Lab Experiment

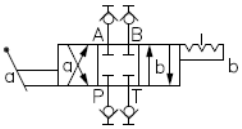
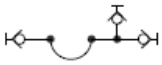
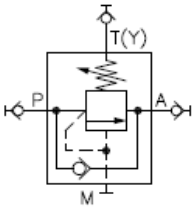
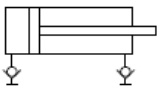
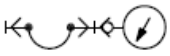
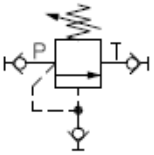
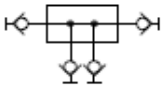
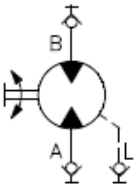
Sequence Circuit

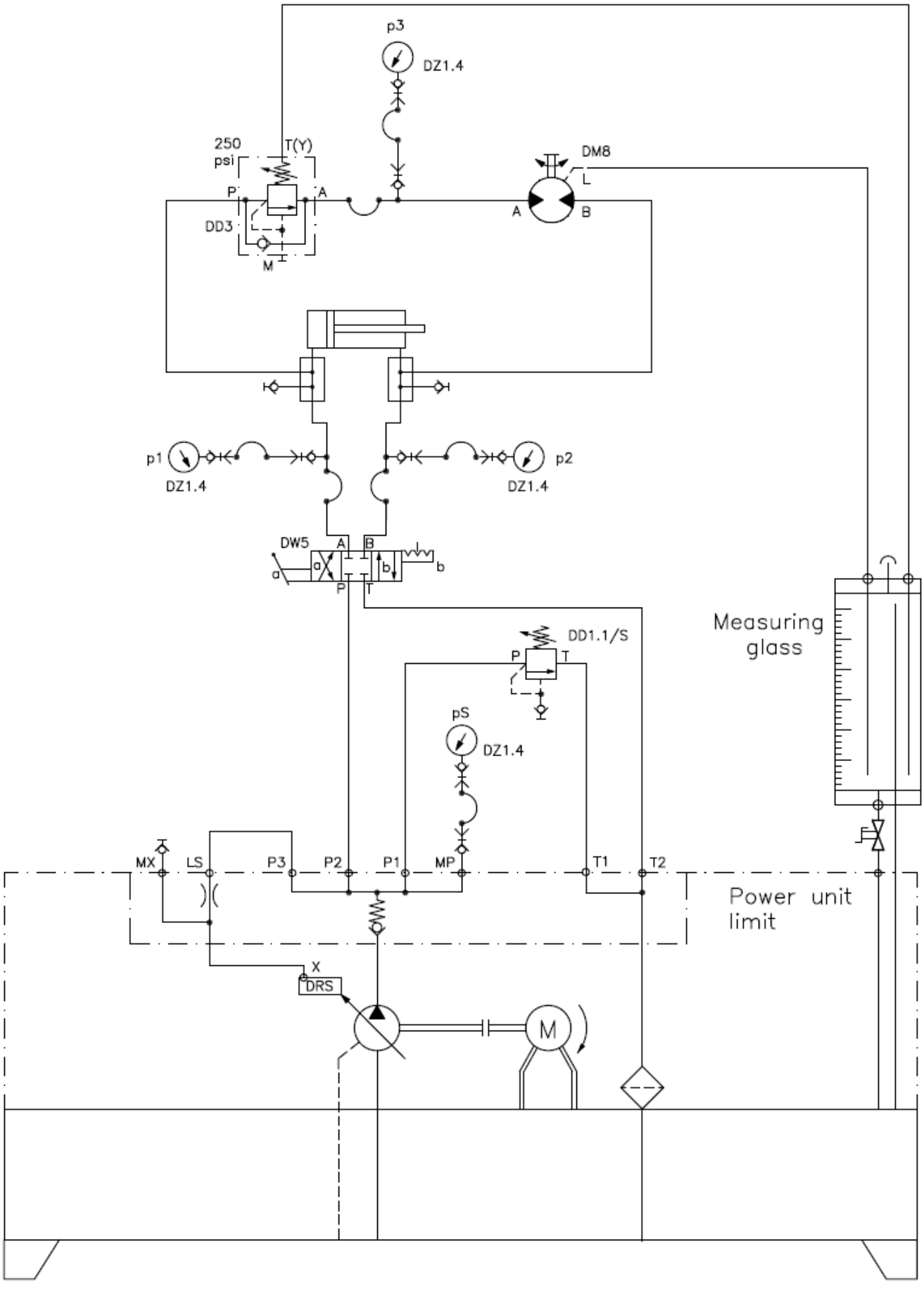
Fundamentals
Sequence valves fall into the family of normally closed pressure valves however to think of them as a pressure control is misleading. The typical function of a sequence valve is to isolate one portion of a circuit until a certain pressure has been reached and therefore it actually works more like a pressure activated switch or directional control valve.

