able to use the remote relief to set the system pressure at a level lower than the setting of the main pressure relief valve. In part II we were able to use the remote relief to set the system pressure at a level only higher than the setting of the main pressure relief valve.

5. The hydraulic trainer has a pressure compensated pump which limits the working pressure to 725 psi. What do you think the maximum achievable pressure would be if the supply was via a gear pump with no other system relief valve?
   -In part I
   The maximum achievable pressure would have been 400 psi

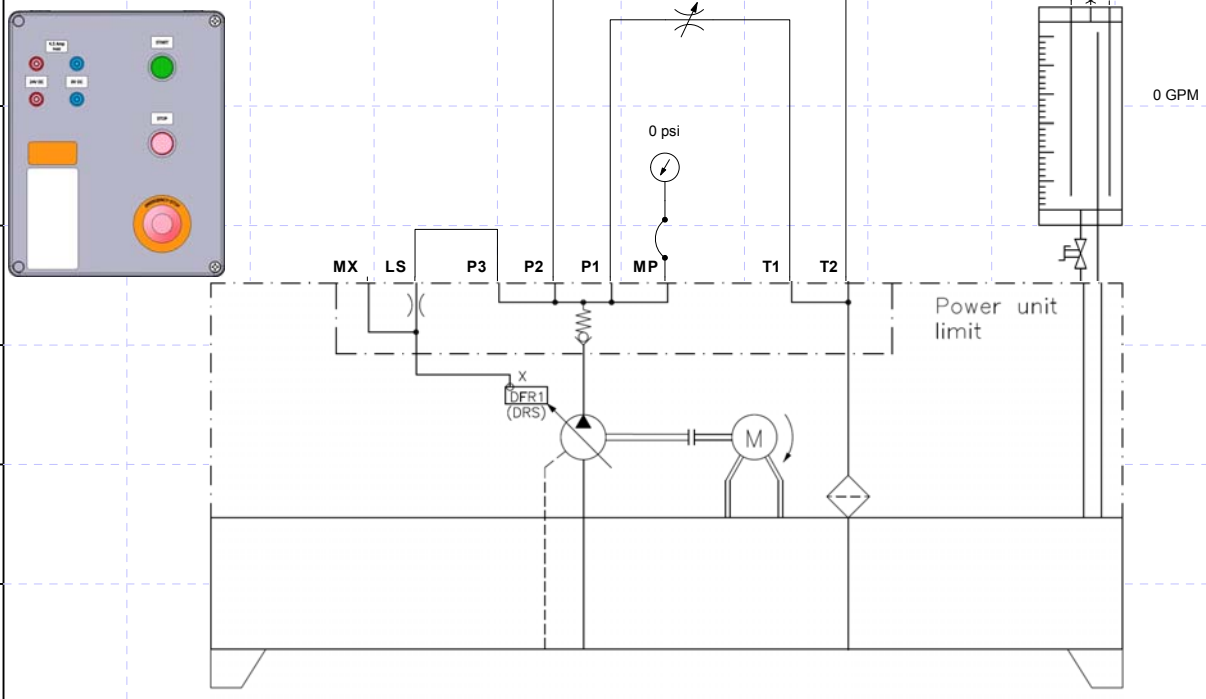
   -In part II
   The maximum pressure would have been based on the maximum pressure setting of the remote relief valve plus 400 psi.

6. Do you think that there is any advantage of utilizing the X (remote pilot) port for controlling the max system pressure vs. utilizing the Y (drain) port? Why?

When using the remote pilot port the spring setting of the main relief can be used to protect the system by limiting the maximum system pressure. No matter what happens with the pilot valve the main valve will always be a safety.



Pilot Operated Relief - X-port control



Pilot Operated Relief - Y-port control