5. Identify various components one by one referring general layout of Pneumatic system.
6. Connect components as per general layout and run the system.
7. Write specification and function of each component.
8. Draw ISO symbol of identified component.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Hydraulic trainer		Actual working components	1	
2.	Pneumatic trainer		Actual working components	1	
3.	Models of pumps		Working / Actual	1	
4.	Reciprocating compressor		Pressure 0-10 bar	1	

XIII Actual Procedure Followed

1] Identify various components one by one referring general layout of Pneumatic or hydraulic system.
2] Connect components as per general layout & run the system.
3] write specification & function of each component.
4] Draw ISO symbol of identified component.

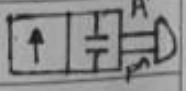
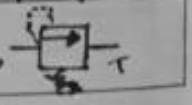
XIV Precautions Followed

1] Avoid improper/loose connections of components.
2] Do not forcefully connect to connectors to avoid the damage.

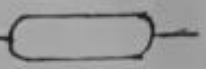
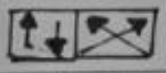
XV Observations and Calculations

1. Hydraulic Trainer

S N	Component Name	Specification	Function	ISO Symbol
1	Pump	External gear Pump Pressure range: 10 bar Flow: Radial PM	Increase pressure of oil.	
2	Motor	Hydraulic	To drive the pump	
3	Filter	Partial Air Filter	Remove impurities from oil.	
4	Reservior	10000ml capacity (10 lit)	store hydraulic Fluid (oil)	

5	Check Valve (N.R.V.)	Non-return type	Allow single directional flow of oil.	
6	Direction control valve	2|2; Push button	control movement of actuator.	
7	Double acting cylinder	operating stroke & Return stroke	Actuator	
8	Pressure relief valve (P.R.V.)	Set pressure = 36 Kg/cm²	removes excess Pressure	

2. Pneumatic Trainer

S N	Component Name	Specification	Function	ISO Symbol
1	Compressor	Make: Pressure range: 15 Drive: variable speed	Compress the air to the desired pressure.	
2	Motor	Pneumatic	to drive the compressor	
3	Air tank	Capacity = 30 lit	Stores compressed air.	
4	Filter	Non-partial Air Filter.	Remove impurities from air	
5	Cooler	Blower type Model-BS-APROS	Reduce temp. of heated air.	
6	Directional control valve	4|2; Push button	Controls direction of air flow.	
7	Single acting cylinder	Single acting	works as an actuator.	
8	Flow control valve	Non-variable	control the flow of compressed air.	

XVI Results

The observed component in hydraulic & pneumatic trainer kit were checked & thier respective functions were written along with their respective Iso symbols.

XVII Interpretation of Results

The ISO symbols (basic) were nearly same for both the pneumatic trainer & the hydraulic trainer parts/components.

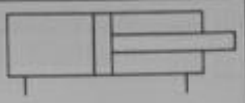
XVIII Conclusions

Hence, the components of hydraulic & Pneumatic trainer were noted (observed) & the ISO Symbols of the components were drawn along with their functions.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. Identify the given symbols and name the components.

Symbol	Name of Component	Symbol	Name of Component
	Compressor		Double acting Cylinder.

2. Identify load application system on UTM available in Strength of Material laboratory.
3. Identify components of hydraulic tractor trolley lifting mechanism.

[Space for Answer]

2] UTM :- A machine used to test specimens for tensile strength, compressive strength, shear strength & to perform bend test along other important laboratory tests. The primary use of the testing machine is to create the stress strain diagram. Once the diagram is generated, a pencil & straight edge or computer algorithm can be used to calculate yield strength, Young's modulus, tensile strength or total elongation.

Applications :-

UTM can be used & applied to perform tests on the following example:

1] Rope 2] steel rope 3] Winches 4] steel wire 5] Electrical wire 6] Webbing 7] Spring 8] Slings 9] Cable 10] Nylon rope 11] Links 12] chain.

3] The components of hydraulic tractor trolley lifting mechanisms are :

1] Reservior 2] Pump 3] check valve 4] Main cylinder 5] Ram piston 6] Release valve 7] Warm & worm gear 8] Moving Frame 9] Trolley 10] Scissor jack 11] 12 V battery which is continuously charged. 12] D.C motor 13] 2 stroke engine. 14] Silencer 15] wheel arrangement. 16] Bearing 17] Bearing housing 18] Rear axle 19] Front axle 20] Pivot bush 21] Hinge bush

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	**Hydraulic trainer**	Transparent /actual working components. 1. Gear or Vane pump with electric motor 2. Pressure relief valve 3. Pressure gauges 4. Flow control valve with check valve 5.Pressure reducing Valve 6. Sequence valve 7. Set of D.C.Valves 8. Actuators 9.Flowmeter 10.Tachometer	1

X Precautions to be Followed

1. Avoid improper/loose connections of components.
2. Do not forcefully connect to connectors to avoid the damage.

XI Procedure

1. Initially check the level of hydraulic oil to ensure adequate oil in the tank.
2. Make connections of pump discharge to the pressure gauge and flow meter.
3. Allow the trainer in ON position for 5 minutes for initial warm-up.
4. Note down the pressure and Flow rate generated by the pump.
5. Make necessary connections to the actuators like S.A.Cylinder, D.A.Cyinder, Hydraulic motors
6. Tabulate the readings.
7. Calculate forces developed during forward and return strokes of cylinders.
8. Measure speed of hydro motor using tachometer.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Hydraulic trainer		Actual working components. 1. Vane pump, P.R.V., F.C.V, D.C.V., Actuator.		

XIII Actual Procedure Followed

1] Initially check the level of hydraulic oil to ensure oil in the tank. 2] Make connections of pump. 3] Allow the trainer in ON position for 5 min. 4] Note down the pressure & Flow rate generated by pump. 5] Make necessary connection to actuators like S.A.C. cylinder, D.A.C. cylinder, Hydraulic motors. 6] Tabulate readings. 7] Calculate forces. 8] measure speed of hydro motor using tachometer.

XIV Precautions Followed

1] Avoid improper/loose connections of components.
2] Do not forcefully connect to connectors to avoid the damage.

XV Observations and Calculations

1. **Pump**

S.N.	Type of pump	Specification	Pressure developed(~~kg/cm²~~ bar)	Flow rate (LPM)
1	External gear	20-100 m³/s	300 bar	400
2	Pump.	(Viscosity)		

2. **Actuators**

Hydraulic cylinder (specifications)

Stroke length: 200 mm

Cylinder bore Diameter: 35 mm

Piston rod diameter: 25 mm

S.N.	Type of Actuator	No. of ports	Specification	Oil Pressure (~~kg/cm²~~) bar	Output Motion observed
1	Double		200 mm		Linear &
2	acting.	2	stroke	160 bar	Reciprocating
3	cylinder.		length		movement.

Hydraulic Motor

S.N.	Type of Actuator	No. of ports	Specification	Oil Pressure (~~kg/cm²~~) (bar)	Output Motion observed
1	Bi-directional	2	1440 rpm	190 bar	Rotary
2	hydraulic motor				clock/Anticlockwise

XVI Results

1] The pressure developed by external gear pump is 300 bar & Flow rate is 400 LPM.

2] The Pressure of oil in D.A.C. is 160 bar.

3] The pressure of oil in bi-directional hydraulic motor is 190 bar.

