Regenerative Circuit

Description of experiment

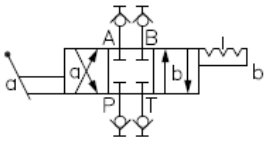
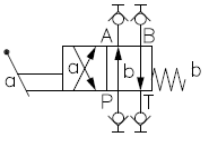
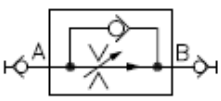
A regenerative circuit is used to gain extension speed when using a differential or single rodded cylinder. In a conventional circuit, the oil that is being discharged from the rod end of the cylinder on extension is typically directed back to the reservoir and the speed of the cylinder in extension is therefore determined by the flow rate being supplied from the oil source. In a regenerative circuit the oil from the rod side of the cylinder is directed back into the cap end side of the cylinder in order to provide additional flow to aid in faster extension. The advantage is that the cylinder extends faster in regenerative mode than with a conventional circuit. The disadvantage is that while we gain speed we ultimately sacrifice output force since there is now pressure on both sides of the piston.

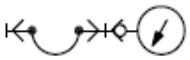
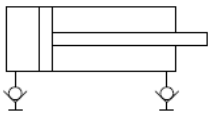
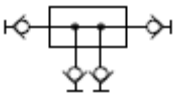
Description of exercise

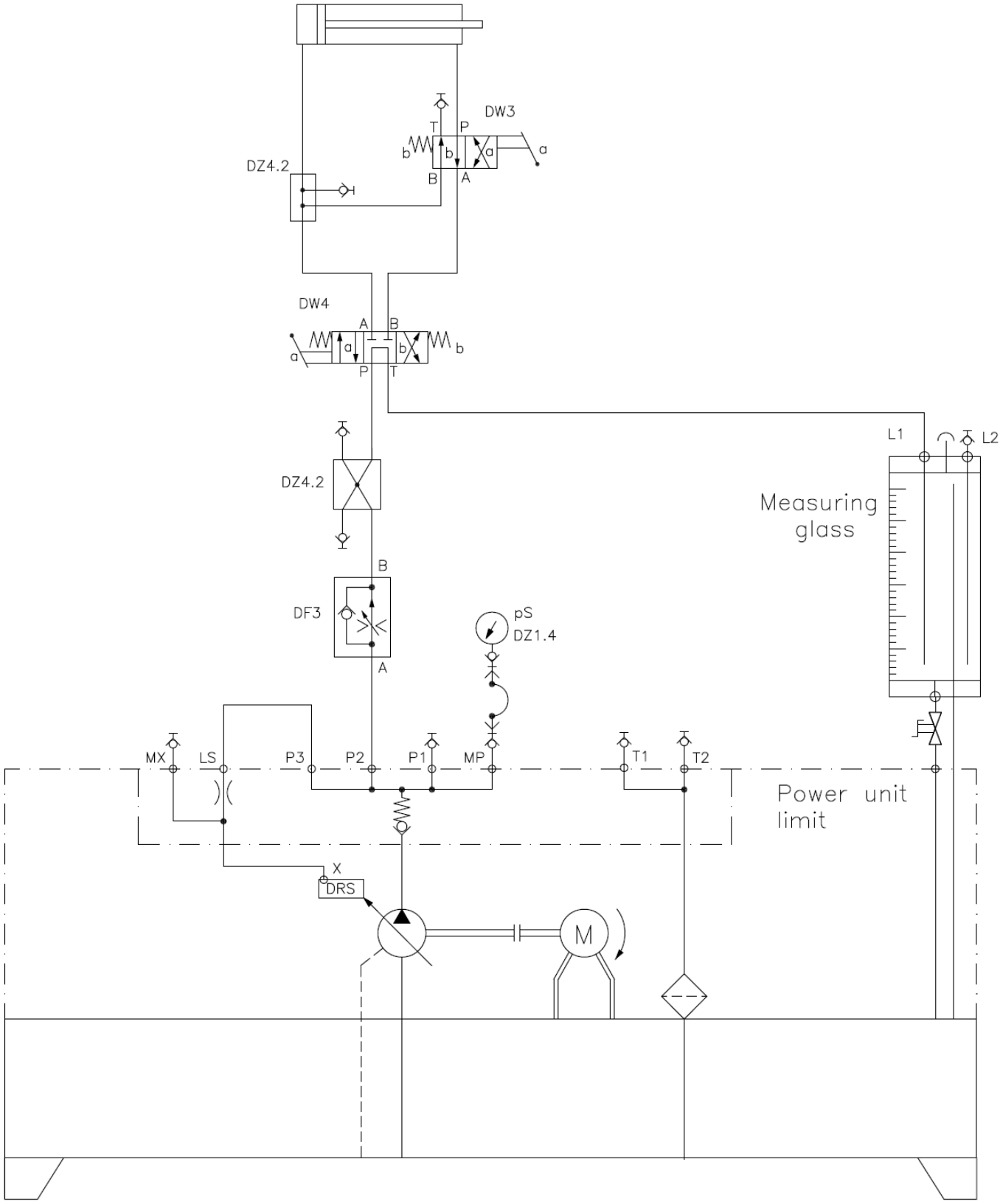
In order to obtain the advantages of regeneration without losing the possibility of high force we can make a two speed regenerative circuit. The circuit on the following page has a 4/2-directional control valve DW3 (‘regen’ valve) installed in the line from the rod end side of the cylinder. By changing the condition of this valve we can select either conventional mode or ‘regen’ mode. In conventional mode where valve DW3 is in the normal ‘b’ position the rod end oil returns directly to 4/3-directional valve DW4 and ultimately to the tank. By shifting DW3 we make a regenerative circuit and the oil exhausting from the rod side of the cylinder is routed directly into the cap end side of the cylinder via connection piece DZ4.2. Because of this, the oil being supplied from the pump and the oil from the rod end side of the cylinder combine to give us a higher travel speed. The ‘regen’ directional control valve DW3 must be in its normal position ‘b’ in order to retract the cylinder again.
Complete the circuit on the following page so that two different travel velocities are possible in the extension direction via the 4/3-directional control valve DW4.

