

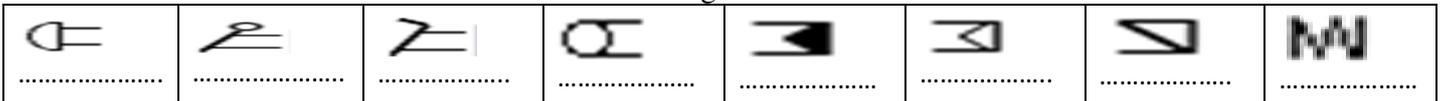
**Self-Study Sheet-5 Part-2, on Chapter-6: Directional Control Valves**

1-What is the function of directional valves? What are the differences bet. types of spool, sliding plate, and the rotary plate Directional Valves? Why can spool valves not be used for locking the circuit Actuators?

**2- Select True (√) or False (x) for each statement:**

#	True	False	statement
1			The function of directional control valves is to start, stop and change direction of the fluid through a hydraulic circuit
2			The type of the directional control valve does not designate the type of hydraulic circuit either open or closed one.
3			Directional control valves may be designed as rotary or poppet style. The spool type is not the most common.
4			Spool type consists of a body with internal passages connected or sealed by sliding spool along the lands of the valve
5			Directional control valves are not sealed along the clearance between the moving spool, the land and the housing.
6			Degree of sealing in directional control valves does not depend on clearance, viscosity of the fluid and the pressure.
7			Due to an internal slight leakage, the spool type directional control valves can alone hydraulically lock the actuator.
8			Poppet directional control valves have seating elements in the form of balls, poppet or plates.
9			Advantages of the poppet design of directional control valves are zero leakage and no sticking under high pressure.
10			Directional control valve is designated by number of possible positions, port connections or ways& actuation method
11			Directional control valves include three-position type or two-position type or one-position type
12			The spool type directional control valves in industrial applications are sub-plate or manifold mounted
13			Sizing of directional control valves is not according to flow capacity which is critical to proper function of the valve.
14			Flow capacity of directional control valves depends on port sizes and pressure drop across the valve
15			Direct acting directional control valves may be either manual or electrical-solenoid actuated to shift the spool.
16			The pilot directional control valves are actuated hydraulically to shift the main valve by a small direct acting valve
17			Pilot directional control valves do not require external pressure flow/signal to the pilot valve from an external source.
18			One advantage of external piloting is having constant pressure supply regardless of other influences in main system
19			One advantage of external piloting is that pilot oil source may be filtered separately to prevent silting of pilot valve.
20			Pilot directional control valves can not use external or internal drain of the pilot valve
21			Pressure surges in tank port may take place if pilot directional control valve is drained internally
22			External drain of pilot directional control valves have to be used to avoid pressure surges in the tank port and the bad or side-effects on the unloaded side of main spool, as well as the pilot valve.

3-Write the name of each method for actuation or shifting the directional control valves as shown below:



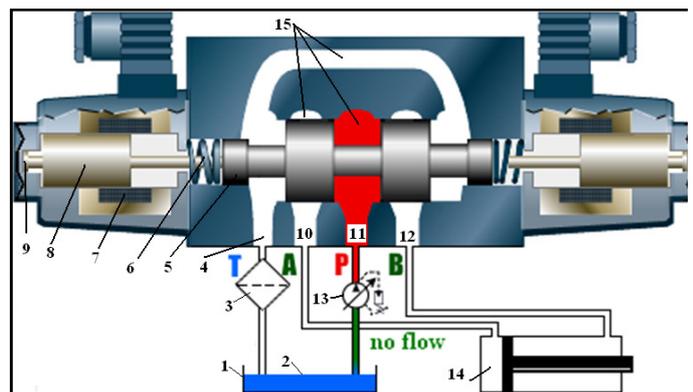
4-Write the name or type, number of possible positions, number of ports, normally open or close and the actuation method for each valve shown below.

Valve	Valve designation name	# of positions	of ports	ormally open or closed	actuation method

5- Write name of each part of direct acting directional control valve shown on fig. You may select from list below:

Double acting cylinder, valve internal passages, Vented open oil tank, Valve body, Tank port, Valve Main spool, 2<sup>nd</sup> Load port B, solenoid or magnetic coil, small clearance between valve and spool, Pump port, 1<sup>st</sup> Load port A, Internal sealing, hydraulic oil, filter or strainer, return spring, armature plunger, mechanical stop, variable flow pump,

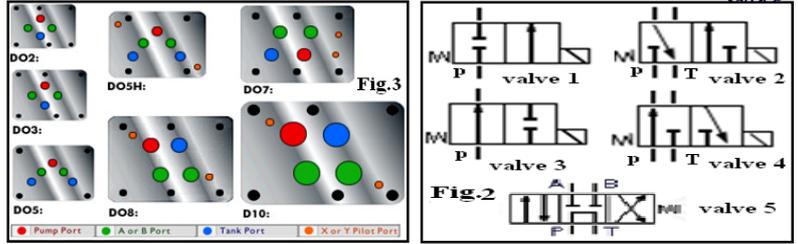
#	Part name								
1		2		3		4		5	
6		7		8		9		10	
11		12		13		14		15	



6-State function & description for each valve on Fig.2 (to include actuation method).