XVII Interpretation of Results

1] The observed motion in DAC is linear motion.

2] The observed motion in bi-directional hydraulic motor is rotary motion.

XVIII Conclusions

Hence; the performance of pump & actuators mounted on hydraulic trainer were analyzed.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1 List pumps in ascending order according to the pressure developed by the pumps.

2 Write mounting methods of hydraulic cylinders.

3 Identify actuators in a. Hydraulic press machine 2.JCB arm

[Space for Answer]

Q.1 → Types of Pump : Pressure developed.

1] Screw Pump - 60 - 175 bar

2] Variable Vane pump - 75 - 125 bar

3] External gear pump - 100 - 300 bar

4] Fixed vane pump - 125 - 175 bar

5] Internal gear pump - 350 - 400 bar

6] Variable axial Pistan - 700 bar

7] Bent axis pistan - 700 bar

8] Radial piston pump - 1000 bar

Q. 2 →

The different types of hydraulic cylinder mountings are :

1] Centre line mounting
2] Foot mounting
3] Pivot mounting
   a] clevis mounting
   b] Trunnion mounting :

Q. 3 →

a] Hydraulic Press machine
   1] Side cylinder (usually 2)
   2] Press cylinder

b] JCB Arm
   1] Double acting cylinder

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Hydraulic trainer		P.R.V, F.C.V., set of D.C. valve	1.	
2.					
3.	Pneumatic trainer		F.C.V., set of D.C. valve.	1.	

XIII Actual Procedure Followed

1] Initially check the level of hydraulic oil to ensure oil in the tank. 2] Make connections. 3] Allow the trainer in ON position for 5 min. 4] Note down the pressure & flow rate generated by pump. 5] Make necessary connections to the actuators like S.A. cylinder, D.A. cylinder. 6] Tabulate readings. 7] Calculate forces developed during stroke of cylinder. 8] Measure speed of hydro motor using tachometer.

XIV Precautions Followed

1] Avoid improper / loose connections of components. 2] Do not forcefully connect to connectors to avoid the damage.

XV Observations and Calculations

- **Pressure relief valve**

S.N.	Type of valve	Specification	Pressure set(kg/cm²)	Observed reading (kg/cm²)
1	Pressure relief valve	temp:- 55°C	5.0 kg/cm²	4.2 kg/cm²
2	Pressure relief valve	temp:- 40°C	2.6 kg/cm²	2.4 kg/cm²

- **D.C. Valve**

a. **Type of Actuator: S.A. Cylinder or_____**

S.N.	Type of control (Lever/Push button/any other)	No. of ports and position	Actuated Position	Actuator movement (Direction)
1	Push button	1 port &	First	Left to right &
2		(2 position)		reciprocating.

b. Type of Actuator: D.A. Cylinder or

S.N.	Type of actuation	No. of ports and position	Actuated Position	Actuator movement (Direction)
1	Lever operated	2 port 2 (2 position)	Both	clockwise or anticlockwise
2				

- **Flow control Valve**

  Stroke length of actuator: 200 **mm**

S N	Setting level	Flow(LPM)	Time for piston movement(T) Sec	Actuator speed observed(L/T)mm/sec
1	Fully open	382	4.44	45.45 mm/sec
2	50% open	189	9.48	21.09 mm/sec

- **Pressure regulator**

S.N.	Type of regulator	Specification	Pressure set(kg/cm²)	Observed reading (kg/cm²)
1	-	-	-	-
2	-	-	-	-

XVI Results

Pressure relief valve :- 1) 4.2 kg/cm2
2) 2.4 kg/cm2

Flow control valve :-
1) 382 LPM (45.45 mm/sec)
2) 189 LPM (21.09 mm/sec)

XVII Interpretation of Results

From the readings of Flow control valve.
200 mm stroke length. 1) 382 LPM - 4.44 sec - 45.45 mm/sec
2) 189 LPM - 9.48 sec - 21.09 mm/sec

XVIII Conclusions

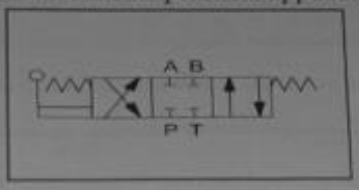
Hence, the performance of control valve used in hydraulic & Pneumatic circuit was analyzed.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Select control valve for safety of hydraulic system against overload.
2. State the difference between 3/2 and 4/2 D.C.valve

3. Identify given symbol and state its practical application.



[Space for Answer]

Q.1→ Pressure relief valve is selected For safety of hydraulic system against overload.

Q.2→

3/2 D.C. Valve	4/2 D.C. Valve
1] It has 3 connections.	1] It has 4 connections
2] It is used in single acting cylinder.	2] It is used in double acting cylinder.
3] Applications: 3/2 Push button operated Spring Return D.C.V.	3] Applications: 4/2 way bi-stable direction control valve.
4] Symbol:-	4] Symbol:-

Q.3→ The given symbol is of lever operated (4/3 direction control valve.)

- Applications:

1] It is used in hydraulic system known as 4x3 DCV.

2] The closed centre position of 4x3 DCV is suitable For immediate closing of movement or actuator.

6. Change FCV setting and observe change in flow, pressure of oil.
7. Tabulate the readings using stop watch

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Hydraulic trainer		DCV, FCV & Flowmeter	1	

XIII Actual Procedure Followed

1] Initially checked level of hydraulic oil to ensure oil in tank.
2] Make connections. 3] Allow the trainer ON position for 5min.
4] Note down pressure & Flow rate generated by pump.
5] Make necessary connections to actuators through FCV.
6] change FCV setting & observe change in Flow & pressure of oil.
7] Tabulate readings.

XIV Precautions Followed

1] Avoid improper / loose connections of components.
2] Do not forcefully connect to connectors to avoid damage.
3] Connections should never be made while machine is running.
4] If difficulty is encountered while attempting to make connection make sure machine is off & load or lines are not under pressure.

XV Observations and Calculations

1. **Meter-in circuit** Stroke length (L) = 200 mm

SR No	Setting level of FCV	Pressure before throttling (kg/cm^2)	Pressure after throttling (kg/cm^2)	Flow (LPM) After throttling	Time for piston movement (T) Sec	Actuator speed observed (L/T) mm/sec	Remark (Slow/fast)
1	Fully open	87	64	382	4.44	45.45	Fast
2	50% closed	55	31	189	9.48	21.09	slow

2. **Meter-Out circuit** Stroke length (L) = 200mm

SR No	Setting level of FCV	Pressure before throttling (kg/cm^2)	Pressure after throttling (kg/cm^2)	Flow (LPM) After throttling	Time for piston movement (T) Sec	Actuator speed observed (L/T) mm/sec	Remark (Slow/fast)
1	Fully open	61	45	256	6.57	30.44	Fast
2	50% closed	28	19	115	12.54	16.47	slow

XVI Results

① For meter-in circuit :-
- FCV 100% open speed 45.45 mm/sec.
- FCV 50% closed speed 21.09 mm/sec.

② For meter-out circuit :-
- FCV 100% open speed 30.44 mm/sec.
- FCV 50% closed, speed 16.47 mm/sec.

XVII Interpretation of Results

1] For meter-in circuit.
- FCV 100% open, speed is fast.
- FCV 50% closed, speed is slow.

2] For meter-out circuit :-
- FCV 100% open, speed is fast.
- FCV 50% closed, speed is slow.