Components:

You will require the following components:

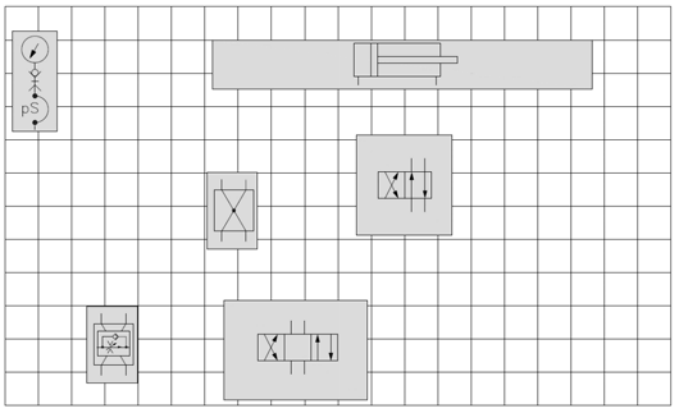
	Hose assembly	
1x	Directional control valve DW5	
1X	Directional control valve DW3	
1X	Flow control c/w bypass check DF3	

1x	Pressure gauge DZ1.4	
1X	Hydraulic cylinder	
1X	Connection piece DZ4.2	


DW3
T
P
b
a
B
A
DZ4.2
DW4
A
B
a
b
P
T
DZ4.2
B
DF3
A
pS
DZ1.4
L1
L2
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. Close the flow control valve DF3 completely
4. Open the shut-off valve on the measuring glass to allow it to drain to tank.
5. Ensure the red E-STOP button is not engaged on either of the starters. (rotate the button to reset)
6. Switch on the pump via the green START push button

Experiment
a) Shift the 4/3-directional control valve DW4 to position ‘a’ and open the flow control valve to obtain cylinder extension.
b) Adjust the flow control until it takes 4 seconds to completely extend the cylinder.
c) Retract the cylinder completely
d) While retracted shift the 4/2-directional control valve DW3 to position ‘a’.
e) While holding valve DW3 shifted, shift directional valve DW4 again to extend the cylinder and record the time to extend.
f) Record the time as well as the flow to the measuring glass in the following table.