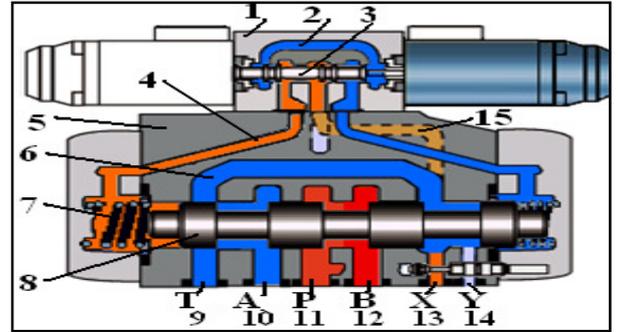
7-On each valve on Fig.3, write down valve size sub-plate or industry standard porting pattern.

8- Write name of each part of pilot operated directional control valve shown on next fig.



You may select from list below:

Main valve internal passages, main valve body, Tank port, Valve Main spool, 2<sup>nd</sup> Load port B, Pump port, 1<sup>st</sup> Load port A, main valve return spring, body of pilot valve, pilot valve internal passages, spool of pilot valve, internal pilot line, external pilot pressure port X, external drain port Y, internal drain passage in main valve



#	Part name								
1		2		3		4		5	
6		7		8		9		10	
11		12		13		14		15	

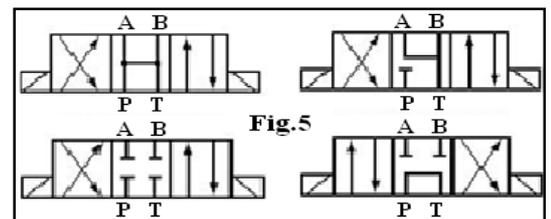
9- Select True (√) or False (x) for each statement:

#	True	False	statement
1			Single and double solenoid control valves are not available with DC or AC solenoids both equipped with manual overrides that allow the spool to be shifted by hand.
2			Pilot operated directional control valves must have provision to drain the pilot oil at the opposite end of the spool in order for the valve spool to shift.
3			Blocking drain or "Y" port of externally drained pilot directional control valve will not prevent spool from shifting.
4			Spool" type directional control valves have small leakage from the spool cause cylinder to drift under load/pressure
5			To prevent a cylinder to drift under load/pressure due to internal spool leakage, the hydraulic circuit must have a pilot operated check valve in conjunction with a float center spool type directional control valve
6			Hydraulic circuits are classified as open center or closed center based on the type of directional control valve used.
7			Open center circuits route pump flow back to tank through directional control valve during neutral or dwell time.
8			Open center circuits use a fixed volume pump type, such as a gear pump.
9			Closed center circuit blocks pump flow at directional control valve if it is in neutral or centered.
10			Closed center circuit must use pressure compensated pump, as piston pump, to be de-stroked at over-pressure.
11			Closed center circuit with fixed volume pump type must use unloading circuit to prevent over-pressurization.
12			Closed center system maintains constant flow, but no pressure when the directional control valve is centered.
13			Type of pump(fixed vs. pressure compensated) designates whether we have an open or closed center system.
14			In an open center system, flow passes through valve center and back to tank at low pressure when valve is centered

10-Describe the limits and compare between **Direct Acting** versus **Pilot Operations** of directional valves.

11- On Fig.4, name the valve type and name all the shown parts. State and Sketch the symbol used for this valve.

12- State the type and description for the valves on Fig.5 (include central/neutral valve position).



13- Discuss and Compare between open circuit of hydraulic motor without and with using four ways, two-positions directional valve. Show advantages & disadvantages of each circuit. Show the circuit to be used to get variable motor speeds for different operation conditions?

14-Discuss & describe **an open circuit** with hydraulic motor & 4-ways, 3-positions directional valve. Show advantages & disadvantages of this open circuit. Show how can the motor be locked for both directions?

15- Discuss & describe **a closed circuit** with a bidirectional hydraulic motor without using valves. Show advantages & disadvantages of this circuit.

16- Discuss & describe **a closed** with a bidirectional hydraulic motor and with using pressure control valves. Show advantages & disadvantages of this closed circuit. Show how can the motor be locked for both directions?

\*\*\*\*\* End of directional control valves \*\*\*\*\*