XVIII Conclusions

Hence, meter-in & meter-out circuit for hydraulic trainer was actuated.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List the applications of Meter-in and Meter out circuits.
2. State the function of FCV with check valve used in the practical.
3. Differentiate between Meter-in and Meter out circuits.

[Space for Answer]

→ 1] Meter-in circuit Applications :-
1] It generally used when load characteristics are constant & positive.
2] It ideally applied on surface grinder, milling machine
3] Used where finer speed control is required.
4] Used for opposing load.

Meter-out circuit Applications :-
1] Used for both opposing load as well as running away load. 2] It suitable for drilling, boring, reaming.

→2] In meter-in circuit, F.C.V. is installed before actuator. The FCV is accomplished by a check valve (non-return-valve). The FCV is used to control the Flow & the check valve is non-return valve which does not allow the fluid to go in back-ward direction or return flow of Flow.

→3]

Meter-in circuit	Meter-out circuit
1] The flow rate of fluid entering from the tube side which can not be controlled.	1] The flow rate of fluid entering from the tube side which can be controlled.
2] It is used to restrict the flow to an actuator.	2] It is used to controlled exhaust flow from actuator.
3] It is not used for general applications.	3] It is used for general applications.
4] Suitable for very low piton rod speeds.	4] Provides positive speed contral of cylinder.
5] Used for - surface grinders, welders, milling machines.	5] Used for - Drilling, boring, reaming.

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Hydraulic trainer	Transparent /actual working components.	1
2	Hydraulic Shaper/Grinder/Milling	Actual machines/Demo models	1

X Precautions to be Followed

1. Avoid improper/loose connections of components.
2. Do not forcefully connect to connectors to avoid the damage.
3. Connections should never be made while the machine is running.
4. If difficulty is encountered while attempting to make a connection, make sure that the machine is off and that the lines are not under pressure.
5. Any oil spills should be cleaned up immediately.

XI Procedure

1. Initially identify the hydraulic system in hydraulic shaper/milling/grinding machine.
2. Note down the pressure and flow rate generated by the pump.
3. Record observations for motion of component.
4. If machines are not available, develop circuits on trainer.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Hydraulic shaper/Grinding/ Milling machine		Working /demo models	1	
2	Hydraulic trainer		With required components	1	

XIII Actual Procedure Followed

1] Initially identify hydraulic system in hydraulic machine.
2] Note down the pressure & Flow rate generated by pump.
3] Record observations for motion of component.
4] If machines are not available, develop circuits on trainer.

XIV Precautions Followed

1] Avoid improper/loose connections of components.
2] Do not forcefully connect to connectors to avoid damage.
3] Connections should never be made while machine running.
4] If difficulty is encountered while attempting to make connection, make sure machine is off & lines are not under pressure.

XV Observations and Calculations

Sr No	Name of Machine	Machine component with hydraulic system	Type of actuator used	Motion observed	Remark
1	Shaper -	Ram tool hard	Double rod	Reciprocating	Forward & reverse
2	- machine		double acting cylinder		stroke are obtained.
3	Surface -	Table along with	Double rod	Reciprocating	Forward & reverse
4	- cylinder	magnetic chuck.	double acting cylinder		stroke obtained.

XVI Results

The actuators used ~~was~~ were double rod, or double acting cylinder.

XVII Interpretation of Results

The motion observed were reciprocating motion & the stroke observed were forward & reverse stroke.

XVIII Conclusions

Hence, the actuator used & motion were observed by a machine.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the working principle of hydraulic grinding machine.
2. Calculate the ratio of linear speed of cutting stroke and return stroke in hydraulic shaper.
3. Develop circuit for movement of tail stock of lathe machine for drilling operation.

[Space for Answer]

1] → Hydraulic grinding machine works on the principle of hydraulic power being converted into rotary motion or torque i.e. twisting movement.

2] →

In shaper machine,

Time taken for forward stroke = 9 sec for each

Time taken for reverse stroke = 6 sec for each

∴ Ratio of linear speed of cutting stroke to return stroke.

Since the mechanism is quick return mechanism

∴ Ratio of time cutting stroke to time of return stroke = $(360 - \beta)/\beta$

Here, $\beta = 144$

∴ Ratio = $(360 - 144)/144$

$= 216/144$

Ratio = 1.5

- Run the system for at least 10 min. and observe working of various components and fill up the information in the inspection format for each component.
- Go through the fault, cause and remedial actions table from book. Search out remedial action for observed fault.
- By following instructions, safety takes the appropriate remedial actions using tool kit under the teacher's guidance.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		~~Make~~	Details		
1.	Hydraulic oil.	As recommened by manufacture		1	
2.					
2.	Tool kit	As recommened by manufacture		1	

XIII Actual Procedure Followed

1] Go through instruction & operating manual supplied by manufacturer
2] Go through safety precautions
3] Run the system at least 10 min & observe working of various components & fill information in inspection format.
4] Go through fault, cause & remedial actions table from book.
5] By following instructions, safety takes appropriate remedial actions using tool kit.

XIV Precautions Followed

1] Avoid improper handling of hydraulic oil.

2] Don't apply excessive pressure on actuator.

XV Observations and Calculations

Name of the mobile hydraulic equipment:-

Brief description/specification/make/ of mobile hydraulic equipment:-

Table 1.Inspection table

Sr No	Component	Condition observed
1	Pump	Smooth running or making noise
2		
3		

Table 2.Observed faults and remedial action taken

Sr No	Observed fault and its indications.	Probable cause	Remedial action.
1			
2			
3			

XVI Results

From this practical we maintain simple parts of mobile hydraulic system.

XVII Interpretation of Results

We know about that different equipment which is related to this practical.

XVIII Conclusions

We conclude that how to maintaing simple parts of mobile hydraulic system such as In earth moving equipment.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. State the importance of filtering in hydraulic system.
2. List causes of seal failure.
3. State the causes of excessive fast motion of actuator.
4. Name the two ways in which a hydraulic fluid becomes contaminated.

[Space for Answer]

1]→ Importance of filtering in hydraulic system is to eliminate the dust & forgen particles in oil from entering into the pump & further in system. If filters are not installed the pump rotor's & inner casing might wear cut due to subbing action of forgen dust particle between them.

2]→ Causes of seal failure are,

i] Increase in temp. of hydraulic oil flowing in system.

ii] changing environment conditions in the room where system is placed such as temp. & humidity.

iii] using unsuitable oil in circuit.

3]→ Causes of excessive Fast motion of actuator are,

i] Increase pressure in circuit.

ii] Increase in Flow of oil in circuit.

iii] Reduced load on actuator.

iv] Wear out of casing & rotary of sliding parts in actuator.

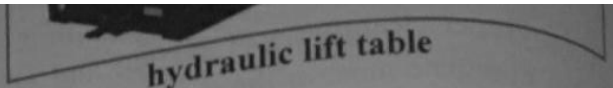
4] → Hydraulic oil may get contaminated due to-

i] over heating of oil due to some region may degrade the quality of oil.

ii] Failure of Filter.

iii] Uncovered conservior load to accumulating of dust on oil.

hydraulic ram lifter



hydraulic lift table

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Hydraulic oil	As recommended by manufacturer	1
2.	Tool kit	As recommended by manufacturer	1

X Precautions to be Followed

1. Avoid improper handling of hydraulic oil.
2. Don't apply excessive pressure on actuator .

XI Procedure

- Go through the instruction and operating manual supplied by the manufacturers and also follow the instructions given by teacher.
- Go through the safety precautions, guidelines given for maintenance in lab manual.
- Run the system for at least 10 min. and observe working of various components and fill up the information in the inspection format for each component.
- Go through the fault, cause and remedial actions table from book. Search out remedial action for observed fault.
- By following instructions, safety takes the appropriate remedial actions using tool kit under the teacher's guidance.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Surface		3100 rpm,	1	
2.	grinding		120mm - cross transfer		
3.	machine		table.		