Objective
To understand the application and operation of a sequence valve in a hydraulic sequencing circuit. To learn how to set the valve based on information given in the hydraulic schematic.

Description of exercise
In this experiment you will construct a circuit which will allow two operations to happen sequentially. Referring to the schematic on the following page it can be seen that one directional control valve (DW5) supplies both a hydraulic cylinder and a hydraulic motor. The sequence valve (DD3) in the line supplying the motor prevents oil from travelling in this direction until the cylinder has extended and the pressure builds to 250 psi.

Components:
You will require the following components:

	Hose assembly	
1x	Directional control valve DW5	
2X	Pressure hose c/w gauge connection	
1X	Pressure sequence valve DD3	
1X	Hydraulic cylinder ZY1	
4x	Pressure gauge DZ1.4	
1X	Pressure relief valve DD1.1	
2X	Connection piece DZ4.2	
1X	Hydraulic Motor DM8	

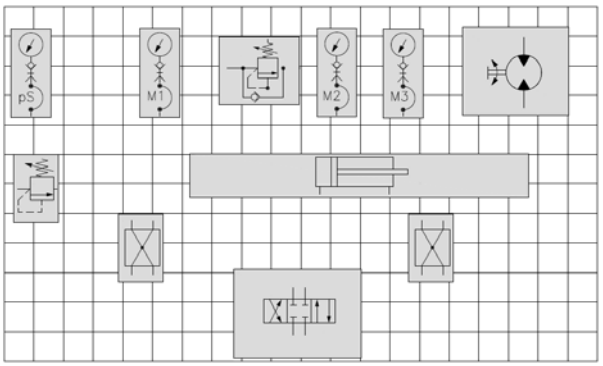

p3
DZ1.4
250
psi
T(Y)
P
A
DD3
M
DM8
L
A
B
p1
DZ1.4
p2
DZ1.4
DW5
A
B
a
b
b
P
T
DD1.1/S
P
T
pS
DZ1.4
Measuring
glass
MX
LS
P3
P2
P1
MP
T1
T2
Power unit
limit
X
DRS
M

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. Directional control valve DW5 should be in its centre condition
4. Back out the setting (CCW) of pressure relief valve DD1.1 until a setting of zero. This will ensure that there is minimum pressure at the pump outlet.
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

Setting the sequence valve

a) Turn the adjustment of the pressure sequence valve DD3 clockwise to the maximum pressure setting
   Caution: Do not force the adjustment screw as it may have a tendency to stick
b) Adjust the pump supply pressure to 250 psi via relief valve DD1.1. This can be read at gauge pS
c) Shift the 4/3-directional valve DW5 to extend the cylinder.
d) Set the cracking pressure of the sequence valve DD3 to 250 psi. The valve is set properly when pressure begins to rise at gauge p3 and/or the motor first indicates rotation.
e) Retract the cylinder and centre the directional control valve
f) Adjust the pump supply pressure until 500 psi is seen as pS via pressure relief valve DD1.1

8. Shift the 4/3-directional control valve in order to extend the cylinder.
9. While the cylinder is extending measure and record in the table the pressures at p1, p2 and p3
10. Once the cylinder has extended and while the motor is turning measure and record in the table the pressures at p1, p2 and p3
11. Retract the cylinder and while it is retracting measure and record in the table the pressures at p1, p2 and p3

12. Once the cylinder has retracted and with the directional valve still shifted measure and record in the table the pressures at p1, p2 and p3
13. With the directional control valve in its centre condition (setting 0) adjust the system pressure to 700 psi with pressure relief valve DD1.1
14. Repeat steps 8 to 12 with this new system pressure setting.

Evaluation

Operation	System pressure	Gauge pressure		
		p1	p2	p3
Cylinder extending	500	100 psi	50 psi	100 psi
	700	100 psi	50 psi	100 psi
Motor turning	500	340 psi	50 psi	220 psi
	700	340 psi	50 psi	220 psi
Cylinder retracting	500	100 psi	300 psi	200 psi
	700	100 psi	300 psi	200 psi
Cylinder retracted	500	50 psi	320 psi	200 psi
	700	50 psi	320 psi	200 psi

What is preventing the motor from turning while the cylinder is extending?
The sequence valve is closed and blocking the flow to the motor
What pressure must exist at the cylinder cap end before the motor begins to turn?
250 psi
With the motor turning what was the highest pressure that could be seem at the cap end of the cylinder? Why was this higher than the cracking pressure of the sequence valve?
340 psi
250 was the cracking pressure. 340 is the full flow pressure (pressure override of the valve)

What do you think would be the maximum pressure which would be available to turn the hydraulic motor at system pressure settings of 500 psi and 700 psi? Select one of the following.