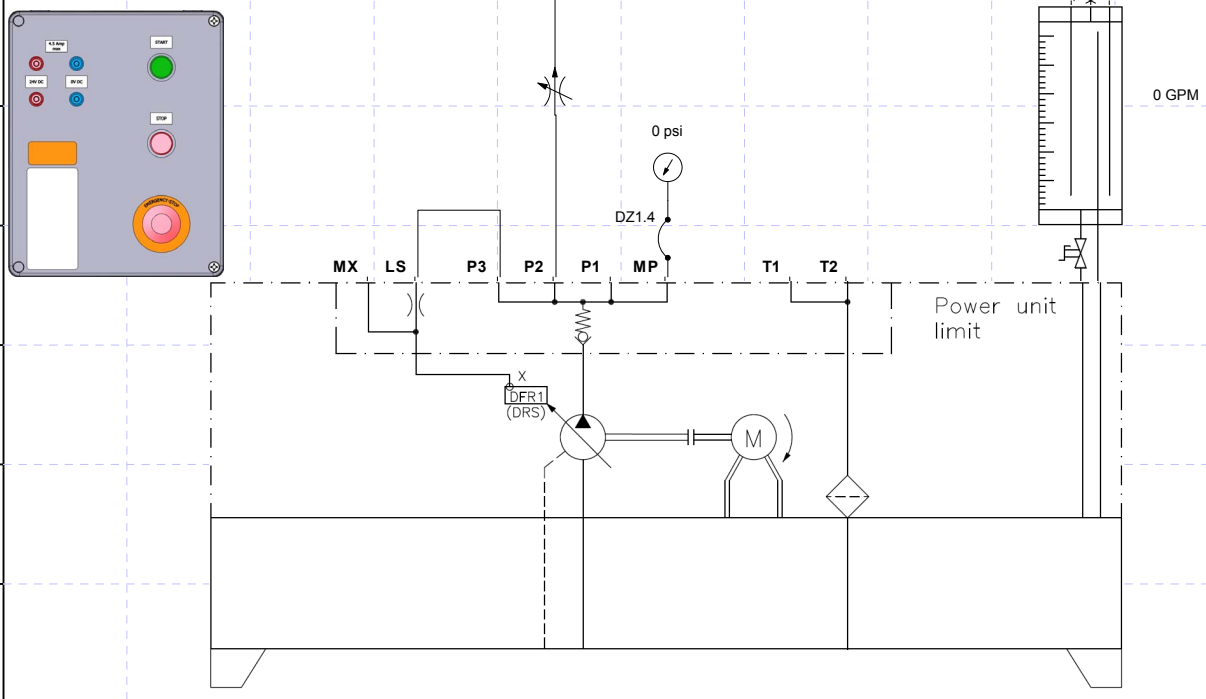
	Time (sec)	Flow at measuring glass? (yes/no)	Position of valve DW3
Non-regenerative	4	yes	b
Regenerative	1.81	no	a

Conclusions

1. Would a log splitter be a good application for a two speed regen. circuit? Why?
   Yes.
   There are two distinct parts to the cycle
   1) Low force approach = regen to save time
   2) Hi force when splitting = non-regen

2. Why is there a cost saving when a regenerative feature is added to a multiple speed circuit?
   You can achieve higher speeds without supplying additional flow (smaller pump)

3. What is one factor which must be considered whenever a regenerative circuit is designed?
   You gain speed but you sacrifice output force.



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