XIII Actual Procedure Followed

1] Go through instruction 2] Go through safety precaution
3] Run system at least 10 min & observe working & Fill information
4] Go through fault, cause & remedial actions from book
5] By Following instructions

XIV Precautions Followed

1) Avoid improper handling of hydraulic oil.
2) Don't apply excessive pressure on actuator.

XV Observations and Calculations

Name of the mobile hydraulic equipment:- Surface grinding machine.

Brief description/specification/make/ of mobile hydraulic equipment:-

Surface Grinding machine no:- SGMC 1/27C
Price :- ₹ 1,45,000 Speed of grinding wheel :- 3100 r.p.m
Gross transverse table = 170 mm
Maximum distance admitted = 170 r.p.m
Marking surface of table = 450 x 150 mm

Table 1.Inspection table

Sr No	Component	Observed Condition
1	Directional control valve	Good condition
2	Double acting cylinder	Leakage
3	Flow control valve	Faulty condition

Table 2.Observed faults and remedial action taken

Sr No	Observed fault and its indications.	Probable cause	Remedial action.
1	No Fault	-	-
2	Leakage	Piston seals are broken	Replace piston seals.
3	Faulty condition	Knob is not working properly.	Replace the knob.

XVI Results

The piston seals were broken & the which causes leakage & the knob was not working properly.

XVII Interpretation of Results

The piston seals & knob were replaced.

XVIII Conclusions

Here, simple parts were maintained of surface grinding machine.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Name five reasons for the overheating of the fluid in a hydraulic system.
2. Name four causes of low or erratic pressure.
3. List four recommendations that should be followed for properly maintaining and disposing hydraulic fluid.
4. If an actuator fails to move, name four possible causes.

[Space for Answer]

Q.1 →

1) Use a fluid with low fire point.
2) Non-Filtered oil.
3) overheating pump.
4) Viscosity of oil if it light or heavy rises of heat.
5) Low diameters of pipes causes shear that raised heating.

Q.2 →

1) Air in the hydraulic fluid.
2) Pressure relief valve set too low.
3) Pressure relief valve not properly seated.
4) Leak in hydraulic line.

Q.3 →

1) Select the optimum fluid for appln involved.
2) Utilize well designed filtration system to reduce contamination & increase useful life.
3) Follow proper storage procedure of unused fluid supply.
4) Transporting of fluids from storage containers to hydraulics systems.

Q.4 →

1) Valve is binding.
2) Solenoid voltage is incorrect.
3) power gas pressure is too low.
4) Air is leaking at piston guide bushings.

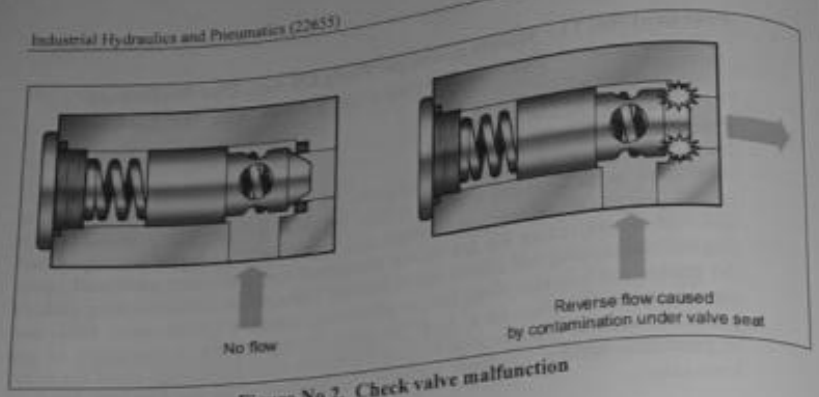


Figure No 2. Check valve malfunction

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Pneumatic system	As per available in lab, industry.	1
2.	Tool kit	As recommended by manufacturer	1

IX Precautions to be Followed

1. Avoid improper handling of hydraulic oil.
2. Don't apply excessive pressure on actuator .

X Procedure

- Go through the instruction and operating manual supplied by the manufacturers and also follow the instructions given by teacher.
- Go through the safety precautions, guidelines given for maintenance in lab manual.
- Run the system for at least 10 min. and observe working of various components and fill up the information in the inspection format for each component.
- Go through the fault, cause and remedial actions table from book. Search out remedial action for observed fault.
- By following instructions, safety takes the appropriate remedial actions using tool kit under the teacher's guidance.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Pneumatic system		As per available in	1	
2.	Tool kit.		lab, industry	1	
3.					

XII Actual Procedure Followed

1) Go through instruction & follow the instructions.
2) Go through safety precaution.
3) Run the system at least 10min. observe working. Fill informatio
4) Go through Fault, cause & remedial actions from book.
5) By following instructions.

XIII Precautions Followed

1) Avoid improper handling of hydraulic oil.
2) Don't apply excessive pressure on actuator.

XIV Observations and Calculations

Table 1.Inspection table

Sr No	Component	Observed Condition
1		
2		
3		

Table 2.Observed faults and remedial action taken

Sr No	Observed fault and its indications.	Probable cause	Remedial action.
1			
2			
3			

XV Results

From this practical, we know about that different tools equipment, machine tool during maintenance, simple part of any.

XVI Interpretation of Results

From this practical we know about the how to maintain simple part of any one stationary pneumatic system.

XVII Conclusions

we conclude that simple part of stationary pneumatic system such as

XVIII Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List five possible causes of a pressure drop in a pneumatic system.
2. List protective devices that can be found on a compressor.
3. List four maintenance problems common to pneumatic systems.
4. List three advantages of using a preventative maintenance program for a pneumatic system.

[Space for Answer]

Q.1 →

1] Leakage in connections.
2] Failure of compressor.
3] Leakage in air reciever.
4] Failure of filter causes contaminator of air.
5] choke up of lines in bends & valves.

Q.2 →

1] oil level indicators.
2] Pressure gauge
3] Air Filter.
4] Relief valve
5] Shut off valve
6] to prevent human contact to rotating element.

Q.3 →

1] Actuator moving too slowly
2] Too much air choke.
3] Dirty or damaged filter.
4] Directional control valve not changing direction.

Q.4 →

1] Conservation of assets.
2] Machine efficiency.
3] Time savings
4] Fewer interruptions to critical operations.

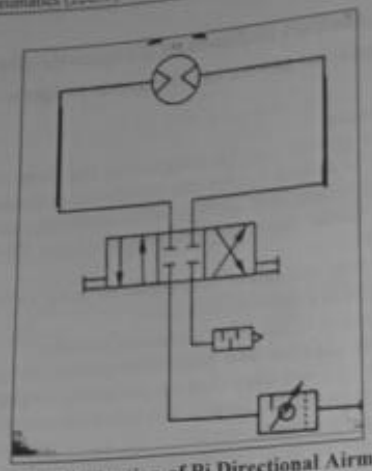


Figure No 3 Actuation of Bi Directional Airmotor.