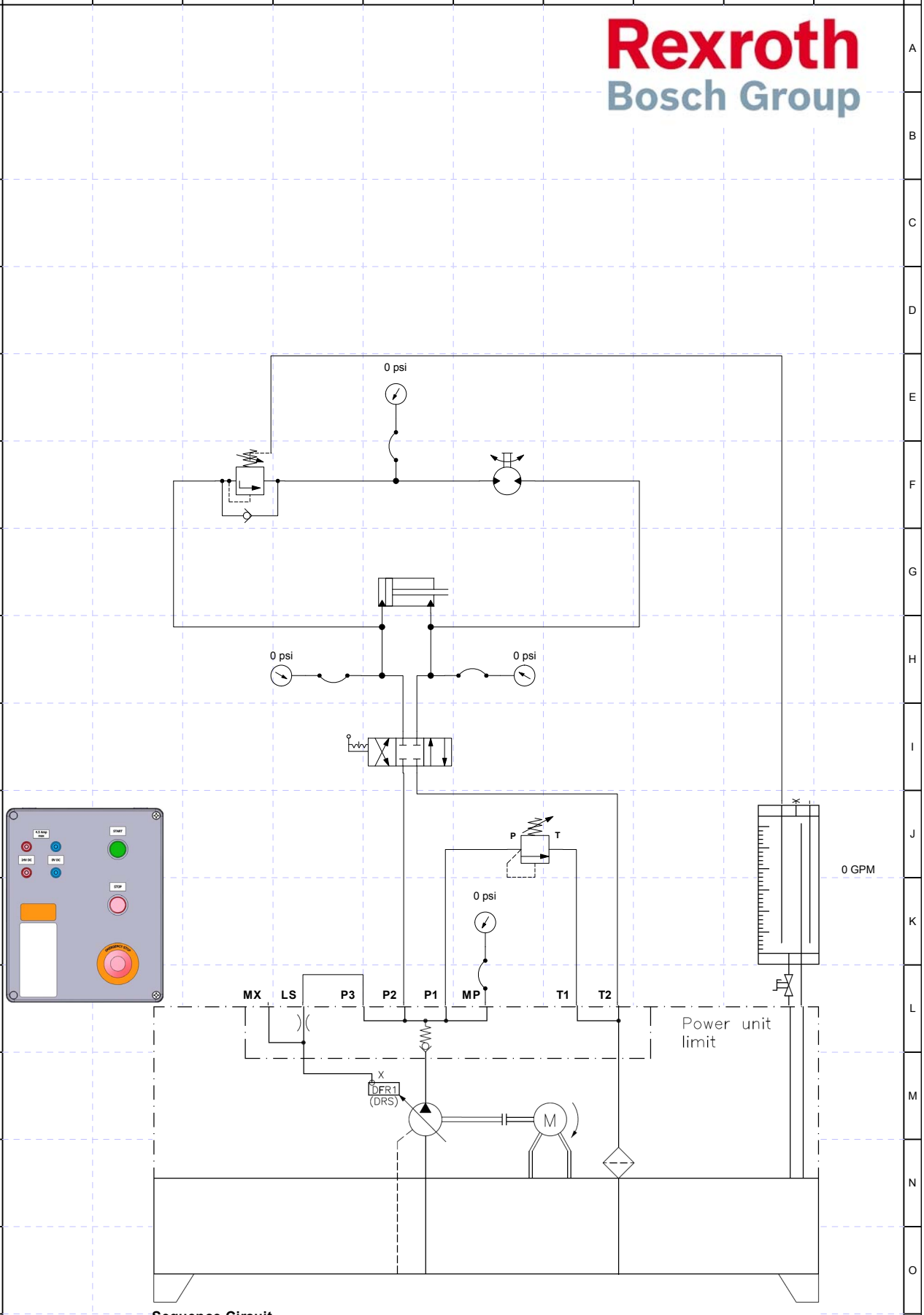
a) 250 psi, 450 psi

b) 50 psi, 450 psi

c) 500 psi, 700 psi

d) 250 psi, 700 psi

Why were the pressures you recorded nearly the same for both the 500 psi and the 700 psi system pressure setting?
The resistances and therefore the pressures were the same in both circuits. We never reached system pressure
Explain why the motor turns faster once the cylinder has fully retracted.
The cylinder is no longer consuming any of the pump flow therefore full pump flow to the motor



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