IX Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Pneumatic Trainer	D.C.V., D.A.C., P.R.V.	1
2	Stopwatch		

X Precautions to be Followed

1. Avoid improper handling of flow control valve
2. Don't apply excessive pressure on tips of Transducer .

XI Procedure

- Clean the trainer unit to ensure clean working environment.
- Follow the instructions given by the teacher and in operating manual.
- Know the specifications of all components either from operators manual or from the specification given on each component and note down in the table.
- Read circuit diagram, select component to be used.
- Connect all selected components as per circuit diagram for indirect control of single acting and double acting cylinder.
- Check all connections for proper fitting. Start and run the compressor to store sufficient pressure up to 6 bar in reservoir. Check FRL unit for lubricating oil level.
- Observe actuation of cylinder.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Pneumatic		D.C.V, D.A.C.	1	
2.	Trainer		P.R.V., DC motor		
3.	Stopwatch			1	

XIII Actual Procedure Followed

1) Clean the trainer unit to ensure clean environment
2) Follow instructions 3) Know specifications of all components
4) Read circuit diagram, select component to be used
5) connected all select components as per circuit diagram
6) check all connections for proper fitting. 7) Observe actuation of cylinder

XIV Precautions Followed

1) Avoid improper handling of flow control valve
2) Don't apply excessive pressure on tips of transducer

XV Observations and Calculations

1. Actuation of SA Cylinder

SR No	Stroke length(mm)	Air pressure (Kg/cm²)	Type of DC Valve	Type of Movement	Time in sec	Linear velocity (mm/sec)
1	120	8	3/2 DCV	Linear	0.50	240
2	120	7	3/2 DCV	Linear	0.60	200
3	120	6	3/2 DCV	Linear	0.75	160
4	120	5	3/2 DCV	Linear	0.90	133.33

2. Actuation of DA Cylinder

SR No	Stroke length(mm)	Air pressure (Kg/cm²)	Type of DC Valve	Type of Movement	Time in sec	Linear velocity (mm/sec)
1	220	8	4/2 DCV	Linear	0.40	550
2	220	7	4/2 DCV	Linear	0.50	440
3	220	6	4/2 DCV	Linear	0.62	359.53
4	220	5	4/2 DCV	Linear	0.70	314.28

3. Actuation of Air motor

SR No	Type	Air pressure (Kg/cm²)	Type of DC Valve	Type of Movement	Angular Velocity(RPM)
1					
2	–	–	–	–	–
3					
4					

XVI Results

The valve of air pressure stroke length & time requested was find out

XVII Interpretation of

It was noted that SA cylinder use 3/2 DCV. & DA cylinder use 4/2 DCV.

XVIII Conclusions

Hence, actuating circuit for SAC, DAC Air motor was observed.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Explain exhaust air throttling for speed control of double acting cylinder.
2. Differentiate between supply and exhaust air throttling for speed control of pneumatic cylinder.

[Space for Answer]

Q.1 → Exhaust Air throttling :-

In case of exhaust air throttling, supply air flows freely to the cylinder & the flow control in the exhaust line resists the escaping air. The piston is held between two air cushions. be used for large double acting cylinders with long strokes, & when the loads are not constant.

Q.2 →

Supply air throttling	Exhaust air throttling
1) It control flow of air to flow in only one direction.	1) It control valve allow air to exhaust with restrist flow.
2) It control the flow of air.	2) It control rate of exhaust air adjusted.
3) This valve is used for air supply in cylinder.	3) This valve is used for air supply out the cylinder.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Pneumatic		Compressor, reservior, FRL	1	
2	trainer		SAC, DAC, Air motor		
3.					

XIII Actual Procedure Followed

1] Clean the trainer unit to ensure clean environment.
2] follow the instructions 3] know the specification of all components.
4] Read circuit diagram, select component to be used.
5] Connect all selected components as per circuit diagram.
6] check all connections 7] Observe actuation of cylinder.

XIV Precautions Followed

1] Avoid improper handling of compressed air.
2] Don't apply excessive pressure on actuator.

XV Observations and Calculations

Sr No	Flow rate	Time to complete stroke in seconds	Actuator speed in mm / sec	Actuator speed in mm / min
1	Minimum(For SAC)			
2	Medium (For SAC)			
3	Maximum(For SAC)			
4	Minimum(For DAC)			
5	Medium (For DAC)			
6	Maximum(For DAC)			

XVI Results

In this practical we control the speed of actuator by using flow control valve.

XVII Interpretation of Results

From this practical we observed the speed of Actuator & in single acting or double acting cylinder.

XVIII Conclusions

In this practical we construct & actuate speed of actuator pneumatic circuit for given purpose.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. List the basic five rules that are important in design of pneumatic circuits.
2. Explain any one control valves used in experiment for given pneumatic application.

[Space for Answer]

Q.1→

1] each Function of the valve shall be represented by a square.
2] Arrow in pneumatic system indicatent flow directions of air current should be properly given in pneumatic circuit.
3] The pneumatic symbol of operational component should be drawn outside of square.
4] Pneumatic operation signal pressure lines should be drawn inside of the square.
5] In pneumatic operation triangle are used to represent direction of air flow.

Q. 2] → Flow control valve (needle type) :-

Construction :-

Needle type F.C.V. consist with variable area needle. This needle is inserted into a pipeline from upper side it is connected to hand wheel which move needle as per requirement.

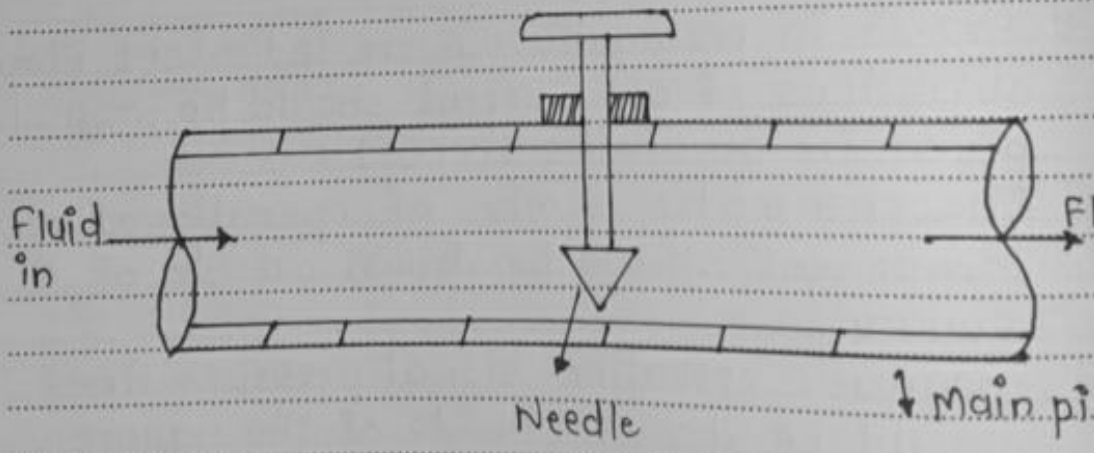
Working :-

This is a most common type of flow control valve used in hydraulic circuit.

① First Fluid flow into main pipe move towards Flow control valve.

② If Flow control valve is totally closed then, there is not Flow at outlet.

③ when hand wheel is rotated in anti-clockwise direction, then needle is more gradually in.



XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Pneumatic		Compressor, Reservior,	1	
2.	trainer		FRL, 5/2 DAC, DAC, Air motor	1	
3.					

XIII Actual Procedure Followed

1] clean the trainer unit to ensure clean environment. 2] Follow the instruction. 3] Know the specifications of all components. 4] Read circuit diagram, select component to be used. 5] Connect all selected components as per circuit diagram. 6] check all connections. 7] observe actuation cylinder.

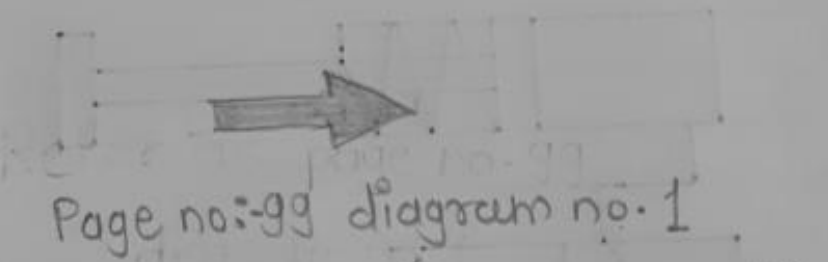
XIV Precautions Followed

1] Avoid improper handling of compressed air.

2] Don't apply excessive pressure on actuator.

XV Observations and Calculations

Draw indirect (pilot) control Pneumatic circuit for the given purpose (Actual Circuit constructed in laboratory)



Page no:-99 diagram no. 1

XVI Results

From this practical we know about how to actuate indirect (pilot) control pneumatic circuit.

XVII Interpretation of Results

From this practical we learns different equipment, tools & machine tools which is used in maintaining the pneumatic circuit

XVIII Conclusions

We conclude that how to construct & actuate indirect (Pilot) pneumatic circuit For the given purpose.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. A small single acting cylinder is to extend and clamp a work piece when a push button is pressed. As long as the push button is activated, the cylinder should remain in the clamped position. If the push button is released, the clamp is to retract. Use additional start button.
2. A filling system fills bottles with milk. The bottles are fed to the system on a conveyor belt and are stopped underneath the filler using pneumatic cylinders. The double acting cylinder 1A1 (due to its large size) has to be controlled indirectly.

[Space for Answer]

Q.1 →

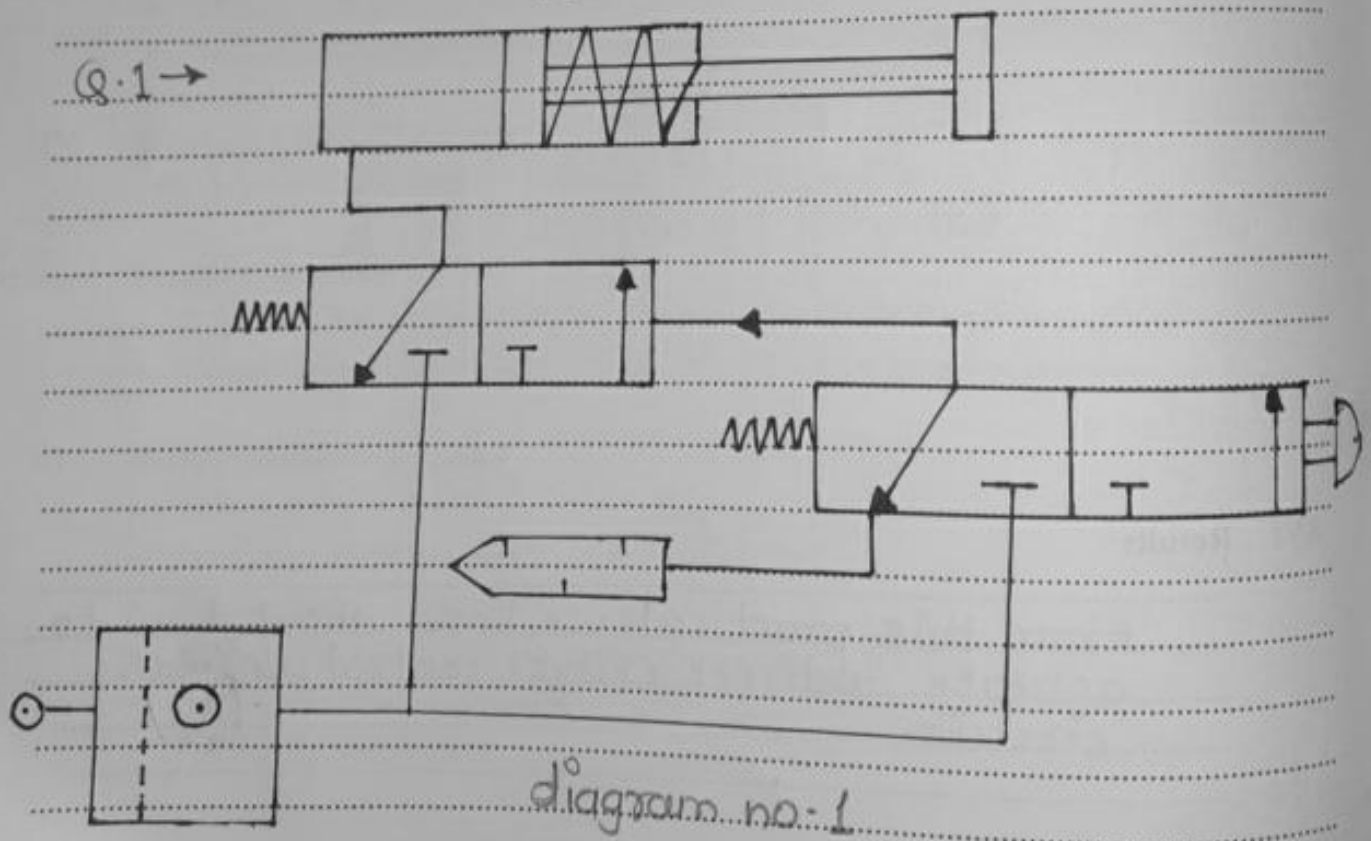


diagram no-1

Q. 2 →

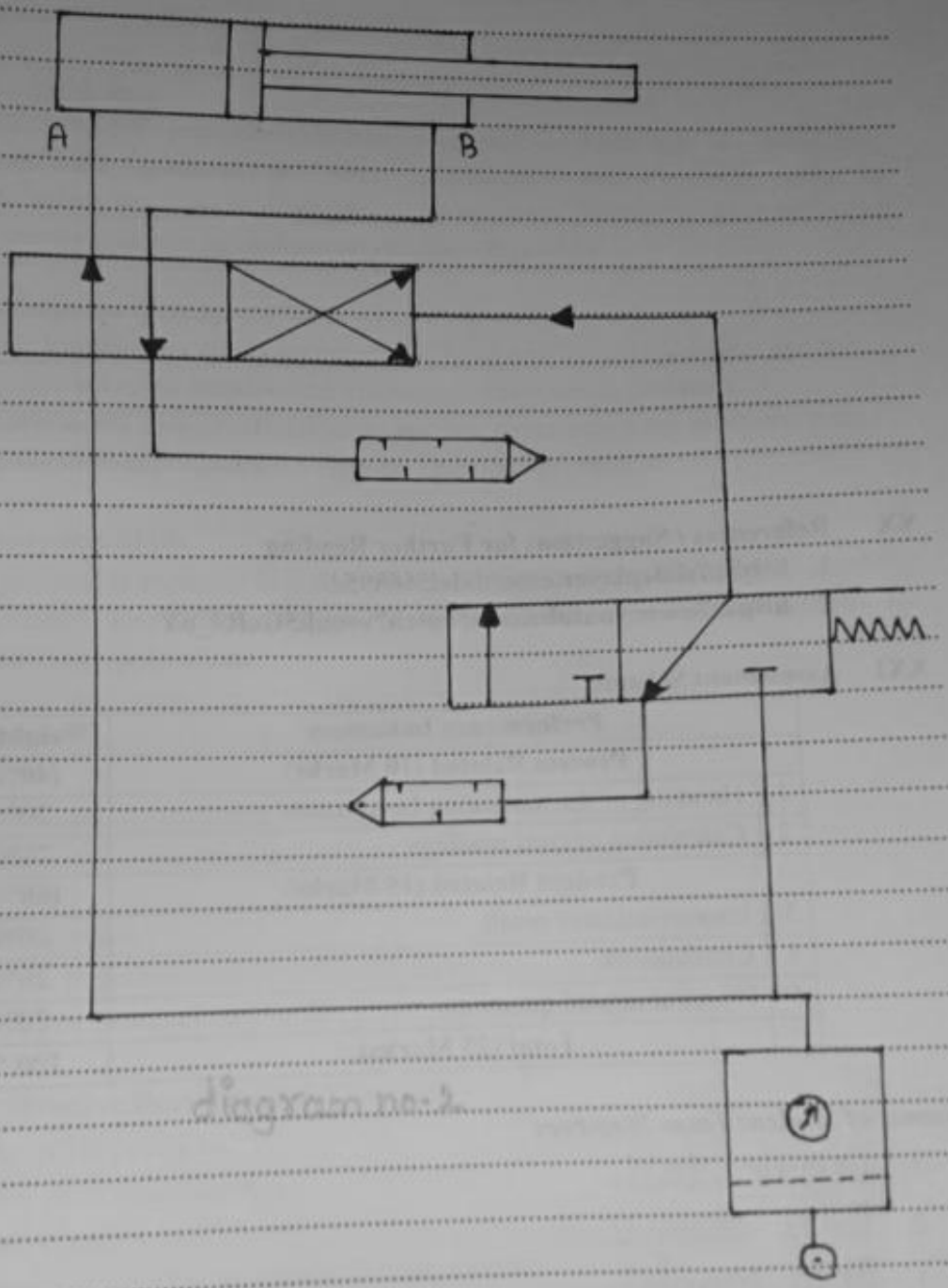


diagram no:1

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Pneumatic trainer	Compressor, Reservoir, FRL, SAC, DAC , Air motor, Direction control valves , pipes, connectors. Logic function valves- OR, AND, . Time delay valves.	1
2.			

X **Precautions to be Followed**

1. Avoid improper handling of compressed air.
2. Don't apply excessive pressure on actuator .

XI **Procedure**

- Clean the trainer unit to ensure clean working environment,
- Follow the instructions given by the teacher and in operating manual.
- Know the specifications of all components either from operators manual or from the specification given on each component and note down in the table.
- Read circuit diagram, select component to be used.
- Connect all selected components as per circuit diagram for the given Logic functions (AND/OR/TIME DELAY).
- Check all connections for proper fitting. Start and run the compressor to store sufficient pressure upto 6 bar in reservoir. Check FRL unit for lubricating oil level.
- Observe actuation of the given Logic functions (AND/OR/TIME DELAY).

XII **Resources Used**

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Pneumatic		Compressor, Reservior	1	
2.	trainer		FRL, SAC, DAC, Air motor	1	
3.					

XIII **Actual Procedure Followed**

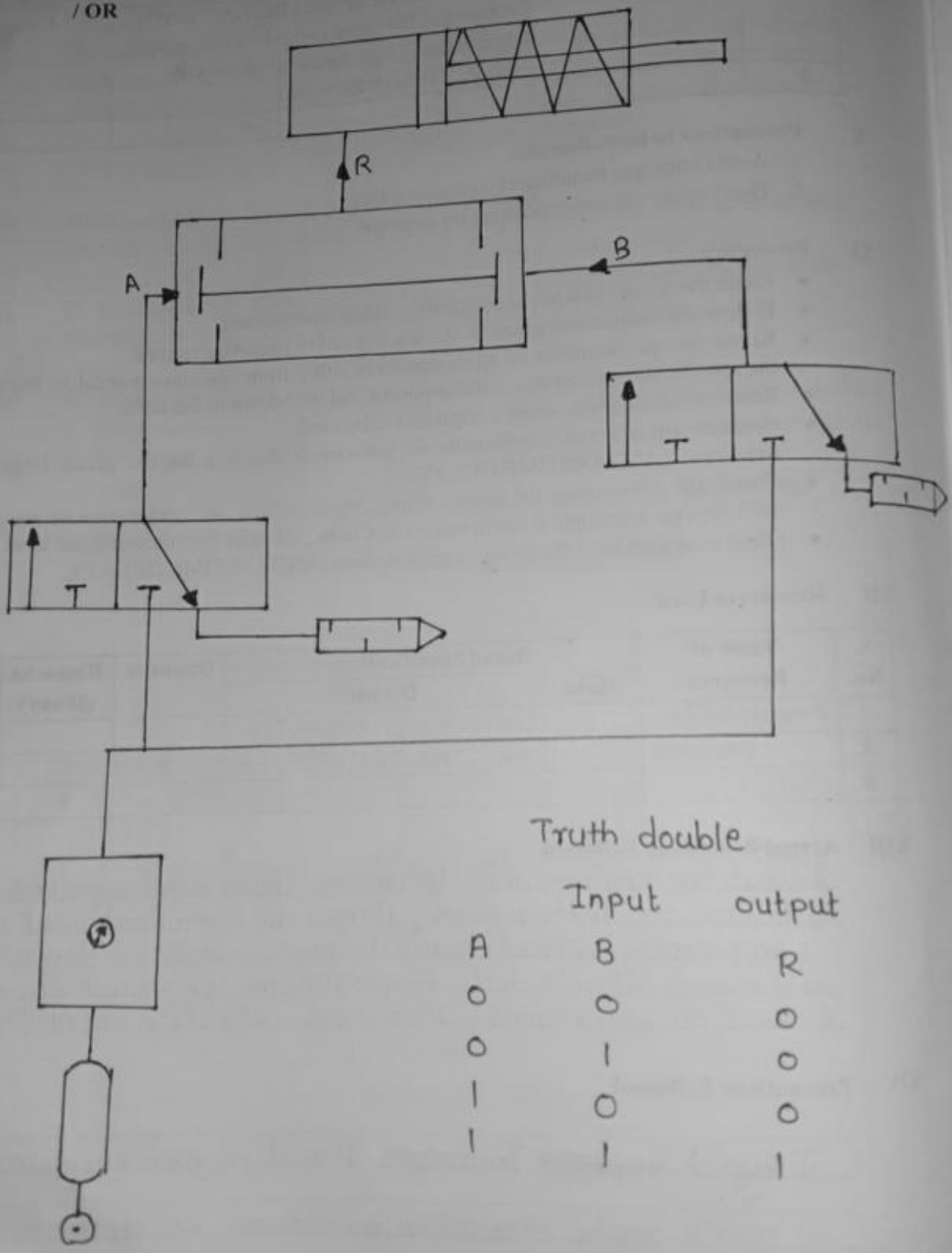
1] clean the trainer unit to ensure clean environment.....
2] follow the instructions. 3] know the specification of all components. 4] Read circuit diagram, select components.
5] connect all selected component as per circuit diagram.
6] check all connections. 7] observe actuation of (AND/OR/TIME DELAY)

XIV **Precautions Followed**

1] Avoid ~~improper~~ improper handling of compressed air.
2] Don't apply excessive pressure on actuator.

XV Observations and Calculations

Draw actual circuit constructed and prepare truth table for Logic functions AND / OR



Truth double

Input		output
A	B	R
0	0	0
0	1	0
1	0	0
1	1	1

XVI Results

* OR Gate: Movement of single acting cylinder to produce reciprocating motion using two DC valve i.e. operator 1 or operator 2 actuates their respective valve (or both)
* AND Gate: Motor prodaded CSA cylinder movement), when both the operates actuates their valve (button)

XVII Interpretation of Results

'OR' function used when both the operators are at different position, where as 'AND' position is used in case of press machine (usually / generally) operation. (i.e. where both operators must approve the operation).

XVIII Conclusions

Hence, pneumatic circuit for 'OR' & 'AND' Functions were constructed & actuated.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. A double acting cylinder is used to press together glued components . Upon operation of a press button, the clamping cylinder slowly advances. Once the fully extended position is reached , the cylinder is to remain for a time of t = 6 seconds and then immediately retract to the initial position. A new start cycle is only possible after the cylinder has fully retracted and after a delay of 5 seconds. During this delay the finished part is manually removed and replaced with new parts for gluing. The retracting speed should be fast, but adjustable.
2. List practical applications of AND , OR valve.
3. Write the functions of pneumatic timer delay valves.
4. Differentiate between ON time delay and OFF time delay with help of symbols

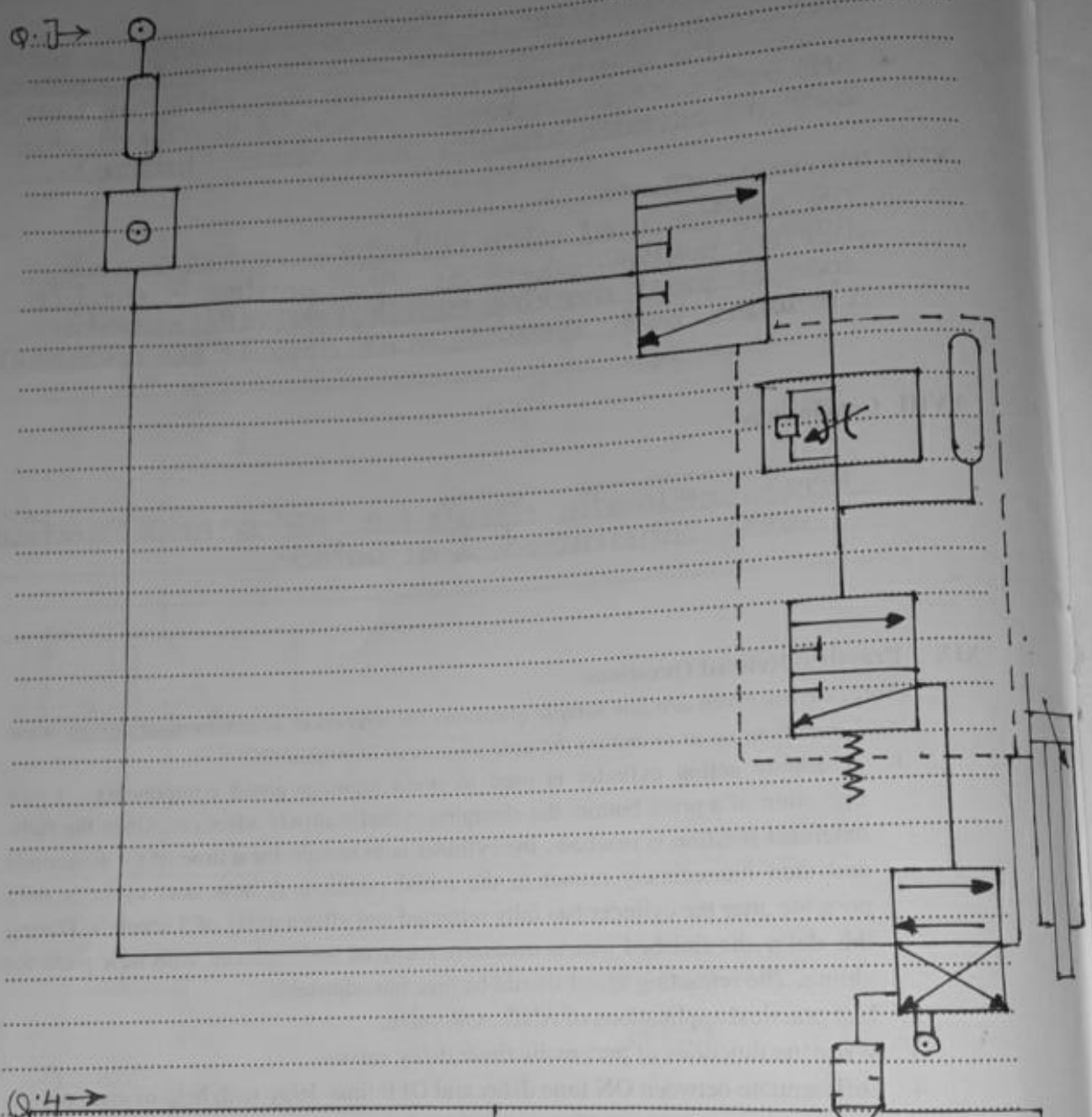
[Space for Answer]

3] →

1] Time delay valve is used to delay the output signal.

2] It is used to delay operation under time

Q.3 →



Q.4 →

On time delay	Off time delay
It turns on a circuit after a predetermind time has ellapsed.	It turns off the input after predetermined time delay has ellapsed.

Q.2 → Practical applications of 'AND' 'OR' valve are,

1] Water supply.
2] Waste water treatment
3] Fire protection
4] Gas supply
5] chemical & oil industries.

XX References / Suggestions for Further Reading

1. https://www.youtube.com/watch?v=7ucJV41LkXo
2. https://www.youtube.com/watch?v=uWwGPy7AjaA
3. https://www.youtube.com/watch?v=BX2XfIID7l0
4. https://www.youtube.com/watch?v=hTA-mLXZM5M
5. https://www.youtube.com/watch?v=cfjKk79uXr8
6. https://www.youtube.com/watch?v=i4aaNDDHVnE

XXI Assessment Scheme

Performance Indicators		Weightage
Process Related (10 Marks)		**(40%)**
1	Handling of the measuring Instruments	20%
2	Calculation of final readings	20%
Product Related (15 Marks)		**(60%)**
3	Interpretation of result	20%
4	Conclusions	20%
5	Practical related questions	20%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. Gugale Yash.
2. Patel Manav.
3. Bhor Manish.

Marks Obtained			Dated signature of Teacher
Process Related(10)	**Product Related(15)**	**Total (25)**	